



NICKEL PLATED, TUBING INTERIOR

WSS-M1P51-A

1. SCOPE

The material defined by this specification is a finished tube with a nickel plating requirement on the interior surface. The tube is derived from a coil of steel electroplated on one side, slit to size, and formed into a single wall tube with the edges welded together.

2. APPLICATION

This specification was released originally for low carbon steel fuel lines used for flex fuel and biodiesel vehicles for improved corrosion resistance over uncoated low carbon steel.

3. REQUIREMENTS

3.1 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

Material suppliers and part producers must conform to the Company's Standard Requirements For Production Materials (WSS-M99P1111-A).

3.2 NICKEL PLATING THICKNESS, (Metallurgical cross section, ASTM E3)

3 μ m, min

The nickel plating on the interior surface shall be at or above the minimum. The weld bead can be less than 3 μ m but must have full coverage of nickel when checked using a metallurgical mounted cross-section viewed at 400X – 500X magnification (see Figure 1 and 2). Actual coating thickness of the nickel finish shall be monitored circumferentially and longitudinally for each tube manufacturing line. A sampling plan shall be referenced in the control plan. Any non-conforming weld bead will require Ford Materials Engineering approval.

Other methods of measurement may be used as long as they correlate to the metallurgical cross-section testing method, but the cross-section is the final determinant.

3.3 HUMIDITY TESTING (ASTM D1735, 168 h)

Finished tube shall be exposed to the following humidity test using 150 mm straight samples. The cut ends of the test samples shall be sufficiently protected to prevent rust bleed out. The samples shall be placed approximately at a 30° angle from the vertical in order to allow for moisture to run off. After 168 hours of humidity testing, the three test samples shall be sectioned longitudinally 90° to the weld bead, exposing the plated inside surfaces of the tube.

Requirement:

There shall be no red rust on the interior surfaces except for the weld bead. The weld bead shall have less than 5 red rust spots no larger than 3 mm in diameter. A sampling plan shall be referenced in the control plan.

Date	Action	Revisions	Rev. 0
2014 01 07	Released		



Documents

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3.4 FUEL COMPATIBILITY (FLTM BZ 105-03, 5000 h)

The nickel plated tubing shall be exposed to C[E25]A and B30A fuels per FLTM AZ 105-02. Three 150 mm straight samples shall be exposed for 5,000 h per FLTM BZ 105-03 and then sectioned longitudinally 90° to the weld bead to expose the inside surface of the tube.

Requirement:

Upon inspection, there shall be no red rust on the plated interior surface except for the weld bead where there is no requirement. Note: This test is required for initial validation and needs to be performed only once.

4. GENERAL INFORMATION

The information given below is provided for clarification and assistance in meeting the requirements of this specification. Contact gmfs@ford.com for questions concerning Engineering Material Specifications.

4.1 NICKEL COATED WELD BEAD

This specification is aimed at evaluating the re-flow of the nickel plating over the weld on the interior surface. The ability of the nickel to properly cover the weld bead is a result of careful development and setup of the edge to be welded and the welding process line. The processes and controls of the tube forming and welding control the quality of the nickel re-flow.

To ensure good re-flow at the weld, it is important that the weld bead have a smooth cross-sectional profile and minimum bead height. (The typical bead height shall be 0.15 mm or less.) See photograph of typical bead.

4.2 SAMPLE PREPARATION

The tubing shall be sectioned at several transverse locations to determine compliance to a minimum thickness of coatings. The sections are to be deburred, cleaned and dried. Each section is wrapped separately in aluminum foil and the foil is then molded to the part with the fingers prior to mounting. Only one layer of foil is required and the tube should be covered in its entirety, being careful not to puncture the foil. The excess folds and overlaps should be above the plane of polish. Exercise care in mounting, being sure each section is perpendicular to the plane of polish. The samples should be compression mounted with a thermosetting powder such as diallylphthalate. Compression molding also serves to mold the foil contour of the coating, providing excellent edge retention and a well defined interface. The mount(s) should be slowly cooled to ambient temperature to prevent edge separation.

5. SUMMARY OF REVISIONS