PS-480

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

1. PURPOSE

This specification establishes the process parameters required to ensure visual weld inspections on the NCSX SE120-002 Vacuum Vessel Sub Assembly are performed within the guidelines required by PPPL product specification NCSX-CSPEC-121-02

2. SCOPE

This specification defines the minimum requirements for visual inspecting all welds applied to the NCSX VVSA highly shaped vessel walls and components when required by the MTM MIT.

3. DEFINITIONS

CWI – AWS Certified Welding Inspector
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

4. REFERENCE DOCUMENTS

PPPL Product Specification NCSX-CSPEC-121-02
AWS QC1-96 – Standard for Certification of Welding Inspectors.
AWS B1.11-00 – Guide for the Visual Examination of Welds
AWS D1.6-99 – Structural Welding Code, Stainless Steel
ASNT 2055 SNT-TC-1A-2001 – Recommended Practice
WPS328.5-PPPL – MTM Welding Procedure Specification
WPS390-PPPL – MTM Welding Procedure Specification
QA-SOP-01 – Non-Conformance Control
MTM Mfg. Routing / Inspection Plan / Quality Assurance Plan 65678
PS483 – Cleanliness / Contamination Control
QA-SOP-05 – Gage Calibration

5. PRODUCT SPECIFICATION NCSX-CSPEC-121-02-03 CORRELATION

- 2.1j, 2.1 k, 2.1 l
- 4.1.3, 4.2.6.1

6. EQUIPMENT AND SUPPLIES

6.1. Equipment used for inspection may include, but is not limited to, scales, undercut gages, fillet weld gages, Cambridge gages, mismatch gages, mirrors, pyrometers, and magnifying devices. All equipment used for visual examination shall be capable of meeting the requirements of the applicable codes or specifications. Measuring devices must be capable of meeting the required precision for the specified dimension being measured. All gages used to make accept/reject decisions must be calibrated per MTM QA-SOP-05.

7. INSPECTION INSTRUCTIONS

7.1. All visual weld inspections will be performed per AWS B1.11at 8X magnification minimum.

7.2. Adequate / auxiliary lighting will be utilized when necessary to maintain a minimum light intensity at the surface being inspected (using natural or supplementary lighting) of 100 foot-candles. The light intensity shall be verified using calibrated light meters as required (available from the MTM NDE lab).

7.3. Each completed weld pass will be visually inspected for the entire length of the weld.

7.4. Direct visual inspections will be made when access is sufficient to place the inspector's eye within 24 inches and at an angle not less than 30 degrees from the surface of the component.

7.5. Mirrors may be utilized to improve the angle of vision.

7.6. Indirect visual inspections, utilizing bore-scopes, cameras, or other suitable instruments, may be substituted for direct examination providing the resolution of the instrument is at least equivalent to that obtainable by direct visual observation

8. ACCEPTANCE CRITERIA

8.1. Visually inspected welds will be accepted or rejected according to AWS D1.6, Paragraph 6.29.1 with the following exceptions:

8.1.1. No visible porosity will be accepted
8.1.2. Inter-pass visual inspections may be performed prior to cooling to ambient temperature, as long as the part is within the inter-pass temp erature required by the WPS.

8.2. Weld preparations will be clean, smooth, free of burrs and heavy grinding marks.

8.3. Weld joint fit-up will be smooth and continuous, with a maximum allowable joint misalignment of 1/32".

9. TASK RESPONSIBILITIES

9.1. Qualified MTM Mfg. Personnel may only perform visual inspections under the approval and guidance of a CWI. A CWI will retain the responsibility of accepting or rejecting parts.

9.2. The primary visual inspection responsibility will be distributed as follows:

- Final weld joint visual inspection: MTM CWI
- Inter pass (stringer) visual weld inspections: Qualified MTM Mfg. personnel
- Root pass visual weld inspection: Qualified MTM CWI
- Weld joint fit-up / alignment verification: Qualified MTM M fg. Team Leader
- Weld preparation inspection prior to fit-up: Qualified MTM Mfg. Team Leader

9.3. All personnel performing visual inspections on VVSA welds will be trained according to AWS B1.11 2000 by an AWS QC-1 CWI. The qualifying MTM CWI will provide training documentation in accordance with AWS B 1.11. At a minimum, this training will consist of the following items:

- The requirements of this process specification
- Overview of welding code / specifications / PQR / WPS requirements
- Inspection instructions / equipment / methods / practices
- Inspection acceptance criteria

9.4. All personnel performing visual inspections shall have documented evidence of having met visual acuity requirements of 20/40 (or better) Jaeger J2, or an equivalent visual acuity standard.

9.5. The responsible Mfg. Team Leader and CWI will audit / monitor inter-pass visual inspections being performed by Mfg. personnel throughout the production process to verify accuracy is maintained.

9.6. If imperfections are discovered within inter-pass welds, they will be removed, repaired, and verified by the responsible Team Leader, and/or CWI prior to applying covering passes.

9.7. If imperfections are discovered in completed weld joints, which have been submitted to the CWI for certification, they will be documented and repaired via MTM Non-Conformance system.

9.8. Periodically, in order to ensure accuracy, a fine line 1/32" wide or less in width, or other simulated imperfection, will be placed in the least discernable area on the surface of the part to serve as a reference. The inspector's verification of the imperfection shall validate the inspection process.

10. QUALITY ASSURANCE / DOCUMENTATION

10.1. 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

10.1.1. 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).

10.1.2. To ensure compliance is maintained throughout the manufacturing process, interim / additional documentation requirements will be provided within the associated MTM IDC, and QAP system

10.1.3. 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

10.1.4. 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 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.

10.2. 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.