

DESIGN REVIEW DOCUMENTATION – RESULTS

Title: NCSX Electrical Joint Peer Review _____ **WP#:** _____ (ENG-032)

Type of Review: Peer CDR PDR FDR

Cog Individual: J. Chrzanowski _____ **Date of Review:** ___ April 24, 2006 _____

Review Board Members:

Chairperson: C. Neumeyer

Invited attendees :

M. Cole, L. Dudek, P. Fogarty, G. Gettelfinger, P. Heitzenroeder, T. Meighan, H. Neilson, B. Nelson, S. Raftopoulos, R. Simmons, M. Williams, D. Williamson, M. Zarnstorff

Regulatory Compliance _____

Items Reviewed:	Sat.	Unsat.	Comments
Appropriate requirements identified	<input type="checkbox"/>		Design to fit given space and current __
Development plans and schedules	<input type="checkbox"/>	<input type="checkbox"/>	Not Presented _____
Regulatory compliance including USQD and NEPA	<input type="checkbox"/>	<input type="checkbox"/>	Not Presented _____
Disposition of CHITS from previous reviews	<input type="checkbox"/>	<input type="checkbox"/>	Not Presented _____
Cost objectives	<input type="checkbox"/>	<input type="checkbox"/>	Not Presented _____
Other review objectives addressed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Comments/exceptions below

Concerning proposed soldering operation....

- 1) Has adequate testing been performed to proceed with implementation? Yes
- 2) Have all credible risks been adequately addressed? Yes
- 3) Have special risks to C1 [already VPI'd] been adequately addressed? Yes
- 4) Are the design and procedure revisions adequately documented to proceed with implementation? Not yet; procedure needs to be reviewed by persons with relevant experience before proceeding with soldering.

SUMMARY OF RESULTS:

Presentation was made by J. Chrzanowski. Basically, due to issues related to imperfect fit-up of the joint, consisting of a tapered male section mating with a female connector, it has been concluded that some sort of modifications are needed to 1) restore desired electrical conductivity on the joints of the already fabricated C1 and C2 coils for which modification of the basic joint design is virtually impossible at this time, and 2) ensure desired electrical conductivity on the joints of remaining coils for which connector parts have been fabricated but can be modified. It is proposed to supplement the mechanical joining of the connecting parts by soldering, with the aim of increasing the cross sectional area available to current flow. There are various concerns related to this process which were addressed at the review. There is also a concern that the behavior of the joint has not been quantified at this time so that the criticality of joint resistance, and the meaning of resistance measurements made thus far, are not well understood. More work needs to be done in this area to determine what processing and/or modifications should be performed on subsequent coils after C1 and C2. And to determine what precision is necessary in making

the joint resistance measurements. Until this work is done, it was the consensus of the group that the soldering operation should proceed on C1 and C2, since soldering will surely not detract from the performance of the joint. As explained in the presentation, precautions will be taken during the soldering process to prevent damage to the C1 epoxy insulation, since it has already been impregnated. Also, the C1 coil will be subject to prototype tests at full load current so that any serious joint issues should be exposed at that time. Fourteen (14) chits were generated (summary list attached). Those directly related to the proposed soldering operation (5, 7, 10, 11) shall be resolved prior to proceeding with same.

Disposition: [check one]

Acceptable

Acceptable pending resolution of concerns- CHITS identified above must be resolved prior to installation.

Incomplete

Chairperson Signature: _____ **Date:** _____

Distribution: Review Board Members, Operations Center, Cognizant Design Engineer, System Engineer(s), Attendees, QA, ES&H

#	By	Concer	Disposition	Comment
1	Neumeyer	Basic performance of nominal joint needs to be understood. What is current density distribution at joint, considering unbalance between parallel windings? What is max local temperature rise? What is expected resistance? What is impact of thermal and mechanical effects?	Concur	
2	Neumeyer	Need more precision in R measurements	Concur	
3	Neumeyer	Consider making male part fluted (with ridges) to promote high pressure contact regions plus paths for solder flow.	Concur	Should be evaluated
4	Heitzenroeder	Consider sanding longitudinal strips on pins to ensure solder flow	Concur	See chit 3
5	Neumeyer	Use non-corrosive flux	Concur	
6	Neumeyer	Consider >10ft-lbs torque and alternate belleville washers (flatten at initial load)	Concur	
7	Neumeyer	Determine temperature of epoxy to avoid burning	Concur	
8	Neumeyer	Consider inserting screw into side of C1 connects to ensure good joints	Concur	
9	Heitzenroeder	Consider a pre-heating/cooling cycle on C1 joints with N2 blast to clean any epoxy which may be in joints	Concur	
10	Heitzenroeder	Compare "cool-heat" to Cu clamps in effectiveness to limit T of Cu before deciding on procedure details.	Concur	
11	Gettelfinger	Pedigree of selected solder needs to be confirmed for impact toughness and conductivity	Concur	
12	Gettelfinger	Formalize P Heitzenroeder's "sanding" approach by putting feed lines on mating elements	Concur	See chit 3
13	Gettelfinger	How will project assure that the electrical interfaces on C1 are clean enough to even consider soldering?	Concur	Need to reconsider allowable joint resistance. Then, if C1 passes resistance test, it is acceptable
14	Gettelfinger	Remove (destructively) the leads and jumpers from the C1 coil. Design a clamp-then-solder repair for C1.	Disagree	It is a premature conclusion that C1 cannot be recovered. However, special attention needs to be paid to this coil during subsequent processing and test.
15	Neumeyer	Investigate drawing dimensional error and assess impact.	Concur	