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Process Specification – Radiographic Weld Inspection 65678 PPPL NCSX Vacuum Vessel Sub Assembly

1. PURPOSE

This specification establishes the process parameters required to ensure that radiographic weld inspection performed on the NCSX SE120-002 Vacuum Vessel Sub Assembly is accomplished within the guidelines of PPPL product specification NCSX-CSPEC-121-02

2. SCOPE

This specification defines the minimum requirements for radiographic weld inspection of the NCSX VVSA highly shaped vessel walls and components when required by MTM MIT 65678.

3. DEFINITIONS

PPPL – Princeton Plasma Physics Laboratory

MTM – Major Tool & Machine, Inc.

NCSX – National Compact Stellarator Experiment

VVSA - Vacuum Vessel Sub Assembly

MIT – Manufacturing, Inspection, and Test plan (MTM Mfg. Routing)

IDC – MTM Inspection Data Checklist system

QAP – MTM Quality Assurance Planning system

MQS – Cooperheat/MQS Inspections. Resident radiographic contractor, utilizing MTM's X-ray facilities.

4. REFERENCE DOCUMENTS

- PPPL Product Specification NCSX-CSPEC-121-02-01
- ASME Section VIII, Division 1, UW-51
- ASME Section V, Article 2
- 20.A.100 – Cooperheat / MQS Radiographic Inspection Test Procedure
- QA-SOP-01 Non-Conformance Control
- MTM Mfg. Routing / Inspection Plan / Quality Assurance Plan 65678
- PS483 – Cleanliness Control

5. EQUIPMENT AND SUPPLIES

- MTM X-Ray Booth
- Iridium 192 Isotope Gamma Source
- Kodak AA, or T speed film
- ASTM E 747 Wire penetrameters

6. INSTRUCTIONS – MTM FABRICATION PERSONNEL

6.1. Layout and number film locations on the exterior of the part using an approved marking device.

6.1.1. Use provided templates / markings / targets to orientate the film positions relative to the port holes which will be cut later.

6.1.2. Each film location requires a unique serial number that will not be re-used throughout the production of all three 120 Degree Vessels.

6.1.2.1. Identify each film location with it's respective serial number based on the following numbering scheme:

- Work Order number (65678), Lot number, Sub ID number, Sequence number, shot number.

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- 6.2. Record the film location / serial number on the x-ray map (available via the MTM MIT). Log and file the record within the MTM QAP system as required by the MIT.
- 6.3. Ensure the part is adequately supported and orientated for safe transport, and efficient inspection setup / performance.
- 6.4. Position / setup the part in the MTM X-Ray Booth per MTM NDE and/or MQS direction.

7. INSTRUCTIONS – MTM NDE, & MQS PERSONNEL

- 7.1. Apply the film (double load) and transfer serial numbers from the part layout. Ensure each film is clearly identified, and traceable to its corresponding location via MTM x-ray map.
 - 7.1.1. Note that two separate exposures are required for each shot. One will be filed and logged within MTM's record's control system, and the other will be provided to PPPL as a supplement to the final quality document package.
- 7.2. Perform the radiographic examination per the following:
 - 20.A.100
 - ASME Section VIII, UW-51
 - ASME Section V, Article 2
- 7.3. Once the inspection is complete, and the film is processed, identified, and interpreted. Forward one complete set of film to Engineering for submittal to PPPL. Process the remaining film normally.

8. QUALITY ASSURANCE / DOCUMENTATION

- 8.1. The MTM MIT will specify all in-process and final inspection documentation requirements. All quality documentation will be compiled electronically utilizing MTM's integrated IDC and QAP systems
 - 8.1.1. At a minimum, the MTM MIT will require documentation for all contractual features and/or physical requirements (e.g. final component features / final material condition).
 - 8.1.2. To ensure compliance is maintained throughout the manufacturing process, interim / additional documentation requirements will be provided within the associated MTM IDC, and QAP system
 - 8.1.3. When an IDC record, or QAP document is completed, reference to the specific area being tested will be clearly discernable. The record will include the following information (as applicable):
 - MTM Work Order Number
 - Part Identification Number
 - Part Description
 - Part Serial Number
 - Date of Inspection
 - Gage Serial Number
 - Reference Standard Serial Number
 - Inspector Signature / Acknowledgement, Initials, or Stamp
 - 8.1.4. For all MIT operation sequences that include this document as a task requisite, but do not specify physical inspection records or documentation, the electronic completion ("clocking out") of each

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sequential manufacturing operation within the MTM (Visual Manufacturing®) routing confirms compliance to the applicable requirements. The MTM employee completing the electronic transaction (which completes and closes the operation sequence) personally acknowledges completeness and compliance to the routing instructions.

- 8.2. All un-authorized exceptions / out of tolerance conditions according to MTM MIT will be documented within the MTM Non-Conformance system per QA-SOP-01.