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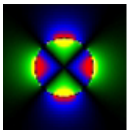
Magnet Division Procedure

Procedure: SMD-AGS-3007

Revision: A



Superconducting Magnet Division

AGS Snake Magnet Insertion

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- ES&H Review: Signature on File

Revision History

Rev A: Initial Release

1 Scope:

This procedure describes the insertion of the AGS Snake Cold Mass. Also included are appropriate inspections, testing, and leak checking.

2 Applicable Documents:

RHIC-MAG-Q-1000	Procedure for Control of Measurement Test Equipment
RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
BNL Dwg. 22010402	Insertion Assembly
BNL Dwg. 25-1912.01-5	Insertion Fixture Assembly

3. Requirements:

3.1 Material & Equipment

None

3.2 Safety Precautions:

3.2.1 Specific steps of this procedure contain electrical and mechanical assembly operations that impact the environment. Prior to performing these steps, personnel shall complete the applicable facility-specific environmental training.

4 Procedure:

NOTE

If it is necessary to support the cold mass during build-up or prep activities it will be necessary to use the Aaronson rollers, suitable wooden chocks or the insertion fixture hardware, whichever is appropriate.

4.1 Blanket Installation

4.1.1 Apply the MLI blankets to the inside of the perforated cryostat blanket support cylinder and the 2 perforated access port blanket support cylinders. Secure the blankets to the inner surfaces using Kevlar string stitched through the blankets and through corresponding perforations in the support cylinders as required. Secure the blankets around all openings and approximately 2 inches back from the open ends of the cylinders. Do not cut or remove the blanket material from the support cylinder openings at this time.

4.1.2 In a similar manner apply the MLI blankets to the inside of the heat shield. Secure the blankets to the inner surface using Kevlar string stitched through the blankets and through corresponding holes in the shield as required. Secure the blankets around all openings in the heat shield and approximately 3 inches back from the open ends of the heat shield. Do not cut or remove the blanket material from the openings at this time. Spot-weld the blankets around the edges of the main access port cutouts (2) so that these two blanket pieces will remain intact when cut loose from the main portion of the blankets. They will be used to line the inside surfaces of the access port covers.

4.1.3 Carefully cut through the blankets around the edges of the access port cutouts in the heat shield and retain these pieces for use on the corresponding access port covers. Use the heat shield covers as a guide to determine the location of the upper horizontal cut. This cut should correspond to the upper edge of the covers.

4.1.4 Insert the insulated cryostat insulation support cylinder into the cryostat so that the cutouts in the cylinder align with the corresponding penetrations in the cryostat. Repeat for the 2 access port insulation support cylinders.

4.1.5 Cut through the main blankets in the access port openings to form a series of long tabs around the openings. Join the main blanket to the access port blankets by folding these tabs out and securing them to the inside surface of the 2 access port blankets completely around the periphery of the access port openings.

4.1.6 Remove insulation blocking the pump-out port.

4.2 Heat Shield Installation

NOTE

The Heat Shield weighs approximately 300 lbs. not including the weight of the blankets.

4.2.1 Prepare cold mass insertion fixture for installation through vacuum vessel. Install heat shield onto long section of extended beam.

4.2.2 Assembly the fixture and cold mass together. Slide heat shield as close to cold mass as possible. The center of mass will be offset toward the heat shield several inches.

4.2.3 Attach slings to fixture and insert heat shield inside vacuum vessel. Adjust crane height to enable attaching the four upper support rods to the heat shield.

4.2.4 Cut small slits through the cryostat insulation and heat shield insulation blankets as required for passage of the support rods, balls and threaded collars.

4.2.5 Insert the eight (8) support rods (4 upper and 4 lower) through the inboard holes in the cryostat suspension turret flanges. Note that the cutouts for IFS lines should be on the rear end of the cryostat (i.e. the end the cold mass will be inserted from).

4.2.6 Adjust the position of the heat shield in the cryostat using the threaded collars on the support rods.

4.2.7 Lower the crane enough to allow shield to be supported on support rods alone.

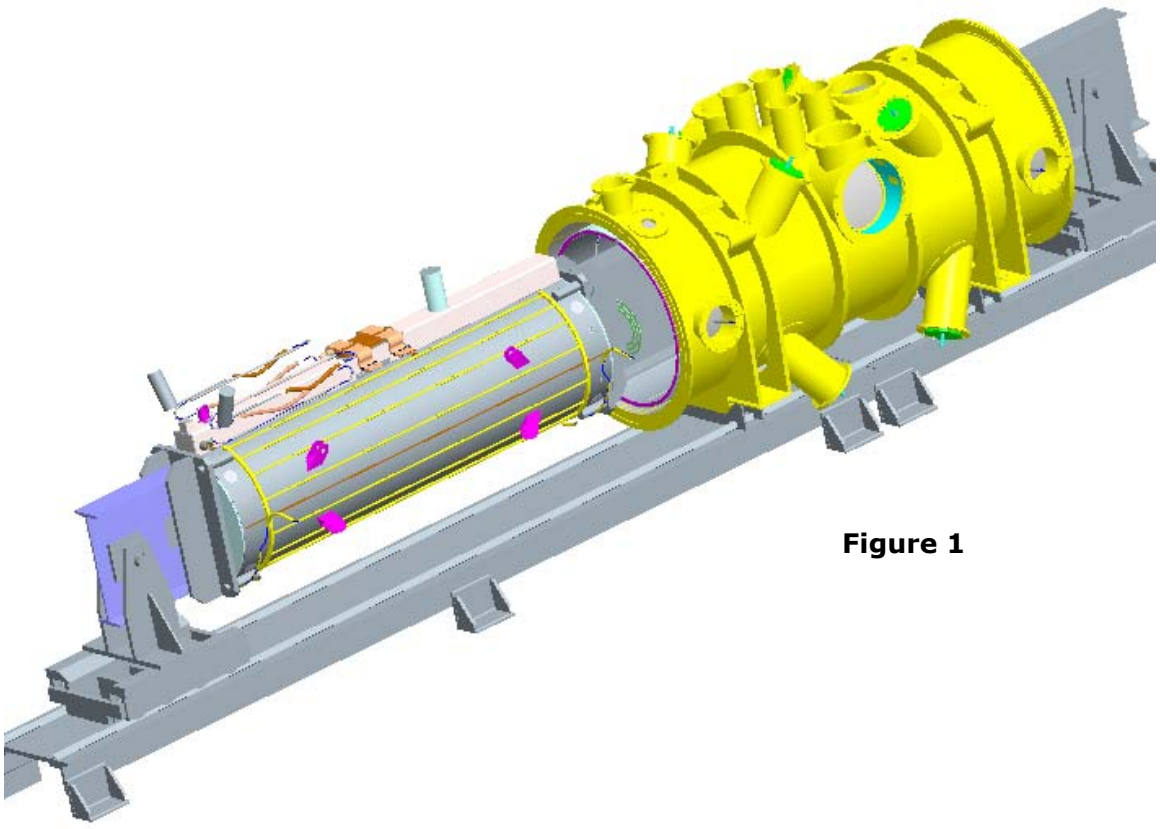

Figure 1

4.3 Cold Mass Insertion

NOTE

Be sure to attach the long beam to the cold mass end opposite the IFS lines

4.3.1 See Figure 1. Bolt the two insertion fixture beams to the cold mass end volumes using 1 inch graded bolts. Support the cold mass/beam assembly by means of suitable blocking under the beams or under the cold mass end volumes. Block securely and leave sufficient clearance below the cold mass to allow for any planned pre-insertion activities. At this stage the cold mass can be supported on the leak test station for such activities if desired.

4.3.2 Verify that the warm-up heater connector has been detached from its mounting pad on the top of the buffer volume and is temporarily stowed at the side of the buffer volume for subsequent insertion of the cold mass into the cryostat.

4.3.3 Verify that the IFS cans and upper helium fill tube pipe have been trimmed to proper length.

4.3.4 If the cold mass was supported on the leak test station trolleys for assembly or prep activities remove the support pins and move the cold mass/insertion fixture beam assembly to a temporary location. Support the assembly with blocking under the beams or cold mass.

4.3.5 Install the cryostat onto the rails of the leak test station using the rectangular spacers provided as part of the insertion fixture hardware. See insertion fixture assembly drawing 25-1912.01-5 for position and location on the rails.

4.3.6 Lift the cold mass/insertion fixture beam assembly using slings around the beams at each end of the cold mass. Keep the slings as close as possible to the cold mass to leave as much unsupported length of beam as possible. The CG of the cold mass/beam assembly is approximately 45 inches inboard of the end of the cold mass to which the long insertion fixture beam is attached. There must be sufficient unsupported length to allow the beam to pass completely through the cryostat.

4.3.7 With one end-support column removed from its trolley, insert the long beam of the cold mass/beam assembly through the cryostat/heat shield assembly until it protrudes sufficiently from the far end of the cryostat to allow insertion of the support pin through the end-support column. Take care to prevent the beam from contacting the heat shield during this operation. Install the other fixture end-support column on its trolley and insert the support pin through the short beam and end-support column. Remove the slings.

4.3.8 Prepare the cold mass for insertion by verifying that all cables, hoses, blankets, straps, etc. are temporarily stowed against the cold mass in order to allow free passage through the heat shield during insertion. The fitting on the helium fill tube is the highest point on the upper buffer volume. Verify that the fitting does not snag on the inside of the heat shield insulation during insertion.

4.3.9 Roll the cold mass through the cryostat using the leak test station winch.

4.4 Link & Thermal Strap Installation

4.4.1 Slit the cryostat and heat shield blankets to allow passage of the support link assemblies. Feed an upper support link assembly through its corresponding cryostat turret with the long link toward the cold mass. Pass the link and spherical bearing through the MLI blankets and through the cutout in the heat shield. Reach in from the end of the cryostat and insert the support pin through the cold mass support trunnion and through the spherical bearing at the end of the support link assembly. Install the hairpin clip through the support pin to retain the pin in the cold mass support trunnion.

4.4.2 Screw a one-foot length of ¼-20 threaded rod into the tapped hole in the end of the adjusting yoke stud to provide a temporary provision for holding the link in position for installation of the MLI blanket and external support flange.

4.4.3 Slide the lower half MLI blanket (tubular shaped) over the link assembly. Be sure the blanket passes through the cutout in the cryostat insulation and heat shield insulation blankets and contacts the cold mass blanket. Fasten the blanket as necessary.

4.4.4 Fasten the heat shield thermal strap to the heat intercept link on the support link assembly by reaching in through the cryostat turret.

4.4.5 Slide the upper half MLI blanket over the link assembly and fasten as necessary.

4.4.6 Slide the support flange over the adjusting yoke stud and bolt the flange to the cryostat turret flange.

4.4.7 Place the spherical washer and nut over the stud and run the nut and washer down firmly against the support flange. Be sure that the "screwdriver slot" in the end of the stud is aligned with the front and rear flange bolts to ensure that the support link is parallel to the cold mass centerline. Note position of heat shield strut. Do not tighten the nut yet. See Figure 2.

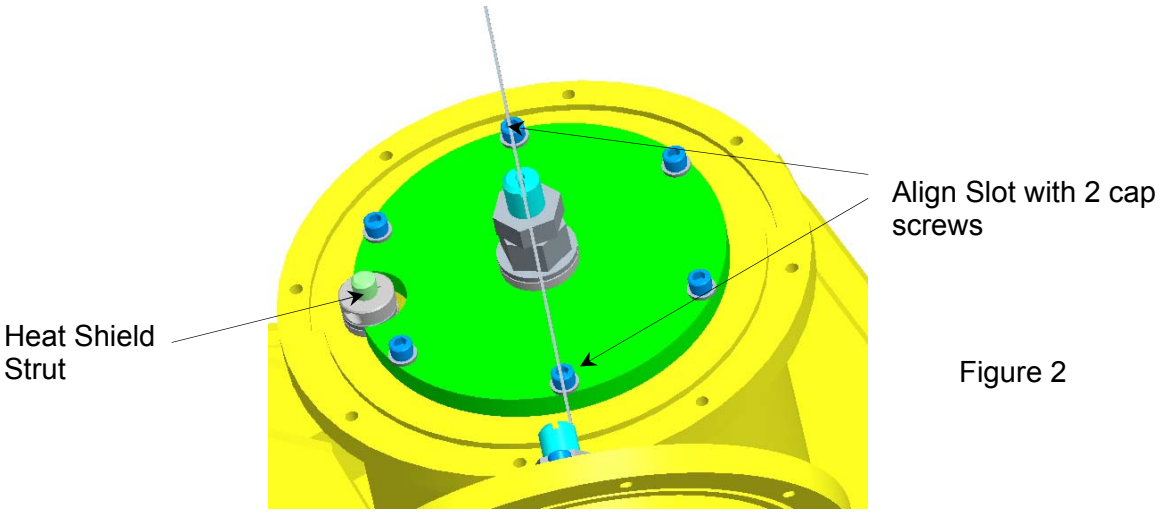

Figure 2

4.4.8 Remove the threaded rod and repeat steps 4.4.1-4.4.7 for the remaining (7) supports.

4.4.9 Alternately tighten the four upper links until the weight of the cold mass is borne by the suspension system so that the insertion fixture beams can be removed. Keep the lower links snug during this operation to prevent the cold mass from swaying laterally. The slots in the adjusting yoke studs must remain aligned with the front and rear support flange bolts to prevent twisting the support link assemblies. Although the support link spherical bearing can accommodate some misalignment the links must remain essentially parallel to the cold mass centerline at all times. Support the weight of the insertion fixture beams and remove from cold mass.

4.5 Alignment & Adjustment

4.5.1 Perform alignment of the heat shield and cold mass using the heat shield support rod threaded collars and the 8 cold mass adjusting stud nuts respectively. Bring the cold mass and heat shield to the proper heights within the cryostat as indicated on drawing 22010402. Be sure to keep the slots in the adjusting yoke studs aligned with the front and rear support flange bolts to prevent twisting of the

support link assemblies during adjustment. The cold mass support link final tensions will be approximately 10,000 pounds in the upper links and approximately 5,000 pounds in the lower links. These tension values shall be achieved by application of the required torques as specified. After completion of the final alignment procedure verify that the heat shield support rod and suspension adjustment yoke stud protrusions do not interfere with subsequent installation of the cryostat turret caps.

4.5.2 Install and torque the jam nuts on the 8 suspension system adjusting studs.

4.5.3 Tighten the locking screws on the 16 heat shield support rod threaded collars.

4.5.4 Fasten the IFS lines to the heat shield.

4.6 Helium Fill Port Installation

4.6.1 Cut the cryostat and heat shield MLI blankets around the buffer volume helium fill tube to permit access to the helium fill pipe.

4.6.2 Apply MLI to the helium fill-pipe and screw the helium fill-pipe assembly into the cold mass helium fill-tube through the helium fill port flange on the top of the cryostat. Use a crowfoot wrench and extension to reach down through the port to turn the assembly by the hex fitting on the bottom of the helium fill-pipe while a second crowfoot wrench and extension is used to “back up” the mating fitting on the cold mass helium fill-tube. This connection need not be completely leak tight so do not over tighten as this could damage the cold mass helium fill-tube. The rotational orientation of the fill tube assembly is important; back off rotation, if necessary, to obtain it.

4.6.3 Install the temperature sensor support wire, spring and sensors to the tabs provided on the lower portion of the inner helium fill pipe.

4.6.4 Slide the vent-pipe assembly over the fill-pipe upper "rolled flange". Insert the vent-pipe lower "rolled flange" into the mating tube on the top of the cold mass buffer volume. Rotate/align the vent-pipe so that the large, upper "rolled flange" is concentric with the fill port flange on the cryostat. [Alternately, this large flange can be left loose on the vent pipe during fabrication of the vent-pipe assembly so that the vent can be rotated to any convenient position during this step in order to facilitate subsequent plumbing of the magnet in the tunnel.] Weld the lower "rolled flange" to the tube on the cold mass buffer volume. Protect the MLI in the area to prevent burning of the blankets during welding. Weld the top of the vent-pipe to the smaller "rolled flange" at the top of the fill-pipe assembly. [If the large "rolled flange" was previously left loose raise it to its proper position on the vent pipe and rotate it so that it is concentric with the cryostat fill port flange. Weld it to the vent-pipe in this position.]

4.6.5 Leak check vent-pipe connections.

4.6.6 Install MLI on outside of the vent-pipe. (# of layers = 40)

4.6.7 Install the first half of the vertically split fill-pipe heat shield by fastening the fill-pipe heat shield flange to the mating flange on the main heat shield.

4.6.8 Install the thermal straps between the fill-pipe heat shield half and the vent-pipe.

4.6.9 Install the second half of the fill-pipe heat shield.

4.6.10 Apply MLI to the outside diameter and top of the fill-pipe heat shield. (# of layers = 40)

4.6.11 Place the intermediate adjustment flange and centering ring over the fill-pipe heat shield and position them on the cryostat fill port flange.

4.6.12 Place the o-ring and outer fill port pipe/flange assembly over the large "rolled flange" on the previously installed vent-pipe assembly and heat shield. Position the outer pipe/flange on the intermediate adjustment flange. The assembly can now be rotated and translated by means of the slotted holes in the flange to match any eccentricity that may exist between the large "rolled flange" on the vent-pipe assembly and the cryostat fill port flange. Install the flange bolts and weld the large "rolled flange" to top of the outer pipe assembly.

4.6.13 Leak check outer pipe welded connection and flange seal.

4.7 Warm-Up Heater Connection

4.7.1 Fasten the warm-up heater receptacle to its mounting pad on top of the cold mass buffer volume by reaching down through the cryostat warm-up heater penetration.

4.7.2 Place the centering ring and warm-up heater flange assembly on the cryostat warm-up heater penetration flange and install bolts.

4.7.3 Verify that the warm-up heater plug can be engaged/disengaged properly by means of the linear motion feed-through on the warm-up heater flange assembly.

4.8 Installing Pre-Cooler Connections

4.8.1 Slit the cryostat and heat shield MLI blankets as required for passage of the pre-cooler hoses.

4.8.2 Connect the cold mass pre-cooler lines to the cold mass pre-cooler and route to the cryostat pre-cooler connection penetrations. Fasten to the heat shield where required. Insulate the lines.

4.8.3 Connect the heat shield pre-cooler lines to the heat shield pre-cooler and route to the cryostat pre-cooler connection penetrations. Insulate the lines.

4.8.4 Place centering rings on the cryostat pre-cooler penetration flanges and temporarily tape or tie in place for subsequent welding operations on the pre-cooler flange assemblies.

4.8.5 Weld the pre-cooler lines to their respective tubes on the pre-cooler pipe assemblies.

4.8.6 Slide the pre-cooler flange assemblies over the “rolled flanges” on the pre-cooler pipe assemblies and bolt to the cryostat pre-cooler flanges. Weld the “rolled flanges” on the pipe assemblies to the flange assemblies.

4.8.7 Leak check all connections and flange seals.

5 Quality Assurance Provisions

5.1 The Quality Assurance provisions of this procedure require that the technician 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.

5.2 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.

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

6 Preparation For Delivery

N/A