

TO: Phil Heitzenroeder
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SUBJECT: Trim Coil Close out Notes, WBS 1354

Date: 10/31/08

Scope

This job includes the design through to the completion of detailed drawings and the FDR for the Trim Coil Assemblies including the coils themselves and the casings.

Status

The Final Design of the Trim Coil Assemblies was completed in May of 2008 and all drawings were signed off and placed in the Intralink Database. Specifications for the Coils themselves were also completed and signed off. R&D concerning the welding of the coil supports and cases was performed but it is likely that further development work is required to finalize the manufacturing procedures with respect to the insertion of the coils into the support casings.

Interfaces

Trim Coils are convection cooled and therefore have no outstanding interfaces with any liquid nitrogen system. There will be I/O interfaces to work out with respect to thermocouple instrumentation to verify operating temperatures. The Trim Coil Assemblies must bolt into the existing structure and have been designed with sliding adjustable brackets to make up for misalignment due to tolerance build up on mating parts. During the development of the assembly procedures care must be taken to determine tightening torque and pre-loads. Bellville washers which appear on the assembly drawing parts lists are correctly sized to allow for the preload to react the calculated loads. Further development will be required for the cable connections to the leads. Cables are planned to be 4 twisted 12 gauge wires brazed into a lead block. Grounding requirements are defined in the final design review material. There are no magnetic diagnostic loops on the Trim Coils

Specifications

Final specifications for the Trim Coils are posted on the NCSX web site.

Schematics and PIDs

N/A

Models

All models are complete and posted in INTRALINK

Drawings

All Trim Coil Assembly drawings including drawings of the coils themselves, brackets, structure and top level assembly drawings are complete signed off and posted on the Engineering View Drawing Web Site

Analyses

All analysis are complete and posted on the NCSX web site

Testing

N/A

Costs

Manufacturing Costs for the trim coils are in the job estimate and based upon preliminary bids from Everson-Tesla as well as a part by part analysis of the support structure part costs.

Remaining Work

The design package for the Trim Coils is complete. The procurement package, for both the coils and the support structure brackets, must be generated, vendors evaluated, the contract awarded, and all of the subsequent Vendor oversight must be undertaken. Prior to assembly the welding R&D must be evaluated with more of the process development completed to ensure that the coil is not overheated while welding on the case. Further process development is required to determine the technique for filling the voids between the coil and the case with the glass epoxy mixture. Fixturing may be developed to assist in efficiently installing the coils onto the modular coil winding forms.

Lessons Learned:

For smaller conductor sizes without cooling holes the use of off the shelf spooled copper conductor can save cost if harden copper is not required. Increasing the number of turns so that current requirement for the power supply is lowered for the same required number of amp*turns can save hardware costs as long as the required voltage is not too high. Making the tolerance requirements no tighter than necessary will minimize coil cost.

Early evaluation of cooling requirements simplifies the design if convection cooling is adequate. Design requirements for the number of coils and their locations need to be determined up front with minimal detailed design begun to limit the amount of wasted effort.

Conclusion:

The Trim Coil design evolved into a focused final design after many design iterations with respect to the coil positions and the number of coils. The final design met the design requirement for minimizing island size with large margins and minimized the cost of fabrication by using standard techniques and a simplified support structure design. The design package is complete and ready for procurement.