



ENG-033 - CRR - CHIT RESOLUTION REPORT

FIELD SCOPE CHIT RESOLUTION REPORT

NSTXU_1-1-2_CRR_100

Rev. 2

Work Planning #:
Effective Date: **03/09/2020**
Prepared By: **Peter Dugan**

Reviewed By	Mojtaba Safabakhsh, Cognizant Individual	03/09/2020 10:06:32 AM
Reviewed By	Yuhu Zhai, Project Engineer	03/09/2020 10:33:15 AM
Approved By	Robert A. Ellis, Chief Engineer	03/09/2020 10:57:52 AM



Chit Resolution Report for Field Scope

NSTX-U-1-1-2-CRR_100 R2

Prepared By: M. Safabakhsh, Cognizant Engineer

Approved By: Y. Zhai, NSTX-U Project Engineer

Approved By: R. Ellis, Chief Engineer



Record of Changes

Rev.	Date	Description of Changes
0	1/21/2020	Initial Release
1	1/23/2020	Chit Resolution from FDR 1
2	2/24/202	Chit Resolution from FDR 2

FDR 2:

Review	ID	Chit
Vacuum Vessel & Internal Hardware DVVR	VVIHCPO 5	There is at least a single galled and broken bolt on (I think) the pedestal. While it has been qualified as acceptable (NSTXU-CALC-12-09-01?), now may be the time to fix it.

Response: Calculation NSTXU_1-1-3-3_CALC_113 determined that there is sufficient strength in the remaining bolts. As a result, not further mitigation is not required.

Review	ID	Chit
VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-02	NSTXU_1-1-2-1-1_CALC_100 Needs to be fully signed and uploaded to DMS. Please ensure that the DMS signatories match those on the Calc/Checking Forms.

Response: The calculation NSTXU_1-1-2-1-1_CALC_10. was signed on 3 February 2020 via PDF. The file contains the check form in addition of the checked calculation. This calculation was uploaded to the DMS on 6 February 2020.

Review	ID	Chit
VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-04	NSTXU_1-1-3-1-4_CALC_100 is uploaded and "approved" on DMS. However, the DMS signatories don't match those listed in the calculation. COG = Moji, Preparer = Keith C, TA = P. Titus, Checker = Jared Sparks. Keith and Jared have not signed this calc. Please correct.

Response: The calculation NSTXU_1-1-2-1-1_CALC_10NSTXU_1-1-3-1-4_CALC_100 has been signed and the signatures match the document roles.

Review	ID	Chit
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VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-06	NSTXU_1-1-2-1_DRP_102 (FDR 2 Design Review Plan) is awaiting upload in DMS. Needs to be finalized (uploaded & signed)
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Response: The FDR Design review plan, NSTXU_1-1-2-1_DRP_102 is uploaded and signed.

Review	ID	Chit
VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-09	A Chit Resolution Report was not among the dashboard documentation. A CRR for all previous chits needs to be finalized (uploaded to DMS and approved).

Response: The Chit Resolution report for FDR 1 has been submitted and signed NSTXU_1-2-2_CRR_101 Rev 1.

Review	ID	Chit
VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-01	Add RTV to the VV support insulation, particularly in area of horizontal G10 sheet. Voltage standoff as designed depends on cleanliness of assembly.
VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-03	Consider applying the RTV sealing to the ID of the hole at the G10 plate to maintain the cleanliness of that local area after installation.

Response: RTV was considered and will be included in the installation procedures to be added in the areas specified in the chits.

Review	ID	Chit
VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-08	Ensure the drilling procedure - drill settings are within the bounds of the FEA parameters that defined the acceptable deflection to achieve the required tolerances of the holes.



VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-05	Design of the fixture or the drilling procedure need to account for the tolerance stack of the drill fixture, the metrology measurement error and the drill + fixture deflection when drilling the holes.
VVHW Recovery Field Scope FDR II	VVHWRE CFSFDR 2-07	<p>I am concerned that the tolerances as stated at the review could lead to an aggregate shift of the bolt circle that could compromise the Project alignment goals. I am concerned, perhaps unnecessarily, that tolerances designed to represent fluctuations about the mean circle could result in an aggregate shift of the mean circle.</p> <p>Please confirm that process proposed is consistent with the global tolerance allocations that have been developed as part of the MCS design.</p>

Response: A mockup is being developed and will be used to ensure the proper alignment and tolerance stack-up is achieved. Extensive use of metrology representing that of the vacuum vessel flange will be used to ensure that the transition to drilling holes using the tapping jig is accurate on the production vessel flange.

FDR 1:

Review	ID	Chit
VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 01	Complete the chit resolutions from previous reviews.

Response: Chit Report was completed and signed as DMS Number: NSTX-U-1-2-2-CRR_100; 1/21/2020 (Closed)

Review	ID	Chit
VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 03	CALC_1-1-3-2_CALC_100 is missing the COG signature. Need this signature, and then filing in DMS (work with Kathleen).

Response: The calculation form was fully signed and submitted through Kathleen to DMS on 12/19/2019. (Closed)



Review	ID	Chit
VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 04	Include DVVR chits in chit report. Chit report must reference closing document numbers.

Response: DVVR chits that were pertinent to the FDR scope are addressed in the Chit Report that was prepared for the FDR, as the Chit report was unsigned at the time of the review. (Closed)

Review	ID	Chit
VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 05	NSTXU_1-1-2_CALC_101 & NSTXU_1-1-2_CALC_102 need to be filed in DMS.

Response: The subject calculations were signed and posted in the DMS. (Closed)

Review	ID	Chit
VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 06	Cut the lower spoke lid blocks off instead of altering them or their connection to the pedestal

Response: The chit was considered, accepted, and is incorporated in the procedure (D-NSTXU-IP-VVHW-4087, Lower Umbrella Reinforcement Installation and Adjustment). (Closed)

Review	ID	Chit
VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 07	Frictional Reusability Assessment test report must be signed by the RE and filed in DMS

Response: The subject Test Report has been posted into DMS: NSTXU_1-1-2-1-2_TREP_100. (Closed)

Review	ID	Chit
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VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 08	Provide WAF form for the cost and schedule for all field scope task including labor, materials, etc.
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Response: The WAF information was developed, shared with the DRC and posted to the dashboard. (Closed)

Review	ID	Chit
VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 09	For the lower spoked lid, does the tracking distance in the joint between the 2 g10 plates and the bushing meet the 0.3 inch tracking length requirement?

Response: Vertical tracking distance (0.344 inch) meets the 0.3 inch requirement. The horizontal tracking distance (0.219 inch) does not meet the 0.3 inch requirements due to the restricted dimensions of the bolt and hole on the lid. Note that 0.3 inch tracking distance is required for not cleaned air. Silicone RTV has more than 10 times in electrical breakdown strength than that of air. Tests have been done (for other tasks) and proved that fully cured silicone RTV works very well in high V insulation in a small structure, see the test report (C-NSTX-PTP-VVIH-004, MPC 01). Using silicone RTV to seal the joint of G-10 bushing and plates meets the requirement of tracking distance. And this is incorporated in the procedure (D-NSTXU-IP-VVHW-4087, Lower Umbrella Reinforcement Installation and Adjustment). This requirement comes from NSTX-U-RQMT-SRD-004-02 Section 10.4.1 a. The casing electrical insulation with respect to ground shall be designed for a 2kV rms high-pot test voltage of duration 1 minute. 2kV rms=2.8 KV peak. By using the 10 kV/inch rule, it requires 0.3 inch air gap clearance. If using RTV to fill the air gap, it requires much less clearance. Closed

Review	ID	Chit
VVHW Recovery Field Scope FDR	VVHWRE CFSFDR 12	PF 2,3,4,5 clamps: If tubes are used to protect threads they should be short enough to remain unloaded with the clamping force applied Silicon rubber pads should be used under the clamping plates to eliminate crushing high spots on the coil ground wrap Bellevilles should be included under the stud nuts to allow thermal expansion of the coil without significantly altering the clamping preload. Clamping preload needs to be set to exceed the net load allowed in the DCPS we need to check 20 ft-lbs vs. 45 ft-lbs

Response: Inspection of all the tubes is in the works. Adding components such as silicon rubber and Belleville washers was not needed for PF2/3 as the PF2/3 coils are not pinned. An analysis was performed for PF4/5 and at the pinned locations, rubber pads will be added to increase friction and reduce the risk of slipping at these locations. The resolution for PF2/3 in response to this chit is documented in



the memo MAG-200122-KC-01. The concern of crushing high spots on the coil ground wrap was mitigated due to coil construction. When the coil ground wrap was cured, the top and bottom were pressed flat eliminating high spots. Clamping torque values of 43 ft-lbs is the historical torque for PF 2,3,4,5 clamps and continued to use that torque will continue to be used.

PDR 1:

Review	ID	Chit
Vacuum Vessel & Internal Hardware DVVR	VVIHFSP DRI01	Create/update wiring diagrams to show all the components that need to be connected to the grounding system.

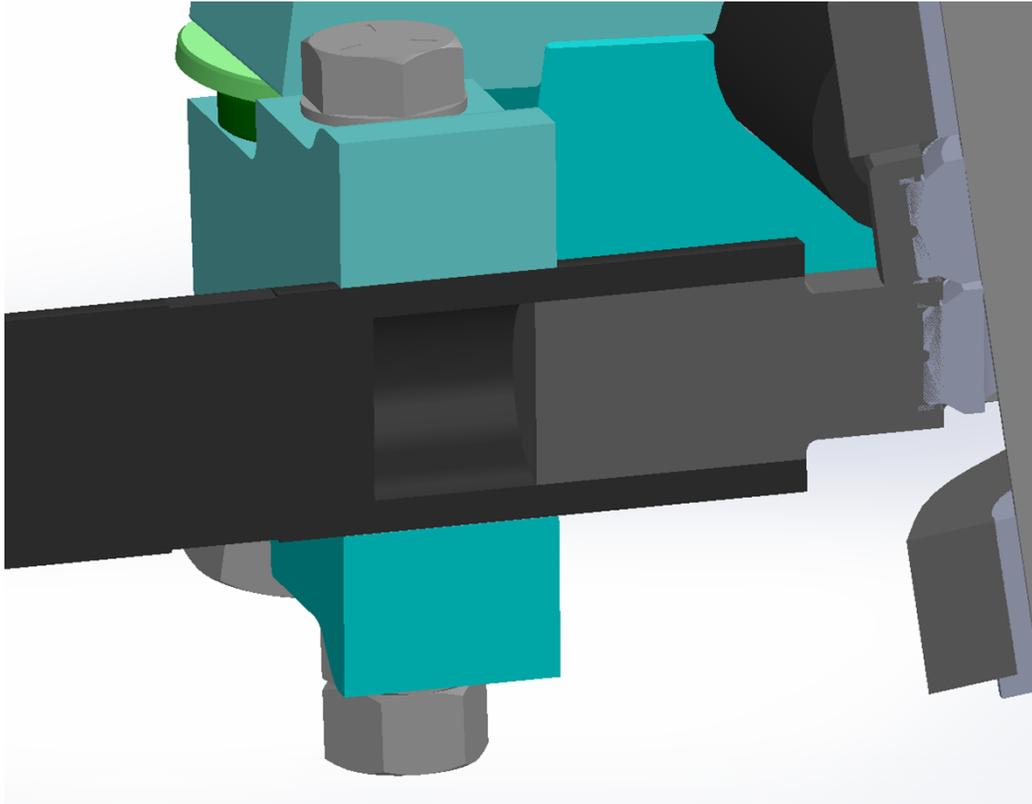
Response: Analysis has been conducted on adequacy of the grounding of PF4-5 clamps. (see calculation form NSTXU_1-1-3_CALC_100 Rev. 0). The task of completing the wiring diagrams will be assigned to the coil reclamping project team.

Review	ID	Chit
Vacuum Vessel & Internal Hardware DVVR	VVIHFSP DRI02	Consider performing an examination of as-built and machined part tolerances (tolerance stack up) to ensure that the frictional contact area is sufficient to prevent galling/slippage on the Truss OD/Clamp interface. What is the OD tolerance on the Truss? What is the machined ID tolerance of the Clamp?

Response: Design drawing (D-DC11318) notes the dimensions and tolerances. Sufficient safety margin in effective coefficient of friction (0.2) and strength of members are ensured (see calculation form NSTXU_1-1-3-2 CALC 100). Closed

Review	ID	Chit
Vacuum Vessel & Internal Hardware DVVR	VVIHFSP DRI03	Ensure that the clamps location on the rods does not overlap the internal threads of the rod OR ensure that the clamping load does not penetrate into the rod end threads and adversely affect thread fatigue life.

Response: The compression of the female threads due to the clamp may actually improve the fatigue life, and in any event will do no harm. See below snapshot and drawing numbers D-DC11318 and D-DC11331. Closed



Review	ID	Chit
Vacuum Vessel & Internal Hardware DVVR	VVIHFSP DRI04	Consider a higher strength bolt for the clamping system so that the Safety Factors can be greater.

Response: Sufficient safety margin is included in the design of components. See details in calculation form (NSTXU_1-1-3-2 CALC 100) and drawings (D-DC11331); (D-DC11317). Closed

Review	ID	Chit
Vacuum Vessel & Internal Hardware DVVR	VVIHFSP DRI05	Consider re-surfacing engaging carbinite surfaces to avoid indexing due to old carbinite engagement divots. This is relative to anticipated alignment needs that will position pieces in different locations from their previous assembly.

Response: Carbonite re-use and re-clamping (at different orientations) have been tested and proved not substantial reduction in coefficient of friction. See test report (Frictional Reusability Assessment of Carbinite-Coated Interfaces in NSTX-U) (NSTXU_1-1-2-1-2_TREP_100). Closed

PDR 2:

Review	ID	Chit
Vacuum Vessel & Internal Hardware PDRII	VVIHFSP DRII01	Specify clearance requirements of TF coil to support based on analysis and capture in requirements document. Verify all design requirement basis are captured in requirements documents.

Response: Refer to Jiarong's calculation (NSTXU_1-1-2_CALC_101) on VV9 chit and presentation which defines the clearance. The clearance meets the requirement that the support not contact the coil during operation. NSTX-U Dimensional Control Requirements NSTX-U-RQMT-RD-011-01 provides the alignment requirements of the TF Coil. Closed

Review	ID	Chit
VVIH Field Scope PDRII	VVIHFSP DRII03	For the lower lid spoke bolted connection, you will have to ensure that the gap between the G10 plates is a little bit larger than the length of the G10 tube otherwise the tube will be crushed.

Response: The G10 bushing is designed 5 mils shorter to provide the gap (see drawings E-DC1579 and C-DC1910). Closed

Review	ID	Chit
VVIH Field Scope PDRII	VVIHFSP DRII04	Use a gap filling structural epoxy to fill between the bolt and the hole/G10 bushing.

Response: Comparing with G10 grade compressive strength, epoxy grout is not a matching replacement. The low stiffness of epoxy grout makes it ineffective compared to the stiffness of the G-10 components, and therefore we did not use it. Closed.



Review	ID	Chit
VVIH Field Scope PDRII	VVIHFSP DRII05	The realignment of the TF Bundle will result in the pedestal moving which in turn will relocate the ends of the spokes. The current locations of the welded blocks will not align. Recommend that the current blocks be removed and new block be field fit and welded on after TF Bundle alignment.

Response: The existing welded blocks will be removed. Installation and assembly of the new welded blocks is part of reassembly scope and will be addressed at assembly in compliance with PPPL engineering requirements.

This is addressed in the procedure (D-NSTXU-IP-VVHW-4087, Lower Umbrella Reinforcement Installation and Adjustment), and referred from the drawings E-DC1579, C-DC1910. Closed

Review	ID	Chit
VVIH Field Scope PDRII	VVHWRE CFSFDR 10	For the lower spoked lid, does the tracking distance in the joint between the 2 g10 plates and the bushing meet the 0.3 inch tracking length requirement?

Response: Vertical tracking distance (0.344 inch) meets the 0.3 inch requirement. The horizontal tracking distance (0.219 inch) does not meet the 0.3 inch requirements due to the restricted dimensions of the bolt and hole on the lid. Note that 0.3 inch tracking distance is required for not cleaned air. Silicone RTV has more than 10 times the electrical breakdown strength than that of air. Tests have been done (for other tasks) and proved that fully cured silicone RTV works very well in high V insulation in a small structure, see the test report (C-NSTX-PTP-VVIH-004, MPC 01). Using silicone RTV to seal the joint of G-10 bushing and plates meets the requirement of tracking distance. And this is incorporated in the procedure (D-NSTXU-IP-VVHW-4087, Lower Umbrella Reinforcement Installation and Adjustment). Closed