PS-487

Process Specification – Surface Finish Inspection
65678 PPPL NCSX Vacuum Vessel Sub Assembly

1. PURPOSE

This specification establishes the process parameters required to ensure surface finish requirements for the NCSX SE120-002 Vacuum Vessel Sub Assembly are maintained within the guidelines required by PPPL product specification NCSX-CSPEC-121-02

2. SCOPE

This specification defines the minimum requirements for maintaining and verifying material surface finish of the NCSX VVSA materials and components throughout manufacturing / MTM MIT performance.

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
PFM – Purchased Finished Material (e.g. vacuum flanges, hardware, etc…)

4. REFERENCE DOCUMENTS

PPPL Product Specification NCSX-CSPEC-121-02
ASME B46.1-95 – Surface Texture (roughness, waviness, and lay)
Operating manual; Phase II+ Surface Roughness Gage Model # SRG-1000
QA-SOP-01 Non-Conformance Control
MTM Mfg. Routing / Inspection Plan / Quality Assurance Plan 65678
PS483 – Cleanliness Control
PS485 – Ultrasonic Thickness Testing

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

- 3.2.2.1, 3.2.2.2, 3.2.3
- 4.1.3, 4.2.2

6. EQUIPMENT AND SUPPLIES

Phase II+ Surface Roughness Gage Model # SRG-1000

7. GENERAL REQUIREMENTS

7.1. All handling equipment such as slings, hooks, and lift-truck forks will be protected with wood, cloth, plastic, or rubber buffers, where feasible, to reduce the possibility of surface damage.

7.2. All material will be inspected upon receipt, and throughout the manufacturing process in accordance with the MTM MIT as follows:

7.2.1. Specific acceptance criteria for raw material surface finish will be according to the national standards / specifications, and specific criteria provided within the MTM MIT. Additionally, any imperfections, pits, voids, or irregularities exceeding 0.04" in depth, that fall within finish part geometry, are to be documented within MTM's Non-Conformance system. Remedial disposition will be provided by Engineering (e.g. weld repair and blend smooth).

7.2.2. Specific acceptance criteria for manufactured items (e.g. CF Flanges, hardware, etc…) surface finish will be per the MTM MIT specified part drawing and/or manufacturer's part identifying catalog requirements.

7.2.3. Acceptance criteria for all interim detail / sub-assy surface finish will be provided within the MTM MIT (e.g. operation card instruction, IDC record, etc…).

7.2.4. All interior / vacuum facing surfaces of the completed VVSA (including the port extension assemblies) will be polished and verified to a minimum of 32 micro-inch roughness average surface finish.

7.2.5. Exterior / non-machined surfaces will remain as produced by the material / component manufacturer, and/or will be blast cleaned as specified within the MTM MIT.

7.3. During the polishing / finishing process, cleanliness / contamination control will be maintained according to PS483.

7.4. During the polishing / finishing process, material thickness will be monitored per PS485. Interim / final material thickness tolerances will be provided on the subsequent part drawing(s), or within the MTM MIT.

7.5. When necessary to protect the surface, polished production components will be covered with protective polyethylene foam cushioning and/or polyethylene sheeting when not being worked on for an extended period of time. Part temperature must be below 150 Degrees Fahrenheit prior to covering.

7.6. Walking on the polished surfaces will be avoided where possible. When necessary to walk on polished surfaces, plastic foam sheeting will be applied to the surface face for protection.

7.7. Appropriate care will be taken during subsequent handling of highly polished surfaces to avoid damaging the surfaces.

8. INSTRUCTIONS FOR USING THE SURFACE ROUGHNESS GAGE

8.1. A clear understanding of the gage operating manual is required. The following steps are to be performed according to the operating manual requirements.

8.2. Prior to taking measurements, set the gage to "Ra" and a sampling length of 0.8mm.

8.3. Prior to taking measurements, and periodically during inspection, ensure gage accuracy by measuring the standard included with the gage. This should be performed approximately every 15 measurements. During multiple point inspections, if the gage is found to have lost accuracy, the condition is to be corrected in accordance with gage operating manual. If this is not successful, the gage is to be returned to

Q/A for the appropriate action (e.g. correction, repair, removal from service). After gage correction, all previous points (to the last known standard verification) are to be re-inspected.

8.4. Measure the surface area specified within the manufacturing routing, following the operating manual instructions. Note the vessel wall surfaces are highly shaped. Take special care to ensure the gage is held as perpendicular as possible to the area being tested.

9. QUALITY ASSURANCE / DOCUMENTATION

9.1. 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

9.1.1. 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).

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

9.1.3. 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

9.1.4. 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.

9.2. 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.