

MINUTES

MQYYM MAGNET AND TOOLING REVIEW

MARCH 1ST 2017 AT CEA

Summary

The goal of this review was to go over the magnet design choices and the assembly tooling from a magnet assembly point of view. We list here the comments and the recommendation of the reviewers along with the action items proposed by the design team to address them

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1 COMMENTS ON TRACES FOR PROTECTION HEATERS

Comment #1: The protection heaters are presently positioned across 2 coils. JCP and NB point out the difficulty to assemble these heaters vertically when the coils are positioned on the stand, and the risk of PH damages due to its low thickness and the relative displacements between 2 adjacent coils during the collaring process. They suggest to consider the possibility to design them coil per coil to ease the installation and to be able to consider the coil + the 0.125 mm L shape insulation + PH as a package when handling the coil.

They also recommend to drop the coverlayer to simplify the PH fabrication and to ensure the protection of the PH by the scheme of the GPI

Drawback: give up on redundancy

Comment #2: 0.050 mm trace is too delicate to handle. Better to spread the thickness between Lshape and PH kapton or to move the coverlay thickness to the base Kapton layer of the trace and remove the coverlay

Drawback: L shape at midplane need to be 0.125 mm.

Comment #3: consider a local coverlay in the end to perform the solder of the wires to the SS trace. The extremity of the SS trace should be copper plated to facilitate the soldering of the powering wires. Consider to use the trace to place the Vtaps routes.

The coverlay thickness in the end should be compensated in the straight section. (possibly by the GPI)

Action item #1: consider a design including PH and Vtap trace and the comments on coverlay and wire soldering.

Action item #2: consider increasing the thickness of the trace

Action item #3: discuss with AF the possibility to fabricate the trace for the short model through the short model "fabrication line" (CERN +)

2 COMMENTS ON INSULATION

Comment #4: make sure that the GPI (Ground Plane Insulation) is sticking out longitudinally to isolate the exiting leads from the collars

Answer: on the lead side, this is already accounted for with a staggered GPI and the collars being stopped in advance with respect to the end of the endshoes. On the RE side, there is no need since there is no leads and that the endshoes are in G11.

Comment #5: The leads going in and going out of the coils are too close from each other and it will be difficult to isolate them. The modification of the endshoes might be necessary to separate the leads.

Action item #4: review of the end shoes to separate the IL and OL leads. This has an impact on the connection box.

3 COMMENTS ON COLLARING

Comment #6: The collaring shoe is approved by JCP and NB

Comment #7: the collaring keys are longer than the collared coils and are sticking out on both sides. During the installation of the coils and collars on the collaring assembly support, the collaring keys are pushed at the bottom of the grooves present at the bottom of the support plate.

After collaring the collared coils are positioned horizontally.

The keys are cut. They are slightly shorter than the thickness of the collar flanges to allow the solder. The flanges are positioned horizontally

Open question for JCP and NB: is there typically a longitudinal weld? If so there is a need for a chamfer.

Comment #8: positioning of the coils on the collaring assembly support:

The straight section should be aligned. The reference dimension is typically taken longitudinally between the flat of the endshoe and the flat of the pole end part (where the collars with collar nose will start). To make sure all the coils are positioned consistently, the endshoes can be remachined or a filler can be added. Ideally, the endshoe can be made slightly longer to provide margin.

Comment #9: axial support is necessary for JCP and NB. However, there might be a need to be able to provide an axial preload on the coils. What happens at cold?

Concern about the bending of the collar end flange. The bean shape extensions seem too flimsy.

MQXC had instrumented bullets screws as part of the connection box.

Action Item #5: 3D model in ANSYS

Comment #10: The pusher from the press that insert the Keys should be smaller than the pusher use to open the collars to allow enough room for the keys to bend.

Discussion: inner layer instrumentation wires are not compatible with the collaring mandrel

Question about mandrel material SPe 300: it is a strong steel from Lugand to allow strain relieving (fine machining)

Action Item #6: look if wire routing IR to OR trace could be possible through the coil end part holes

Action Item #7: order more collaring keys than necessary and check dimensions of the compressing length versus the insertion length on the press (check drawings)

4 COMMENT ON CONNECTION BOX

Comment #11: the support piece of the CB should be reviewed to be simplified and provide more room to the collaring flange/axial support.

Comment #12: the layer of the connection box which encompasses the instrumentation wires should be placed on the top of the connection box

Comment #13: each layer of the CB should be screwed down the previous layer or the bottom layer. Concern about the fact the cables are springy.

Comment #14: discussion on soldering process. The typical method used on short model at CERN includes:

- A straight part of the twist pitch length to ensure the solder
- The room to introduce a heating cartridge in order to solder the 2 splice cables and the copper groove. The assembly is lifted from the CB, heated with monitoring of the temperature and put back in position

This is different from the technique used at CEA for the Nb3Sn quad (see pictures)

Comment #15: the cable exit trajectory could be revised.

Action item #8 : check reason for cable position and relative position with respect to leads from 4K pot.
Action item #9: review splice box design, also due to **Action item #4**.

5 COMMENTS ON YOKING

Comment #16: There is a need to reference (in terms of position and rotation) the collared aperture with respect to the yoke end plate positioned on the yoking support. This is missing and could be fixed by adding a pin and a slotted hole between the collar flange and the yoke end plate

Comment #17: the top plate used to precompressed the yoke is not thick enough and provision for lifting fixture is missing

Action item #10: modify the end plate and the flange according to the comments 16 and 15

6 COMMENT ON HANDLING

Importance to plan for parts to allow fixing the magnet on the yellow rotating machine. NB proposes to send picture and drawings.

Action item #11: need to design/plan for this magnet rotating tooling