

**QUALITY ASSURANCE AND  
MANUFACTURING PROCEDURES FOR  
FLUOROPOLYMER COATED  
METAL VESSELS**

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## I Purpose

This standard sets forth the minimum requirements for the quality assurance and manufacturing procedures for fluoropolymer coated steel structures completed at **Fisher|Moore**. This program reviews the fabrication of electrostatically powder coated steel vessels for applications into the nuclear, chemical processing, electronics and semiconductor industries.

## II Requirements

### 1. Organization

**Fisher|Moore** is organized in a manner that allows the quality assurance inspector to report directly the company president. This organizational structure allows for the inspection of all fluoropolymer lined and coated metal projects throughout the manufacturing process, and for any necessary corrective action to be consistently adopted and documented.

### 2. Quality Assurance Program (QAP)

- A. A quality assurance program has been established at **Fisher|Moore** in accordance to applicable ASME NQA - 1A requirements. This program provides for the systematic inspection of fluoropolymer-lined products throughout the manufacturing process for the explicit purpose of reducing and eliminating defects in materials and workmanship. **Fisher|Moore** management shall regularly review this quality assurance program and ensure that it remains adequate and correctly applied.
- B. The purpose of quality control is to insure adherence to industry standards and practices as well as customer specifications. It is critical the fabricated items conform to the customer's approved design and intended usage in a safe manner over an expected life span.

- C. Inspection documentation will be filed in each job file. Inspection documents will be kept in permanent file for a minimum of 5 years, or as specified in contract documents. Only approved documents will be used for entering data accumulated during making the inspections.
- D. When nonconformities or imperfections are discovered, a Correction Report will be issued by the Quality Control Manager. The Correction Report will be forwarded to the General Foreman and or his assistants in his absence to initiate corrective action.

3. Design control

- A. The design of fluoropolymer coated steel vessels shall be defined, controlled, and verified. Coating application for steel vessels shall be in accordance to the steel fabricator, **Fisher|Moore**, and end user recommendations.

Important areas of design include metal fabrication, coating resin, and environmental exposure and conditions.

- B. Coating resin selection shall be made in accordance with resin manufacturers' published recommendations, **Fisher|Moore** experience, and end user preference. Resin selections shall consist of several fluoropolymers including ETFE 1020™, PVDF (2800 and 2850 copolymer), and ECTFE. Additionally, polypropylene and polyethylene may be considered for the coating of metal structures.

4. Procurement document control

It is necessary to qualify, monitor and test materials supplied by resin manufacturers and to monitor subcontracted services and purchased materials. All incoming resins shall be independently verified for quality prior to acceptance and use at **Fisher|Moore**. Such qualifications of materials may include determining melt flow index, particle size, distribution and thermal stability.

5. Drawings

When required, all shop drawings shall be done at **Fisher|Moore** according to the ANSI Y14.5 standard. An approved shop drawing must be received by **Fisher|Moore** prior to beginning any work.

6. Document control

Document control for the Quality Assurance Program (QAP) shall be maintained by the Quality Control Manager in a file separate from the current work in progress file. A duplicate copy shall also be stored with the applicable job file.

7. Control of purchased items and services

- A. Critical purchased resins and raw materials for coated steel components and structures include metal preparation, geometries, grit blasting, resin testing, and consistency.
- B. Metal fabricators and suppliers must meet the minimum requirements of manufacturing and preparation as outlined in the **Fisher|Moore** document. Any deviations in quality shall be noted and the part returned to the supplier or customer for modification and rework. Only those steel fabricators familiar with the requirements of fluoropolymer coatings are acceptable.
- C. All lot numbers of incoming resins and raw materials are noted. The melt flow index of each resin lot shall be tested during application. The resin will be stored in the manufacturer's recommended environment. Application of the coating resin shall be in accordance to the resin manufacturer's instructions and **Fisher|Moore's** experience. All personnel applying coatings shall periodically submit coated samples to maintain competent coating proficiency. The use of each resin lot shall be noted and tracked with the component or vessel in which it is used. This record will be used for any future references to the part and resin lot.

The thermal stability and melt index shall be measured.  
Results will be compiled and stored for reference.

8. Identification and control of items

Control and documentation of resins and primers shall be controlled to insure that only correct material shall be applied and in areas to be coated.

9. Control of processes

- A. All processes involved in coatings shall be routinely examined and evaluated to insure a continuous level of quality. These processes include primer preparation and preparation of the substrate and coating application.
- B. Fluoropolymer coated test samples shall be routinely submitted for testing and evaluation. Testing shall include visual inspection, thickness measurements, and peel tests. The adhesive strength as evaluated shall be used to determine the quality of the bond.
- C. Coating with the fluoropolymer resins shall be conducted in accordance to **Fisher|Moore** and manufacturer's recommendations. Coated samples will be routinely cut and evaluated for resistance to peel.

10. Inspection

- A. Regular inspections will occur through out the entire fabrication process of fluoropolymer coating metal components.
- B. Metal fabrication
  - 1. Where possible the metal components to be coated should be fabricated by those familiar with the requirements of coating, such as with other types of coatings to insure the completed parts are suitable for coating. The steel fabricator should be thoroughly familiar with NACE RPO178-95.

2. Welds need to be neat and smooth and must be ground smooth but not necessarily flush on all interior surfaces of vessels to be coated. (See Figure 1 p. 3 NACE RPO178-95.)
3. Weld splatter must be removed from any welded areas. (See Figure 3 p.4 NACE RPO178-95.)
4. It is preferred that corners of rectangular structures be bent to minimize the number of seams and joints and should be free of welds.
5. Flat surfaces should be even and planer. Care should be taken to prevent warpage during fabrication.
6. Minimum desirable radius at corners is 1/8". 1/16" is adequate under most circumstances. See NACE RPO178-95 Section 4:1 p.2.
7. Threaded nozzles or appurtenances are problematic. All connections ought to be flanged. If threaded connections are required consultation with **Fisher|Moore** is necessary. See NACE RPO178-95 Figure 4, p.4.

C. Surface preparation

1. Metal surfaces to be coated must be thoroughly cleaned and free from oil, scale, rust or contaminants.
2. Surfaces are to be sandblasted to an NACE #1 finish if possible or white metal profile. Chemical etchants can be used in restricted environments where particulate matter from blasting would be unacceptable. Blast profile to NACE #1 standards will be verified by the optical comparator method. Silica sand is the preferred blast media.

3. Grit or bead blasting may be required to prevent damage or warpage as a result of typical blast pressures and velocities.

D. Quality assurance and testing

1. After the coating is completed a spark test is required in the presence of the owner or customer or his representative. All surfaces are free of holidays or pinholes. No spark can jump between the liner and steel substrate.
2. Voltage is between 2.5 to 3 kV DC for the spark tester.
3. Vessels at the option of the customer are hydrostatically tested and then retested.

11. Test control

- A. Testing is done by **Fisher|Moore** technicians at the company lab in Centerville, Utah.
- B. When required outside testing labs may be subcontracted to analyze or verify test results.

12. Control of measuring and test equipment

All test and measuring equipment shall be routinely inspected so that a consistent level of quality control can be maintained by **Fisher|Moore**. Any deviations noted or corrective action required shall be monitored and documented so that the appropriate changes will occur.

13. Handling, storage, and shipping

All applicable materials shall be handled, stored, and shipped in the prescribed and recommended manner. Any significant deviations from normally recommended practices shall be noted and documented.

14. Inspection, test, and operating status

Upon agreement between **Fisher|Moore** and the customer arrangements can be made to make a final inspection in the field prior to startup to insure no damage has occurred in transit or upon installation.

15. Control of non-conforming items

Any purchased or manufactured item exhibiting unacceptable quality shall be returned or reworked by the applicable organization for the necessary improvement. All items rejected will be documented so that the corrective action can be tracked and noted.

16. Corrective action

Any existing conditions that may impede quality fabrication and workmanship standards shall be determined and identified. These conditions shall be documented so that the necessary corrective action can be instituted by either the Quality Assurance Inspector, **Fisher|Moore** management. Any required follow-up action shall also be noted and documented.

17. Quality assurance records

Quality assurance documents and records shall be prepared and maintained by Fisher Company for every fluoropolymer lined steel project. These records shall be kept and stored in a neat and legible format with the applicable project for a period of not less than 5 years.

**End of Document**