

**OVERSIGHT PLAN**

**FOR**

**FABRICATION OF THE HEAT  
TRANSFER TUBES, AND  
HEAT TRANSFER PLATES**

**NSTX-U-OP-VVIH-005-01**

REFERENCE WORK PLANNING NO: 2322

PREPARED: \_\_\_\_\_  
C. Pagano, Engineer

REVIEWED: \_\_\_\_\_  
D. Cai, Cognizant Engineer

REVIEWED: \_\_\_\_\_  
M. Ramos, Quality Assurance

APPROVED: \_\_\_\_\_  
D. Loesser, Responsible Engineer

CONCURRED: \_\_\_\_\_  
Y. Zhai, NSTX-U Project Engineer

Key: E=Engineer; T=Technician, QA/QC = Quality Assurance/Control Personnel

General Notes:

- Designated hold points may be through an onsite visit or documented through other media such as photos

Heat Transfer Tube Fabrication:

KEY OVERSIGHT ACTIVITIES PLANNED HOLD/WITNESS POINTS	NOTES/COMMENTS	PERSONNEL
Hold after submission of MIT Plan	<ul style="list-style-type: none"> <li>• Review and approve.</li> <li>• MRR at supplier's site.</li> </ul>	E w/ QA/QC
Hold after winding the Heat Transfer Tube on the Mandrel (E-DC11073-10) but prior to placing the outerform	<ul style="list-style-type: none"> <li>• Ref. NSTX-U-SPEC-VVIH-003</li> <li>• Document in Surveillance Sheet (ref. NSTX-U-PLAN-001-01, Attachment 2)</li> <li>• Check that parts are meeting dimensions outlined on drawings and that the tube is not being kinked or deformed during assembly</li> </ul>	E or T and/or QA/QC
Hold after placing the outerform (E-DC11225-1) over the wound Heat Transfer Tube		E or T and/or QA/QC
Hold after heat treating the Heat Transfer Tube (E-DC11073-10)		E or T and/or QA/QC
Hold after bending the Inlet of the Heat Transfer Tube (E-DC11073-2) and verifying fit with 3d Printed form provided by PPPL		E or T and/or QA/QC
Hold after welding the fittings to the Heat Transfer Tube and Outlet Lines (E-DC11073-03 & -04)		<ul style="list-style-type: none"> <li>• Ref. NSTX-U-SPEC-VVIH-004</li> <li>• Document in Surveillance Sheet (ref. NSTX-U-PLAN-001-01, Attachment 2)</li> <li>• Check that parts are meeting dimensions outlined on drawings</li> <li>• Verify compliance and ensure completion of all test reports</li> </ul>
Witness testing the fitting welds (E-DC11073-03 & -04)	E or T and/or QA/QC	
Hold before packing and crating to CSC Vendor	<ul style="list-style-type: none"> <li>• Ref. NSTX-U-SPEC-VVIH-003 and -004</li> </ul>	E and/or QA/QC
Hold after final packing and crating when ready for shipment to CSC Vendor		E and/or QA/QC

HTP and Machined Accessories:

KEY OVERSIGHT ACTIVITIES PLANNED HOLD/WITNESS POINTS	NOTES/COMMENTS	PERSONNEL
Hold after submission MIT Plan	<ul style="list-style-type: none"> <li>Review and approve.</li> <li>MRR at supplier's site.</li> </ul>	E w/ QA/QC
Hold after Fabrication of the Heat Transfer Plate Components	<ul style="list-style-type: none"> <li>Ref. NSTX-U-SPEC-VVIH-004</li> <li>Document in Surveillance Sheet (ref. NSTX-U-PLAN-001-01, Attachment 2)</li> <li>Check that parts are meeting dimensions outlined on drawings</li> <li>Verify compliance and ensure completion of all test reports</li> </ul>	E or T and/or QA/QC
Hold after Heat Transfer Plate E-Beam Welding and Witness Testing		E or T and/or QA/QC
Hold before final packing and crating	<ul style="list-style-type: none"> <li>Ref. NSTX-U-SPEC-VVIH-004</li> </ul>	E and/or QA/QC
Hold after final packing and crating when ready for shipment	<ul style="list-style-type: none"> <li>Properly package/monitoring/labeling per specification to avoid any damage during transport</li> </ul>	E and/or QA/QC

Heat Transfer Tube Mandrel and Outerform:

KEY OVERSIGHT ACTIVITIES PLANNED HOLD/WITNESS POINTS	NOTES/COMMENTS	PERSONNEL
Hold after submission of MIT Plan	<ul style="list-style-type: none"> <li>Review and approve.</li> </ul>	E w/ QA/QC
Hold after completion of fabrication, including any welding and machining	<ul style="list-style-type: none"> <li>Ref. PQA 420186</li> <li>Check that the parts meet the dimensions outlined on the drawings</li> <li>Visually inspect all welds</li> <li>Document in Surveillance Sheet (ref. NSTX-U-PLAN-001-01, Attachment 2)</li> </ul>	E or T and/or QA/QC
Hold before final packing and crating	<ul style="list-style-type: none"> <li>Ref. PQA 420186</li> <li>Confirm proper packaging/monitoring/labeling to avoid any damage during transport</li> </ul>	E and/or QA/QC
Hold after final packing and crating when ready for shipment		E and/or QA/QC

VISITING ORGANIZATION	MINIMUM NO. OF VISITS	NOTES
Engineer	2	For each contract. Leak test. Other in-process as needed or defined in the MIT plan; Document in-process in Surveillance Sheet (ref. NSTX-U-PLAN-001-01, Attachment 2)
Technician	0	None unless needed for hold/witness points above
QA/QC	1	For each contract. QA or QC; Document in-process in Surveillance Sheet (ref. NSTX-U-PLAN-001-01, Attachment 2)

**In-Process Oversight Checklist**

ACTIVITY	FREQUENCY	NOTES
<b>HTT/HTP COMPONENT FABRICATION</b>		
Fabrication of components and sub-assemblies for the Heat Transfer Tube	As deemed appropriate during performance of activity  Ref. TS §6.0 for testing sequence	All items are fabricated per their associated drawings. Ensure smooth drop shipping of components between bending and fabrication vendor.
Dimensional Measurements (§6.1.1 of each associated TS)		Verify that all components meet the GD&T outlined on each drawing
Acceptance Testing (NDT, Leak, Pressure) of all joints/connections (§6.1.2 of each associated TS)		Review and approve test results
Magnetic Permeability Test (§6.1.5 of each associated TS)		In accordance with the requirements of ASTM A 342, Test Method No. 3
<b>SPECIFIC TASKS</b>		
Lead weekly meetings with PPPL.	Weekly	
Emails with highlight bullets, also added to daily log.	Daily	Create Google doc in "External Suppliers" folder
Attend internal Supplier meetings, if allowed, that pertain to the HTT/HTP scope of work.	When Possible	
Document any non-conforming conditions and report to PPPL.	Per Occurrence	Report within 24 hours
Anticipate hold points and coordinate visits from PPPL staff.	Per Occurrence	Scheduling should be done at least 5 business days in advance
Note any manufacturing, cleanliness, safety, or other deviations from agreed upon manufacturing steps and immediately bring attention to line supervisor.	Per Occurrence	Issue a "Stop Work" if necessary.

<b>PROGRAMMATIC CONTROLS AND WORKPLACE PRACTICES</b>		
Control of Procured Items and Services	As deemed appropriate during performance of activity	<p><b>Oversight &amp; Control of Sub-tier Suppliers</b></p> <ol style="list-style-type: none"> <li>1. Appropriate controls over the services performed by sub-tier suppliers appropriate?</li> <li>2. Is source inspection or receipt inspection controls adequate?</li> </ol> <p><b>Suspect/Counterfeit Items</b></p> <ol style="list-style-type: none"> <li>1. Has the supplier developed a procedure or written instructions to address the review of documentation and inspection materials or parts for suspect/counterfeit items?</li> <li>2. Are these instructions or procedure requirements included in the receiving inspection plan or checklist?</li> <li>3. Are purchased materials received at the supplier tested to verify their authenticity?</li> <li>4. What is the frequency and amount of testing performed?</li> <li>5. How are materials being stored while awaiting receipt inspection and verification of authenticity?</li> <li>6. Are suspect materials segregated and tagged pending final disposition?</li> <li>7. Do procedures in the shop control transfer of identification and temporary markings while the fabrication or machining is in-process?</li> <li>8. Who is the responsible group for receipt of items and identification of suspect/counterfeit items?</li> </ol> <p><b>Material Identification &amp; Control</b></p> <ol style="list-style-type: none"> <li>1. Material storage requirements appropriate?</li> <li>2. Materials uniquely identifiable and traceable to records?</li> <li>3. As required to prevent damage?</li> <li>4. Methods utilized to transfer material identification such that when material is subdivided it remains traceable to the correct supporting record and its point of use?</li> <li>5. Materials being submitted to PPPL for its approval when required?</li> </ol> <p>Parts marking and travelers consistent?</p> <p><b>Control of Shelf Life Sensitive Materials</b></p> <ol style="list-style-type: none"> <li>1. Shelf life controls defined in procedures?</li> <li>2. Shelf life sensitive materials subject to appropriate material identification &amp; control requirements?</li> <li>3. Records of use maintained?</li> <li>4. Materials subject to verification prior to use?</li> </ol>

<p>Identification and Control of Items</p>	<p>As deemed appropriate during performance of activity</p>	<p><b>Weld Filler</b></p> <ol style="list-style-type: none"> <li>1. Material identification maintained – package level, rod Level, oven Level, spool Level?</li> <li>2. Filler material identification recorded on work instructions as material consumed?</li> <li>3. Rod stubs and unidentified materials controlled?</li> <li>4. Rod ovens are calibrated and controlled?</li> <li>5. Weld filler metal is traceable to procurement documents?</li> <li>6. Correct weld material is being utilized?</li> </ol> <p><b>PPPL Supplied Materials</b></p> <ol style="list-style-type: none"> <li>1. Receipt inspections done by the Supplier controlled by procedures approved by PPPL to the PPPL-supplied acceptance criteria?</li> <li>2. Material identification requirements being met?</li> <li>3. Material storage requirements being met?</li> <li>4. Materials being controlled until PPPL approval of testing has been completed and determined to be acceptable?</li> <li>5. Any additional fabrication requirements for the materials being met and documented?</li> <li>6. NCR controls or other suitable measures being utilized to control materials that have been conditionally released for further processing pending further direction from PPPL?</li> </ol>
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<p>Control of Special Processes</p>	<p>As deemed appropriate during performance of activity</p>	<p><b>Welding</b></p> <ol style="list-style-type: none"> <li>1. PQRs and WPSs available for the method(s)/thicknesses being utilized, do they meet code requirements and are they approved?</li> <li>2. Welders qualified?</li> <li>3. Essential variables (WPSs &amp; WPQs) controlled and being met?</li> <li>4. Joint prep/fit-up requirements being met?</li> <li>5. Welding consumable requirements being met?</li> <li>6. Preheat and interpass temperature requirements being met (if required)?</li> <li>7. Weld joint records being developed and maintained?</li> <li>8. Inspection and test requirements being met?</li> <li>9. Are tack welds being controlled in accordance with governing code?</li> <li>10. Weld pick-up needs (spatter, arc strikes, start &amp; stops, roll over, undercut, etc.) addressed appropriately?</li> <li>11. Cleanliness – interpass cleaning requirements being met?</li> <li>12. Weld Repair requirements being met?</li> <li>13. M&amp;TE control, including calibration of portable ovens</li> </ol> <p><b>Temporary Attachment Welding (TAW)</b></p> <ol style="list-style-type: none"> <li>1. Attachment and weld materials compatible with the base material?</li> <li>2. Weld requirements being met?</li> <li>3. Records of the TAW developed and maintained to document location, materials, welders, and inspections?</li> <li>4. TAWs recorded on traveler?</li> <li>5. Removal methods appropriate such that the potential for damage to base material is minimized?</li> <li>6. TAWs in accordance with ASME Section III, if applicable (i.e. NB, NF, NG, non-code)</li> <li>7. Inspection and test (visual, PT, UT thickness) requirements being satisfied?</li> </ol> <p><b>NDT Methods</b></p> <ol style="list-style-type: none"> <li>1. Procedure approved by PPPL?</li> <li>2. PPPL design requirements being met by the stated NDT methods and acceptance criteria?</li> <li>3. NDT technicians qualified?</li> <li>4. NDT methods conducted in accordance with procedure requirements?</li> <li>5. The M&amp;TE utilized appropriate for the method (when utilized) and is it calibrated (e.g. densitometer)?</li> <li>6. Unit conversions within required design tolerances (inches to metric)?</li> <li>7. Lighting requirements met?</li> <li>8. Are non-relevant indications recorded and justified when required by spec?</li> </ol>
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<p>Inspection and Test Control</p>	<p>As deemed appropriate during performance of activity</p>	<p><b>Dimensional Inspection Methods</b></p> <ol style="list-style-type: none"> <li>1. Inspection procedures approved by PPPL?</li> <li>2. Inspections performed in accordance with written instructions?</li> <li>3. Inspection requirements and acceptance criteria in accordance with the requirements of the specification?</li> <li>4. Complete extent of feature inspected on non-machined parts?</li> <li>5. Inspection results being recorded on inspection records at the time the inspection was performed?</li> <li>6. The M&amp;TE utilized appropriate for the inspection (when utilized) and is it calibrated?</li> <li>7. Inspectors qualified for the inspection?</li> <li>8. Unit conversions within required design tolerances (inches to metric)?</li> </ol>
		<p><b>Test Control</b></p> <ol style="list-style-type: none"> <li>1. Tests performed in accordance with written instructions and are the requirements being followed?</li> <li>2. Test procedures approved by PPPL?</li> <li>3. PPPL design requirements being met by the stated test methods and acceptance criteria?</li> <li>4. Test operators qualified for the test activity?</li> <li>5. The M&amp;TE utilized appropriate for the test (when utilized) and is it calibrated?</li> </ol> <p>Unit conversions within required design tolerances (inches to metric)?</p>

<p>Handling, Storage, and Shipping</p>	<p>As deemed appropriate during performance of activity</p>	<p><b>Contamination Controls</b></p> <ol style="list-style-type: none"> <li>1. Handling, storage, cleaning, packaging, shipping, and preservation of items controlled to prevent damage or loss and to minimize deterioration?</li> <li>2. Contamination measures controlled by procedure or other documented work controls?</li> <li>3. Packaging methods appropriate for preventing intrusion of foreign materials?</li> </ol> <p><b>Cleanliness Control</b></p> <ol style="list-style-type: none"> <li>1. Carbon materials kept separated?</li> <li>2. Grinding wheels &amp; wire brushes controlled?</li> <li>3. Softeners or other protective covers utilized to prevent contact with rigging &amp; handling equipment?</li> <li>4. Protective covers utilized for materials that come in contact with carbon steel storage racks, stands, fixtures, etc.?</li> <li>5. Grinding on carbon steel materials is not being performed in proximity to unprotected Inconel/stainless steel materials?</li> <li>6. Test reports available to ensure chemistry of expendables (e.g. water, liquid penetrant materials, markers, UT couplant, machining oils, tape, solvents, etc.) meet requirements</li> <li>7. Expendable materials controlled?</li> <li>8. Packaging materials correct?</li> <li>9. Materials stored properly (on dunnage, protected with plastic wrap, inside, etc.) as required by procedures?</li> <li>10. Housekeeping measures adequate?</li> <li>11. Dust control measures adequate?</li> <li>12. Are fixtures or material handling equipment clean?</li> <li>13. Cleaning procedures meet specification requirements and account for unique cleaning needs resulting from fabrication methods?</li> <li>14. Cleaning methods conform to requirements as invoked by specifications and drawings?</li> </ol> <p><b>Control of Templates/Fixtures Utilized for Work or Inspection Purposes</b></p> <ol style="list-style-type: none"> <li>1. Template/fixtures verified to ensure design criteria have been satisfied (e.g. inspected prior to use and periodically while in use)?</li> <li>2. Template/fixtures uniquely identifiable and controlled (when required)?</li> <li>3. Template/fixtures undamaged and in good working order?</li> <li>4. Templates/fixtures controlled under a calibrated tool system or equivalent level of control?</li> </ol>
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Control of In-Process Records	As deemed appropriate during performance of activity	<ol style="list-style-type: none"> <li>1. In-process records controlled to prevent loss or damage?</li> <li>2. Records identifiable and traceable to associated equipment?</li> <li>3. Records being completed as work progresses?</li> <li>4. Records reviewed for completeness and accuracy in a timely fashion?</li> <li>5. Records properly stored after completion?</li> </ol>
Control of Nonconforming Items and Corrective Action	As deemed appropriate during performance of activity	<ol style="list-style-type: none"> <li>1. Nonconforming items identified and segregated?</li> <li>2. Dispositions developed for nonconforming items appropriate?</li> <li>3. Corrective Actions initiated for repeat, extent of condition and preventative actions purposes when appropriate?</li> <li>4. PPPL approvals obtained when required?</li> <li>5. Rework and repair activities conducted in accordance with approved work control documents?</li> <li>6. Inspection and test requirements being satisfied for rework and repair activities?</li> <li>7. NCR being closed out in an appropriate and timely manner with all supporting documentation identified and available for review or record purposes?</li> </ol>
Personnel Safety	As deemed appropriate during performance of activity	<ol style="list-style-type: none"> <li>1. Proper equipment (hard hats, safety glasses, gloves, hearing protection, etc.) being utilized?</li> <li>2. Ladders and staging in good working order?</li> <li>3. Extension cords GFI protected?</li> <li>4. Tripping hazards minimized?</li> <li>5. Hearing protection requirements identified and followed?</li> <li>6. Personnel safety requirements identified for lead pouring operations?</li> <li>7. Company safety policies are being complied with?</li> <li>8. Crane operators trained?</li> <li>9. PPPL compliance with site requirements?</li> </ol>
Workmanship	As deemed appropriate during performance of activity	<ol style="list-style-type: none"> <li>1. Weld distortion</li> <li>2. Roundness and straightness</li> <li>3. UT thickness inspections at weld joints</li> <li>4. No loose weld backers</li> <li>5. Sharp edges deburred</li> <li>6. No residual, oil, grease, machining fluids or other foreign substances</li> <li>7. All parts and assemblies should be free from weld spatter</li> </ol>

<p>General Considerations</p>	<p>As deemed appropriate during performance of activity</p>	<ol style="list-style-type: none"> <li>1. Do the instructions, procedures, and drawings for the activity require PPPL approval and were they approved?</li> <li>2. Was the document approved by properly qualified personnel?</li> <li>3. Do the instructions, procedures, or drawings comply with the requirements of the specification and drawings?</li> <li>4. Are the personnel performing the work properly trained and qualified?</li> <li>5. Are appropriate work instructions available at the work location and are the instructions being followed (procedure compliance)?</li> <li>6. Is the work being documented (data collection, step sign off, record keeping, etc.) as required by the work instruction (procedure compliance)?</li> <li>7. Is the work instruction adequate for the task being performed (inspection techniques, prerequisites, documentation requirements, etc.)?</li> <li>8. If a problem or unexpected result is identified, was the work stopped or otherwise controlled/addressed as required by work control requirements (NCR, repeated work steps, revisions to work instructions, etc.)?</li> <li>9. Are materials and consumables being utilized for the work properly identified and controlled?</li> <li>10. Are proper housekeeping, cleanliness, and contamination controls being exercised for the work?</li> <li>11. Are the process controls routine, a change from normal operations or something new? Process controls that are a change from normal routine or something new warrant a more in-depth review to determine if the controls are truly understood and being followed.</li> <li>12. Has there been recent staff or organizational changes? New staff and organizational changes warrant a more in-depth review of shop practices to determine if process controls are understood and being implanted correctly by staff.</li> </ol>
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Note: PPPL may optionally visit supplier during the performance of the work.