

PS-484

Process Specification – Magnetic Permeability Inspection 65678 PPPL NCSX Vacuum Vessel Sub Assembly

1. PURPOSE

This specification establishes the process parameters to ensure magnetic permeability 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 measuring magnetic permeability of materials used to produce the NCSX VVSA components (using a Severn Engineering High Sensitivity Low-Mu Permeability Indicator) 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 – High Sensitivity Low-Mu Permeability Indicator – Severn Engineering
- QA-SOP-01 Non-Conformance Control
- MTM Mfg. Routing / Inspection Plan / Quality Assurance Plan 65678
- PS483 – Cleanliness Control

5. EQUIPMENT AND SUPPLIES

- High Sensitivity Low-Mu Permeability Indicator – Severn Engineering

6. GENERAL INFORMATION / PRECAUTIONS

(obtained from Severn Engineering website)

The operation of the Indicator is based on the mutual attraction of a permanent bar magnet for a known standard and an unknown material. In use, an insert is screwed into the top of the case. The magnet is then attracted to the insert by a force dependent upon the insert's permeability. The end of the magnet projecting from the opening in the bottom of the case is then brought into contact with the material being tested. It is essential that the contact surface be clean and free from oxide scale or foreign material. The Indicator is then moved away in a direction normal to the contact surface. If the material being tested has a permeability higher than that of the insert value, the magnet will first break contact with the insert as the Indicator is moved away. Only full, complete breaks should be considered as indicative of a higher permeability than the test material. On the other hand, if the permeability of the material being tested is lower than that of the insert value, the magnet will first break contact with the test material as the Indicator is moved away. Thus, by interchanging the inserts, it is possible to bracket the permeability of the materials under test.

Two features of the Indicator deserve special mention. First, the balanced beam to which the magnet is attached permits the use of the Indicator in all positions without correction due to gravity. Secondly, the hemispherical magnet ends provide point contact with the inserts and the test materials.

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The High Sensitivity Low-Mu Permeability Indicator must be handled with care. The following precautions should be observed:

- Remove metal filings, chips and dirt from the surface of the material under test. Filings and dirt on the end of the magnet can be removed with masking tape.
- Under no circumstances bring another magnet in contact with the indicator magnet. This will disturb the calibration of the Indicator to such an extent that it will necessitate its return and subsequent recalibration.
- Be sure inserts are screwed firmly in place so as to establish contact with the magnet.
- Do not jerk the Indicator away from the test material, especially with the 1.01 insert in place. This will tend to give a false indication. Smoothly lift the unit straight up. Do not “rock” the unit while removing.
- Avoid as much as possible contacting the Indicator with strongly magnetic materials such as steel, cast iron, or straight chromium steels. This can be accomplished by first screening the materials under test with a hand magnet.
- Do not drop the Indicator
- When not in use keep the Indicator in its box with the highest value insert in place in the Indicator.
- Inserts are not interchangeable between indicators

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.