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Process Specification – Sub-Contract Requirements 65678 PPPL NCSX Vacuum Vessel Sub Assembly

1. PURPOSE

This specification establishes the procedures to ensure subcontract manufacturing operations are performed on NCSX SE120-002 Vacuum Vessel Sub Assembly components are maintained within the guidelines required by PPPL product specification NCSX-CSPEC-121-02

2. SCOPE

This specification defines the minimum contractual requirements for all subcontract sequences required by MTM MIT 65678. This document is a supplement to MTM standard business terms and conditions, and MTM Purchase Order requirements from which it is referenced.

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
NCR – Non-Conformance Report

4. REFERENCE DOCUMENTS

PUR-SOP-01 – Vendor Assessment
QA-SOP-01 Non-Conformance Control
MTM Mfg. Routing / Inspection Plan / Quality Assurance Plan 65678
PS481 – Radiographic Inspection
PS483 – Cleanliness Control
PS484 – Magnetic Permeability Inspection
PS485 – U-T Thickness Inspection
PS486 – Vacuum Testing
PS487 – Surface finish Inspection
PS490 – Serialization / Part Identification

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

- 2.1 b, 2.1 q, 2.1 r
- 3.2.2.1, 3.2.2.2, 3.3.2.9
- 4.1.1

6. GENERAL REQUIREMENTS

- 6.1. The responsibility for performing all test and verification rests with the seller. MTM and/or PPPL reserves the right to witness or separately perform all specified tests or otherwise inspect any or all tests and inspections.

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- 6.2. The intent of a contract awarded to a selected Subcontractor is for the material / services be provided solely by the named contractor. Offloading / Sub-supplier activities must be reviewed, and pre-approved by MTM prior to execution. The primary approval authority resides with the MTM Purchasing Manager.
- 6.3. Neither MTM review and/or approval of Subcontractors documents nor MTM inspection of Subcontractors items or services shall relieve the Subcontractor of responsibility for full compliance with the requirements of the Subcontract.
- 6.4. Nonconforming items shall be positively identified, and where possible, segregated to prevent use. MTM must be notified of non-conformances within one (1) business day of discovery. The Subcontractor shall document each nonconformance, identifying the extent and location of the nonconformance and proposing a remedial disposition. The written concurrence of MTM is required prior to implementing the disposition. The Subcontractors system shall provide not only for timely resolution of non-conformances but also for analysis of non-conformances to determine root cause and to implement appropriate and effective corrective actions.
- 6.5. The Subcontractor shall maintain an effective Quality Assurance Program to assure that the Subcontractors work meets the required quality and is performed in accordance with contractual requirements. Subcontractors quality assurance function shall be actively involved in the planning, processing oversight, problem resolution, and determination of acceptability of all work associated to this specification. The function shall be organized to have sufficient authority and independence to identify quality problems, verify conformance of supplied items or services to specified requirements and obtain satisfactory resolution of conflicts involving quality.
- 6.6. Inspection and tests shall be performed to ensure quality and provide the necessary documentation required by the MTM Purchase Order quality assurance provisions. Except where specifically stated otherwise, actual data and accept/reject status for each inspection and test shall be documented. Reports shall clearly identify the item inspected, the locations or areas covered by the report, the performing individual, the date performed, equipment used (with calibration status), and the signature of the authorized individual.
- 6.7. The Subcontractor shall maintain a system of documentation whereby objective evidence of required operations, inspections, examinations, and tests is systematically compiled, indexed, stored and ultimately provided to MTM for inclusion in MTM's quality documentation system. Such objective evidence may include "travelers", and material test, certification, inspection, examination, test and nonconformance reports; which shall be complete, legible, and validated by responsible personnel and shall be traceable to subject items.
- 6.8. Material and equipment identification shall be maintained throughout the program and be traceable to records. Status of acceptability shall be readily discernible through the Subcontractors use of tags, stamps, serial numbers or other positive means.
- 6.9. Inspections and tests shall be performed using properly calibrated measuring and test equipment. Subcontractor shall have in its possession the necessary equipment of perform the required inspections and tests. Calibration standards shall be traceable to the National Institute for Standards and Technology (NIST) or equivalent acceptable to MTM and shall not be used for shop inspections, but instead be protected against damage or degradation.
- 6.10. Authorized representatives of MTM, PPPL, and the U.S. Government shall have the right at all reasonable times to visit the Subcontractor's premises and those of Subcontractor's suppliers during the performance of the Subcontract for the purposes of inspection, surveillance, audit, and/or obtaining any required information as may be necessary to assure the items or services are being furnished in accordance with

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specified requirements. Such visits shall be coordinated with the subcontractors personnel to minimize interference with the normal operations of said premises. The Subcontractor shall make available records and documentation necessary for this function and shall provide all reasonable facilities and assistance for the safety and convenience of MTM, PPPL, and/or U.S. Government representatives in the performance of their duties. MTM, PPPL, and the U.S. Government recognize the Subcontractors right to withhold information concerning proprietary processes.

- 6.11. All tooling specially fabricated for the performance of work related to this specification shall become the property of the U.S. Government and will be clearly identified and included with the final shipment of product to MTM.
- 6.12. The materials / parts supplied by MTM are to be protected at all times from damage and/or contaminants.
- 6.13. The cleanliness requirements of PS483 apply to all subcontract operations.
- 6.14. Material thickness, magnetic permeability, and surface finish are critical component characteristics for all contracted activities and will be thoroughly inspected by MTM both prior to subcontracting, and after receipt of processed goods.
- 6.15. Part identification / traceability will be established by MTM prior to subcontract, and shall be maintained throughout the execution of contracted services in accordance with PS490.

7. THERMAL PROCESSING OPERATIONS

- 7.1. When installing formed panels onto a transportation device (e.g. shipping skid, wood struts, or truck bed), the parts are to be orientated convex side up.
- 7.2. Internal furnace surfaces (e.g. fire brick, supporting structures, or shims) that contact the parts must be clean and free of excessive loose contaminants / swarf which may contaminate the panel surface at temperature.
- 7.3. The parts must rest only on the peripheral edges during the thermal cycle. (The formed panels have approximately 1/2" (minimum) of excess material remaining on the perimeter that will be removed and discarded during later processing)
- 7.4. After the parts are positioned in the furnace, they are to be visually inspected for suitable support, stability, and cleanliness. If dirt or debris exists on the part or contacting supporting structure, it must be removed using an approved solvent or cleaning process prior beginning the heat treat cycle.
- 7.5. An adequate number of thermocouples must be used to ensure accurate temperature measurement and recording. At a minimum two thermocouples will be attached to each panel, one on the perimeter (within 1" of the edge), and one in the approximate center of the panel, on the convex side. No thermocouples are to be attached to the concave side of the formed panels.

8. CUTTING, FORMING, AND BENDING OPERATIONS

- 8.1. All Cutting, forming, and bending shall be performed in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

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- 8.2. Prior to use, the functional faces of all tooling (e.g. Forming Dies, Plate Rollers, Press Brake Dies, etc...) will be thoroughly cleaned to remove any dirt, oil, harmful debris, unnecessary marking and/or materials. This will be accomplished by one or more of the following processes.
 - 8.2.1. Remove bonded materials by scraping, or with authorized abrasive products.
 - 8.2.2. Remove loose debris by blowing with compressed air.
 - 8.2.3. High pressure washing.
 - 8.2.4. Solvent wiping and dry wiping with clean new rags.
- 8.3. The functional tooling surfaces, and production part surfaces will be visually monitored for cleanliness throughout the forming process. If it is noticed during the process, that harmful foreign matter has accumulated on the production panel, or the functional tooling surface, the forming operation will halt until the component is re-cleaned.

9. POLISHING OPERATIONS

- 9.1. Tools used in polishing and lapping operations shall be nonferrous ceramics or nonmagnetic stainless steel, which have never been in contact with materials other than stainless steel, or nickel alloys. .
- 9.2. Surfaces requiring polishing, and their respective finish requirements will be clearly identified by either description within the Purchase Order (e.g. “polish the tubing / pipe I.D. to a 32 micro-inch Ra surface finish”), or a detail drawing, or by clear identification on the surface of the part being polished (e.g. descriptive marking, tags, stickers, etc...).
- 9.3. Surface polishing is a critical finishing step and will be closely monitored by the MTM CFT Engineer and/or Quality Assurance representative. The MTM Subcontract Administrator / Production Control will advise the CFT Engineer when the parts are being delivered for polishing and provide a contact for open communication / dialog / oversight / follow-up throughout the polishing process.

10. MTM INSPECTION REQUIREMENTS

- 10.1. Prior to delivering material / components to a sub-contractor, and again after receiving the processed material / components, MTM Q/A personnel will inspect and document the parts at a minimum for cleanliness per PS483, material thickness per PS485, surface finish per PS487, and magnetic permeability characteristics per PS484 as required by the MTM MIT operation instructions.
- 10.2. The MTM material handler / driver will visually inspect the part(s) at the point of drop off, and pick up for cleanliness and surface damage / imperfections. Concerns will be communicated to MTM Q/A and/or CFT for appropriate action.
- 10.3. At a minimum, all contractor produced features which the MTM Purchase Order requires an actual dimensional record, or inspection report, will be re-inspected / verified upon receipt at MTM. All other features will be audited as determined necessary by the MTM MIT.

11. QUALITY ASSURANCE / DOCUMENTATION

- 11.1. 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

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- 11.1.1. 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).
- 11.1.2. To ensure compliance is maintained throughout the manufacturing process, interim / additional documentation requirements will be provided within the associated MTM IDC, and QAP system
- 11.1.3. 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
- 11.1.4. 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.
- 11.2. 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.