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Process Specification – Material Procurement Requirements 65678 PPPL NCSX Vacuum Vessel Sub Assembly

1. PURPOSE

This specification establishes the procedures to ensure all material procured for NCSX SE120-002 Vacuum Vessel Sub Assembly components is obtained and maintained within the guidelines required by PPPL product specification NCSX-CSPEC-121-02

2. SCOPE

This specification is a supplement to the MTM Purchase Order requirements from which it is referred from. It defines the minimum contractual requirements for the procurement of all plate, sheet, bar, strip, pipe, tubing, components, and hardware 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
NCR – Non-Conformance Report

4. REFERENCE DOCUMENTS

ASTM B443-00 – Standard specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) Plate, Sheet, and Strip
ASTM B444-03 – Standard specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) Tubing & Pipe
ASTM B705-03 – Standard specification for Nickel Alloy (UNS N06625) Welded Pipe
ASTM B446-03 – Standard specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) Rod & Bar
ASTM A240-04A – Standard specification for Chromium & Chromium-Nickel Stainless Steel Plate, Sheet, and Strip
ASTM A193/A193M -04 – Standard specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
ASTM A1014-03 – Standard specification for Precipitation-Hardening Bolting Material (UNS N07718) for High Temperature Service
ASME SFA 5.14-1997 – Nickel & Nickel Alloy Bare Welding Rods Electrodes
ASTM A800/A800M -01 – Practice for Steel Casting, Austenitic Alloy, Estimating Ferrite Content Thereof.
ASTM A249A/A249M-04A – Standard specification for welded Austenitic steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes.
ASTM A213/A213M -03 – Standard specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Super-heater, Heat-Exchanger Tubes.
PUR-SOP-01 – Vendor Assessment
QA-SOP-01 – Non-Conformance Control
MTM Mfg. Routing / Inspection Plan / Quality Assurance Plan 65678
PS483 – Cleanliness Control

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

- 2.1a, 2.1c, 2.1d, 2.1e, 2.1f, 2.1g, 2.1h, 2.1i, 2.1o, 2.1p, 2.1s
- 3.2.2.2, 3.2.3 (less weld), 3.2.4, 3.3.2.1, 3.3.2.2, 3.3.2.3, 3.3.2.4, 3.3.2.5, 3.3.2.6, 3.3.2.7.1
- 4.1.3, 4.2.3, 4.2.5

6. GENERAL REQUIREMENTS

- 6.1. Material supplier(s) providing materials must be approved per PUR-SOP-01.
- 6.2. The MTM MIT Material Requirements Card(s) will specify the basic material requirements (e.g. material type, thickness, basic size, and inspection / documentation requirements). This information is automatically transferred into the MTM Purchase Order by the cognizant MTM Buyer.
 - 6.2.1. The material supplier is required to follow all purchase order requirements, listed specifications, process drawings / CAD files while fulfilling the requirements of the purchase order.
 - 6.2.2. The material supplier must ensure the part quantities match the purchase order quantity for each ordered item. Over shipments will not be received.
- 6.3. Specific shapes and sizes for developed flat blank panel geometry and/or nested shapes will be provided electronically (available via DXF or IGES file format). Each file will be identified with a file number, and revision level. MTM Engineering will log and control the files using the MTM Document Control System. Each required document and/or electronic file, and its level of revision will be listed within the MTM Purchase Order. The cognizant MTM Buyer will compile and distribute the applicable documents and files accordingly. It is the responsibility of the supplier to ensure that the documents they are working to match the Purchase Order listing both in file/drawing number, and level of revision.
- 6.4. Each flat blank development file will have a unique detail / part / serial number included. This number will correspond with the MTM Purchase Order.
- 6.5. Each flat blank development file will include inspection dimensions which are to be verified and documented prior to delivering to MTM.
- 6.6. The responsibility for performing all test and verifications required to comply with MTM purchase order requirements belongs to the seller. MTM reserves the right to witness or separately perform all specified tests or otherwise inspect any or all tests and inspections.
- 6.7. The relevant cleanliness requirements of PS483 apply to all material procurement activities.
- 6.8. All metal working tools must be verified clean and free of debris prior to use. Imbedded foreign material, pits, and/or pock marks discovered in the purchased material surface (normally caused by debris build up on production tooling) will be grounds for rejection.

7. WROUGHT / RAW MATERIAL REQUIREMENTS

- 7.1. Unless otherwise specified within the MTM Purchase Order, the following material requirements will apply.
 - 7.1.1. ALLOY 625 PLATE, SHEET, AND STRIP.

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- All plate, sheet, and strip specified as Alloy 625 shall be annealed Alloy (UNS N06625) and meet the requirements of ASTM B443.

7.1.2. ALLOY 625 TUBING AND PIPE

- All tubing and pipe specified as Alloy 625 shall be seamless or welded Alloy (UNS N06625) and meet the requirements of ASTM B444, or ASTM B705.

7.1.3. ALLOY 625 BAR AND STRUCTURAL SHAPES

- All bar and structural shapes specified as Alloy 625 shall be annealed Alloy (UNS N06625) and meet the requirements of ASTM B446.

7.1.4. 316L SST PLATE, SHEET, AND STRIP

- All plate, sheet, and strip specified as 316L SST shall meet the requirements of ASTM A240.

7.1.5. SST TUBING AND PIPE

- All tubing and pipe specified as stainless steel shall be seamless or welded Alloy 316L and meet the requirements of ASTM A249 or ASTM A213

7.1.6. BOLTING / HARDWARE / SEALS / GENERAL MERCHANDISE

- Items specified by general catalog part IDs will be produced from the catalog specified material(s). The supplier's usual and customary documentation will be included with shipment.

7.1.7. WELD FILLER METAL

7.1.7.1. All weld filler metal shall meet the requirements of the applicable AWS A series specifications or ASME SFA specifications. Certified material test reports shall be supplied for all materials.

- Weld filler metal specified as Inco-82 will be ERNiCr-3
- Weld filler metal specified as Inco-625 will be ERNiCrMo-3
- Weld filler metal specified as 316L SST will be ER316L

8. MATERIAL CHARACTERISTICS

8.1. Raw material will be inspected for conformance to the MTM Purchase Order requirements (e.g. Specified overall sizes, National Standard compliance, etc..) as follows:

8.1.1. Lineal Dimensions:

8.1.1.1. All lineal dimensions for cut shapes will have an accompanying tolerance of + 0.06" / - 0.

8.1.1.2. All purchased finished components will have a dimensional tolerance according to the Purchase Order referenced part drawing, catalog requirements, or specification.

8.1.2. Material Thickness:

8.1.2.1. All plate, sheet and strip material, and cut shapes will be inspected for thickness on a maximum grid of 6" throughout the body of the plate, using a calibrated ultra-sonic testing

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meter. Perimeter readings will be audited / verified with a calibrated micrometer. The following material thickness tolerances will be maintained:

- 1-1/2" Plate: 1.500" +0.07" / - 0.01"
- 1-1/4" Plate: 1.250" +0.07" / - 0.01"
- 1/2" Plate: 0.500" +0.055" / - 0.01"
- 3/8" Plate: 0.375" +0.045" / - 0.01"
- 3/16" Sheet: 0.188" +0.045" / - 0.01"
- 1/8" Sheet: 0.125" +0.02" / - 0"

8.1.3. Surface Finish:

8.1.3.1. All 3/8" and 1/2" plate will be manufactured to plus tolerance condition and ground to specified thickness to remove mill scale, and provide a maximum surface roughness of 63 micro-inches Ra on both sides of the plate.

8.1.3.2. All flat blank geometry provided by MTM is orientated with the functional face of the detail facing upward. (Once formed, and welded, this surface will be polished to a 32 Ra micro-inch surface finish by MTM)

8.1.3.3. Prior to cutting into individual nested pieces, all plate surfaces must be visually inspected for the following surface imperfections:

- Pits, scrapes, gouges, pock marks, dents, irregularities that would inhibit further polishing

8.1.3.4. Once determined, the "better" of the two sides is to be orientated up during the cutting process.

8.1.3.5. All deliverable plate, sheet and strip material, and cut shapes will be inspected for surface finish on a maximum grid of 6" throughout the body of the piece, using a calibrated surface finish tester. The surface finish will be within the applicable ASTM standard plus the following additional requirements:

- All 1/2" and 3/8" plate will be hot rolled and surface ground (via time saver mechanism or equivalent) to a maximum surface finish of 63 micro-inch RA.
- Isolated surface imperfections greater than 0.03" will not be accepted.
- Single isolated surface imperfections 0.03" or less will be accepted.
- Grouped / clustered imperfections will not be accepted (regardless of depth).

8.2. Cut edges:

8.2.1. The following cutting processes are approved for use:

- Abrasive Water Jet Cutting
- Plasma Arc Cutting
- Mechanical Abrasive Cutting / Sawing

8.2.2. Cut shapes produced via. Abrasive Water Jet Cutting will be delivered "as cut".

8.2.3. Cut shapes produced via. Plasma Arc Cutting will be delivered cleaned as follows:

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- Grind / Remove excess dross
- 8.2.4. Cut shapes produced via. Mechanical Abrasive Cutting / Sawing will be deburred prior to delivery.
- 8.2.5. All cut edges should be smooth and continuous without burrs, or excessive material / dross buildup.
- 8.2.6. Start / stop irregularities should be minimal, and in no case protruding into the cut shape geometry.

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8.3. Magnetic Permeability:

8.3.1. All Alloy 625 plate, sheet, strip, bar, tubing, and/or pipe will have a maximum magnetic permeability characteristic of 1.02mu measured with a Severn Gage.

8.3.2. All 300 Series Stainless Steel items will have a maximum magnetic permeability characteristic of 1.02 Mu measured with a Severn Gage.

9. PART IDENTIFICATION / SERIALIZATION / TRACEABILITY REQUIREMENTS

9.1. Each individual Purchase Order line item derives from a specific material requirement provision within MTM's ERP software. Each Purchase Order line item specifies the code number that maps the material / item to its point of origin. This code number is specific to each piece / component procured. It is preferred that the supplier documentation for each piece include the serial code number for each item procured. It is also preferred that this number, and the specific material heat lot number is marked directly on each piece, or attached tag. At a minimum all delivered material must be unquestionably traceable to the individual purchase order line item from which it derives.

10. PACKAGING REQUIREMENTS

10.1. All components shall be wrapped, sealed, packaged, and/or skidded adequately to provide protection against contamination, deterioration, and damage during shipment to MTM.

10.2. Each packaged item will be clearly identified for proper receiving, issuing, and traceability assurance to its specific Purchase Order, and line item number.

11. MTM RECEIVING INSPECTION REQUIREMENTS

11.1. MTM Receiving Inspection will perform a thorough verification of all Purchase Order requirements upon receipt in accordance with the MTM MIT. Non-complying material will be rejected and documented within MTM's Non-Conformance System. MTM Engineering will evaluate and provide remedial disposition (e.g. use as is, repair / correct at MTM, or returned for correction or replacement).

12. QUALITY ASSURANCE / DOCUMENTATION

12.1. Each raw / wrought material shipment to MTM will include the following documentation:

- Material Certification defining the chemical and physical properties, and material condition (e.g. annealed, pickled, etc...) of each production lot included
- Inspection reports (dimensional, visual, etc...) as specified within the MTM Purchase Order, and as follows: Actual data (except where otherwise stated within this document), and accept/reject status for each inspection and test shall be documented. The report shall contain sufficient information to accurately locate the area involved and to reproduce the inspection or test performed. This can be accomplished by clear and direct reference to other seller-provided documents. The procedure, and, as applicable to the process, the technique and equipment used shall be clearly identified. References to calibrated measuring and test equipment shall include date of latest calibration. Inspection and test reports shall identify the personnel performing the inspection or test and their certification level, where applicable. The reports shall be dated and verified by authorized Q/A personnel.

12.2. The MTM Purchase Order will specify all in-process and final inspection documentation requirements.

12.2.1. At a minimum, MTM will require a certificate of compliance for all produced features and/or physical requirements (e.g. final component features / final material condition as provided to MTM).

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12.2.2. When the MTM Purchase Order requires an inspection record, document, or certificate, reference to the specific area being tested will be clearly discernable. The record will include the following information (as applicable):

- MTM Purchase Order number
- MTM Work Order number (as specified on the P.O.)
- Part identification number (as specified on the P.O.)
- Part description (as specified on the P.O.)
- Date of inspection
- Gage serial number
- Reference standard serial number (as applicable)
- Inspector signature / acknowledgement, initials, or stamp

12.3. All un-authorized exceptions / out of tolerance conditions according to MTM Purchase Order requirements must be documented and submitted to MTM Engineering prior to release for shipment. MTM remedial disposition / direction must be included within the supplier quality documentation package accompanying shipment. Non-conforming items without prior acceptance will be returned to the supplier for corrective action.