



Fuel Filler Pipe Coating for Low Corrosion Environments

1 Scope

1.1 Material Description. This specification covers the basic requirements for a conductive, dip applied black corrosion protective coating system to be used over zinc-nickel (Zn-Ni) coated steel. The coating system consists of an approved pretreatment and a dip applied black pigmented topcoat.

1.2 Symbols. Not applicable.

1.3 Applicability. This coating system is used on fuel filler pipes fabricated of Zn-Ni coated sheet steel for use in GMW15272 Class 1 or Class 2 Regions with a 10 year functional requirement or a GMW15272 Class 3 Region with a 12 year functional requirement. The coating is suitable for the interior and exterior of fuel filler pipe assemblies. This coating typically contains epoxy, so it is not recommended for use in locations where it will be exposed to sunlight. In the instances where a fuel filler pipe will be exposed to direct sunlight, a separate topcoat should be developed and then specified on the drawing.

1.4 Remarks. The coating system must be resistant to conventional hydrocarbon fuels, ethanol-based flex fuels ranging from E0 to E100, and B5 and B20 biodiesel.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM D257	ASTM D4496	ASTM E643	ISO 1520
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2.2 GM Standards/Specifications.

GMW3059	GMW14729	GMW15282	GMW17137
GMW3286	GMW14829	GMW15357	
GMW14270	GMW14872	GMW15891	
GMW14700	GMW15272	GMW16816	

2.3 Additional References. Not applicable.

3 Requirements

3.1 Requirements on Test Specimens.

3.1.1 Pretreatment. The approved chemical system shall include the cleaners, pretreatment, and topcoat. This system shall be provided by one chemical supplier. All components of the system shall be recorded in the approval.

3.2 Topcoat.

3.2.1 Dry Film Build. The average minimum dry film thickness of the topcoat shall be 15 µm on the outside of tubes from top to bottom. Measurements shall be made at top, middle, and bottom of tubes. See Figure 1. A minimum of three (3) measurements shall be made around the circumference in each of the three (3) locations.

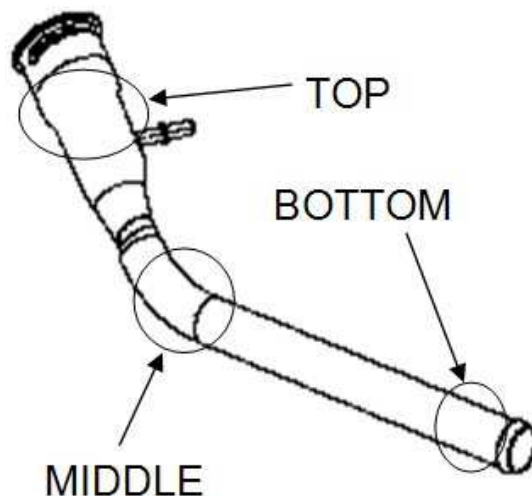


Figure 1: Locations for Coating Thickness Measurements

3.2.2 Appearance. The coating shall have a uniform black appearance free of flaking, cracking, peeling, and blistering on all the critical surfaces. This is a dip/drain process so boundary samples should be established to govern the quality of the coating on critical surfaces.

3.2.3 Critical Surfaces. Critical surfaces shall be designated on the engineering drawing. Those areas should include the sealing surfaces for the gas cap interface and for the fuel tank connection. All parts of the tube that are easily seen by the customer when filling the tank, or during the operation of the vehicle, should also be considered for the critical surface designation.

3.2.4 Interior Coverage. Parts shall be split longitudinally and inspected on the inside surfaces to be sure there are no paint voids or puddles of paint. Any apparent bare spots should be tested using the Copper Sulfate Test in Appendix B, to determine if the paint film is actually present and just lacking pigment. After testing, there shall be no change in color of the "bare spots".

3.3 Conductivity. The finished coated product shall be tested to ensure adequate conductivity to discharge any static electricity that may be generated. Resistance of the part should not exceed 1 MΩ when tested with equipment per ASTM D4496 and ASTM D257, modified such that the inside of the top end of the pipe can be touched with one (1) electrode while the outside of the other end of the pipe can be touched with the other electrode. Test the pipes by touching the location contacted by the fill nozzle with one (1) electrode and touching the location grounded to the vehicle with the other electrode.

Note: Do not scratch through the coating; to avoid testing the resistance of the metal.

3.4 Initial Adhesion. Parts shall rate one (1) or better after crosshatch scribing and tape testing per GMW14829.

3.5 Humidity and Tape Adhesion. Parts shall be exposed for 96 h to water fog humidity per GMW14729. After exposure, parts shall rate one (1) or better after crosshatch scribing and tape testing per GMW14829.

3.6 Stone Impact Resistance. Parts shall rate seven (7) or better per GMW14700 after exposure per Appendix A of this specification.

3.7 Cure. There shall be a rating of zero (0) or one (1) after the cure test per GMW15891.

3.8 Neutral Salt Spray. Painted pipes shall be split longitudinally, the edges protected, and both inside surfaces and outside surfaces scribed longitudinally per GMW15282. The pipes may also need to be sectioned so that both ends of the pipes, as well as the middle, are exposed at the specified angle of the salt spray test. Figure 2 shows an example of a filler pipe with multiple bends, which should be sectioned at each of the arrows before the sections of the pipe are split longitudinally for testing.

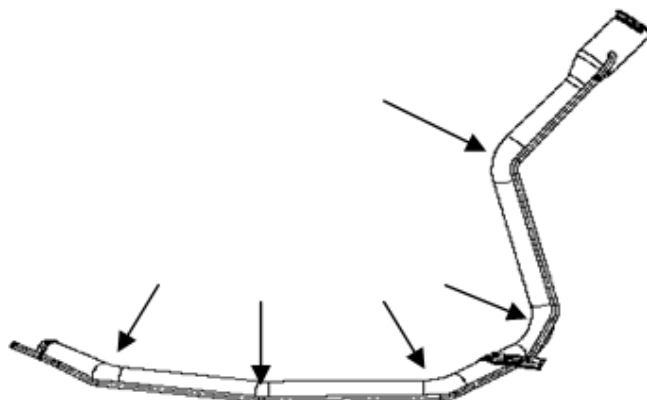


Figure 2: Example Locations for Sectioning Bent Filler Pipe Prior to Salt Spray Testing

3.8.1 Each individual piece should be scribed, as specified, on the test surface. All pieces shall be exposed in neutral salt spray per GMW3286 for 1000 h. After neutral salt spray, the tested part surfaces, excluding edges, scribes, and weld, solder and brazed joints shall exhibit no more than 1% blistering or corrosion. There shall be no more than 3 mm creepback from the scribe line, when measured per GMW15282.

3.9 Cyclic Corrosion. Coated parts shall be exposed to stone impingement in a Gravelometer per Appendix A, Section A1. After stone impingement, the parts shall be exposed to cyclic corrosion per GMW14872, Underbody (UB), All, 4 s, Method 1/2. After Exposure D of GMW14872, the parts must rate a rating of eight (8) or better per GMW15357. After Exposure D of GMW14872, all visible corrosion areas need to be checked for metal loss per GMW15272 Appendix titled, "Corrosion Metal Loss Assessment" to determine if the parts meet the functional requirements (no perforation) for 10 years of corrosion exposure for a GMW15272 Class 1 or Class 2 Region.

3.10 Additional Requirements for Initial Material Approval.

3.10.1 Ductility. The coating must withstand the normal flexing and compression encountered in a crimping operation or thread forming operation without evidence of flaking, peeling, chipping, or loss of adhesion.

3.10.1.1 Cup Ductility Test. For initial material approval, coated test panels 0.75 mm to 1.5 mm thick shall be prepared. Form a cup using the procedure in ASTM E643 or in ISO 1520 to a depth of 7.0 mm with the coating system on the tension side. The speed during the final 1.27 mm of travel shall be 0.10 mm/s maximum.

3.10.2 Tape Adhesion. After forming the cup in 3.10.1.1, apply a 65 mm long piece of pressure sensitive adhesive tape, as specified in GMW14829, over the dome area and smooth firmly and uniformly with finger or thumb pressure. Remove the tape with a firm, rapid upward pull and place the imprinted tape sample on white paper for better visibility. The imprinted tape sample shall exhibit an adhesion rating of eight (8) or better compared to the standards in Figure 3.

3.10.3 Fuel Resistance. For initial material approval and periodic material monitoring, painted panels shall withstand 26 weeks of fuel exposure per GMW17137. After fuel exposure, the coating shall not soften, peel, or show signs of degradation per GMW17137. All the fuels listed in GMW17137 are to be used for fuel resistance testing. The fuel listed in GMW16816 should also be used fuel filler pipes used in General Motors Brazil (GMB).