PS-485

Process Specification – Ultrasonic Thickness Inspection
65678 PPPL NCSX Vacuum Vessel Sub Assembly

1. PURPOSE

This specification establishes the process parameters to ensure ultra-sonic thickness testing performed on the NCSX SE120-002 Vacuum Vessel Sub Assembly is maintained within the guidelines required by PPPL product specification NCSX-CSPEC-121-02-01

2. SCOPE

This specification defines the minimum requirements for ultrasonic pulse-echo measuring the material thickness of the NCSX VVSA highly shaped vessel walls and components (which are primarily inaccessible to standard mechanical measuring devices) when required by the MTM MIT.

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

4. REFERENCE DOCUMENTS

- PPPL Product Specification NCSX-CSPEC-121-02-01
- Operating manual – Krautkramer DM4E, DM4, DM4 DL Ultrasonic testing meters
- QA-SOP-01 Non-Conformance Control
- MTM Mfg. Routing / Inspection Plan / Quality Assurance Plan 65678
- PS483 – Cleanliness Control

5. EQUIPMENT AND SUPPLIES

- Krautkramer DM4E Ultrasonic Testing Meter

6. INSTRUCTIONS

6.1. The panel blanks, formed panel segments, vessel walls, and port extension wall material will be inspected for thickness using MTM's Krautkramer DM4E Ultrasonic Testing Meter in Normal Thickness Measurement (THK) Mode.

6.2. The use of this equipment will follow the guidelines in the operating manual (available in the MTM NDE Laboratory, or MTM Engineering) without exception.

6.3. Prior to inspection, ensure all locations where measurements will be taken are clean and free of any oil, scale, or any other foreign matter that could effect the measurement result. If cleaning is necessary, it should be performed within the applicable guidelines of PS483.

6.4. Material thickness can be checked from either the inner or outer profile surfaces.

6.5. The area(s) being tested must be at, or near ambient temperature.

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6.6. Initial and in-process thickness inspection will be performed only by MTM NDE personnel, or manufacturing personnel who have been instructed on the use of the unit, and have a clear understanding of the operating manual.

6.6.1. Measurements being made by MTM Manufacturing personnel will be audited by MTM NDE personnel.

6.6.2. It is the responsibility of Manufacturing personnel to contact NDE personnel for verification prior to completing the applicable manufacturing operation sequence.

6.6.3. If conflicting results occur, the inspection will be repeated in entirety by MTM NDE personnel, and the appropriate corrections must take place prior to continuing (e.g. training, instruction, personnel adjustment)

6.7. Measurements that are gauged at the limit of tolerance, and/or out of tolerance will be verified by MTM NDE personnel prior to continuing.

6.8. Measurements confirmed as out of tolerance will be documented within the MTM Non-Conformance system per QA-SOP-01, and the following:

6.8.1. Additional measurements must be taken to clearly define the extent of the nonconforming area.

6.8.2. Mark the approximate size and location of the nonconformance on the outside surface of the part being tested.

6.8.3. The approximate length, width, and location of the nonconformance must be reported to Major Tool's engineering department along with the deviation (via definitive photograph / NCR attachment).

6.9. Final thickness inspection of each formed panel (prior to welding), and the final welded / polished assembly will be performed and documented only by MTM NDE personnel as defined within the manufacturing routing.

6.10. If the formed panel / assembly has not already been laid out for inspection, layout according to the criteria specified within the MTM Manufacturing Routing.

6.10.1. The layout should cover the entire part evenly, and consist of an approximate 6" grid throughout the body of the formed panels, and an approximate 1" grid near the weld seams / edges.

6.10.2. Marking material used must be included on the "approved material list" (available from Engineering).

6.11. Calibrate the ultrasonic test equipment using the 2-point calibration procedure (via. Calibrated step wedge).

6.12. To ensure accuracy, the following steps must be followed during every inspection sequence:

6.12.1. Verify the calibration of the test equipment to the calibration standard (at a minimum, re-calibrate after every 25 test points).

6.13. When possible, periodically confirm thickness readings near the edges of the part by means of mechanical inspection.

7. QUALITY ASSURANCE / DOCUMENTATION

7.1. The electronic completion (or "closing / clocking out") of each sequential manufacturing operation within the MTM (Visual Manufacturing®) Routing which includes reference to this document as a task requisite acknowledges compliance to the relevant requirements. The designated MTM employee completing the electronic exchange acknowledges completeness and compliance to the routing instructions.

7.2. When necessary, additional documentation requirements will be provided within the associated MTM IDC, and QAP system.

7.2.1. When an IDC record and/or Inspection report is required, reference to the specific area being tested will be clearly discernable.

7.2.2. When an IDC record and/or Inspection report is required, it will include the following information:

- MTM Work Order number
- Part identification number
- Part description
- Date of inspection
- Gage serial number
- Reference standard serial number
- Inspector signature, or initials, or stamp

7.3. Exceptions / out of tolerance conditions will be documented within the MTM Non-Conformance system per QA-SOP-01.