CORROSION PROTECTIVE COATING, EXTRUDED POLYAMIDE OVER A ZINC/ALUMINIUM ALLOY COATED STEEL TUBE — **WSS-M21P30-A1**

CORROSION PROTECTIVE COATING, EXTRUDED POLYAMIDE OVER ELECTRO-PLATED ZINC COATED STEEL TUBE — **WSS-M21P30-A2**

CORROSION PROTECTIVE COATING, EXTRUDED POLYAMIDE OVER HOT DIP ALUMINIZED STEEL TUBE — **WSS-M21P30-A3**

CORROSION PROTECTIVE COATING, EXTRUDED CONDUCTIVE POLYAMIDE 12 OVER A ZINC/ALUMINUM ALLOY COATED STEEL TUBE — **WSS-M21P30-A4**

1. SCOPE

The material defined by these specifications is an extruded polyamide 12 or polyamide 612 bonded to a primer that has been applied to a zinc/aluminum alloy coated steel tube, electro-plated zinc coated steel or hot dip aluminized steel tube.

2. APPLICATION

These specifications were released originally to specify the performance requirements for a secondary coating extruded over coated steel tube. The extruded coating provides additional protection for fuel lines, brake lines, power steering lines, and transmission oil cooler lines.

3. REQUIREMENTS

3.1 APPROVED SOURCES

WSS-M21P30-A1/A4 This specification requires the use of approved sources. Only the sources identified on the Ford Approved Source List (ASL) can be used when this specification is listed on the drawing, CAD file, or other documents. The list of approved sources is located within Ford at www.mats.ford.com or available externally through a Ford Materials Engineer.

WSS-M21P30-A2/A3 This specification does not use approved sources. Any reliable supplier meeting these requirements may be used.

3.2 SUBSTRATE

The substrate shall be low carbon steel butt welded or double wall brazed construction which conforms to one of the following specifications:

SAE J526	Welded Low Carbon Steel Tubing
SAE J527	Brazed Double Wall Low Carbon Steel Tubing
WSA-M1A308-A1/A2	Tubing, single/double wall low carbon steel

Date	Action	Revisions	Rev. 5
2018 03 06	Revised	Updated substrate and electrical resistance requirements	L. Click NA
2012 12 04	Revised	Clarified the Fluid Resistance Requirements	A.Wedepoh, FNA
1996 02 12	Activated		J. Spencer

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The above tubing shall be coated with the following systems:

3.2.1	WSS-M21P30-A1 and A4	ESA-M1A270-A (zinc/aluminum alloy coated steel)
3.2.2	WSS-M21P30-A2	WSS-M1P85-B2/B3 (electro-plated zinc coated steel)
3.2.3	WSS-M21P30-A3	ASTM A463 or EN 10346 (hot dipped aluminized steel)

If necessary, a hexavalent chromium free conversion coating may be used over the coated steel systems to enhance the adhesion and corrosion resistance properties of the tube.

3.3 POLYAMIDE PHYSICAL PROPERTIES

3.3.1 Polyamide 12 Melt Point (ASTM D3418)

3.3.1.1 WSS-M21P30-A1/A2/A3	170 - 185 °C
3.3.1.2 WSS-M21P30-A4	173 - 179 °C

3.3.2 Polyamide 612 Melt Point (ASTM D3418)

3.3.2.1 WSS-M21P30-A1/A2/A3	210- 221 °C

Note: Conductive PA612 per WSS-M21P30-A4 is unavailable at this time.

3.4 FILM PROPERTIES

3.4.1 Topcoat Type

The topcoat shall consist of polyamide 12 or polyamide 612 for A1, A2, and A3. Only polyamide 12 is allowed for A4.

3.4.2 Primer/Base Coat

Must be sufficiently cured to enhance adhesion of the polyamide. An adhesion test must be part of the control plan.

3.4.3 Appearance

The coating shall be uniform in color and free from discontinuities such as flow lines, pin holes, craters or abnormal roughness. The coating shall be black in color unless otherwise specified on Engineering Drawing.

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3.4.4 Film Thickness
(FLTM BI 117-01 or an approved equivalent)

3.4.4.1	WSS-M21P30-A1 Polyamide,	170 µm, min
3.4.4.2	WSS-M21P30-A2 Polyamide,	150 µm, min
3.4.4.3	WSS-M21P30-A3 Polyamide,	120 µm, min
3.4.4.4	WSS-M21P30-A4 Polyamide,	170 µm, min

3.4.5 Film Properties

Tube Size, nominal	Coated Tube O.D., max
4.76 mm	5.21 mm
6.00 mm	6.45 mm
6.35 mm	6.80 mm
7.94 mm	8.39 mm
8.00 mm	8.45 mm
9.53 mm	9.97 mm
10.00 mm	10.45 mm
11.11 mm	11.59 mm
12.70 mm	13.17 mm
14.29 mm	14.76 mm
15.88 mm	16.35 mm

3.5 RESISTANCE PROPERTIES

3.5.1 Gravelometer/Salt Spray Evaluation

3.5.1.1 Room Temperature Gravelometer

Test Method: Perform gravelometer testing per SAE J400 using five pints of gravel and salt spray per ASTM B 117. Tubing shall show no red rust after 2000 hours of exposure time at non-gravel impacted areas; red rust is allowable up to 1 mm from impacted areas.

3.5.1.2 Low Temperature Gravelometer

Test Method: The tube is to be conditioned at -40 °C for a minimum of four hours prior to performing gravelometer test per SAE J400 using five pints of gravel. Sample should be impacted with gravel within 30 seconds of removal from freezer. Then salt spray per ASTM B 117. Tubing shall show no red rust after 2000 hours of exposure time at non-gravel impacted areas; red rust is allowable up to 1 mm from impacted areas.

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