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Large Hadron Collider
Magnet Division Procedure

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Title: LHC D1 Heat Exchanger and End Volume Installation

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REVISION RECORD

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A	10/24/00		Initial Release	
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1 Scope:

This specification describes the procedure for heat exchanger installation and end volume installation on the LHC D1 Dipole Cold Mass Assembly.

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
LHC-MAG-R-1038	LHC Twist Check & Fiducial Survey
RHIC-CR-E-4703-0041	RHIC Leak Checking Specification

BNL Drawings:

14010088	D1 Electro-Mechanical Assembly

3 Requirements:

Assembly work shall be done in accordance with the drawings and parts lists, and the installation and welding sequence described below.

All welding shall be performed by welders qualified in accordance with ASME Section IX. The welding parameters shall be set in accordance with those specified during welding process development.

3.1 Material/Equipment

LHC Cold Mass Lifting Beam	25-1782.01-5
LHC Weld Rotator Assembly	25-1784.01-5

3.2 Safety Precautions

3.2.1 Operators shall be trained by their cognizant technical supervisor and qualified in the operation of the 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. They shall also be trained in the use of the appropriate lifting device by the Cognizant Engineer or Technical Supervisor.

3.3 Procedure

3.3.1 Heat Exchanger Installation

3.3.1.1 Check the lengths of the copper heat exchanger tubes before installation. Trim to length and thoroughly clean and degrease them inside and out if necessary.

3.3.1.2 Weld a stainless-to-copper transition piece to both ends of each copper tube in accordance with the assembly drawing. Purge the inside of the tubes with argon gas while welding. Vacuum leak check the heat exchanger tubes. Maximum leak rate is 2×10^{-10} std. cc He/Sec.

3.3.1.3 Slide the two copper heat exchanger tubes through the two upper helium bypass holes in the lead end plate. Line up the ends of the two tubes approximately 1 ft. from the face of the lead end plate.

NOTE

When inserting tubes into the cold mass, be extremely careful not to damage wires behind endplates at both ends.

3.3.1.4 Weld the heat exchanger manifold assembly to each transition piece at the lead end. Purge the inside of the tubes with argon gas while welding. Clean all welds on the outside.

3.3.1.5 Weld the two bellows assemblies to the heat exchanger manifold designated for the non-lead end. Purge the inside of the tubes with argon gas while welding.

3.3.1.6 Weld the heat exchanger manifold assembly to the copper-to-stainless transitions at the non-lead end. Purge the inside of the tubes with argon gas while welding. Offer temporary support to the manifold assembly to avoid straining the bellows.

3.3.1.7 Install restraining clamps on each bellows. Cap the 2 inch diameter manifold tube at each end and cap the ½ inch diameter manifold at the non-lead end. Connect the ½ inch diameter manifold tube at the lead end to a dry N_2 gas supply.

3.3.1.8 Pressurize the completed heat exchanger to 75 psia with N_2 gas. Maintain pressure for 10 min. Then relieve pressure back down to atmosphere.

3.3.1.9 Vacuum leak check the completed assembly. Max leak rate is 2×10^{-10} Std. cc He /Sec. Upon completion, remove bellows restraints.

3.3.1.10 Set the position of the completed heat exchanger assembly and lock in place at the non-lead end between the bellows and the end plate.

3.3.2 End Volume Welding

3.3.2.1 Verify that all necessary electrical tests were completed after electro-mechanical assembly.

3.3.2.2 Mount the lead end volume on the magnet. Feed all the instrumentation wires/ cables through the lower left port in the end volume as shown on the assembly drawing. Be certain service loop remains in harness. Mark exiting instrumentation harness to match to flange position.

3.3.2.3 Fix the lead end volume in its proper position per the assembly drawing. Tack weld the end volume in place using six equally spaced fillet welds approximately 1/2" long using filler wire (P/N 12010441-03). Tack weld the heat exchanger manifold assembly to the end volume.

3.3.2.4 Complete the welding of the end volume by rotary MIG welding using .035” filler wire (P/N 12010441-01).

3.3.2.5 Remove temporary heat exchanger fixturing at non-lead end only after proper support is provided by end volume. Repeat steps 3.3.2.4 through 3.3.2.6 for the non-lead end volume. (However, no wires exit out the non-lead end).

3.3.2.6 Fillet weld beam tube to end volume flange at both ends. Argon purge the beam tube while welding.

3.3.2.7 Fillet weld all heat exchanger tubes to the outside face of the end volumes. Argon purge the heat exchanger tubes while welding.

3.3.3 Inspect Welds

3.3.3.1 Call for a certified weld inspector to inspect and sign off on all welds.

3.3.4 Measure cold mass straightness and sag per LHC-MAG-R-1038, section 4.1.

4 Quality Assurance Provision:

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

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

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

5 Preparation for Delivery:

N/A