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SURFACE VEHICLE STANDARD

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CORROSION PREVENTIVE COMPOUND, TOPSIDE VEHICLE CORROSION PROTECTION

1. *Scope*—This specification covers corrosion preventive compounds for spray application to vehicle body cavities

2. *References*

2.1 Applicable Publications —The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the lastest revision of SAE publications shall apply.

2.1.1 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 117-85—Method of Salt Spray (Fog) Testing
ASTM D 609—Method for Preparation of Steel Panels for Testing Paint, Varnish, Lacquar, and Related Products
ASTM D 2247—Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 4585-86a—Practice for Testing the Water Resistance of Coatings Using Controlled Condensation

2.1.2 GENERAL MOTORS PUBLICATION—Available from General Motors, Boise Cascade, 13301 Stephens Road, Warren, MI 48089.

GM9985470

2.1.3 Although this document contains reference to certain automotive industry tests, it only reflects interest in selecting what is felt to be the easiest and most useful tests for evaluation of topside cavity rust preventives. It does not suggest that the tests of other vehicle manufacturers are of lesser value or validity.

2.1.3.1 Test Methods

Salt Spray	ASTM B 117-85
Detergent Resistance	ASTM B 117-85
QUV Aging	ASTM B 117-85
Impact	
High Temperature Flow	
SCAB	
Solvent Washoff	POD VB 65-1 Maintenance Bulletin V-5-65 MIL-C-62218A
Cleveland Condensing Humidity	ASTM D 4585-86a (formerly ASTM D 2247 Annex A2)

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3. *Requirements*

3.1 Qualification—Corrosion preventive compounds furnished under this specification shall meet all the performance requirements herein. These compounds shall not have an undesirable effect on the performance of products used in the manufacture of the vehicle and with which the rust preventive is likely to come into contact.

3.1.1 Any change in formulation shall necessitate requalification.

3.2 Material—The corrosion preventive compound may be a water based or solvent based product which is fluid, homogeneous, free from grit and abrasives, and non-toxic.

3.3 Film Characteristic—The corrosion preventive compound shall readily adhere to surfaces commonly encountered in underbody and inner body cavities of vehicles. The film shall not exhibit evidence of alligatoring, cracking, peeling, blistering, humidity condensate wash-off, or other degradation.

3.4 Color—None specified.

3.5 Sprayability and Low Temperature Fluidity—The rust preventive compound shall be sprayable from 10 to 38 °C (50 to 100 °F).

3.6 Condition in Container—The compound shall exhibit no settling, separation, skinning, or lumpiness.

3.7 Low Temperature Stability—The compound shall show no evidence of separation or nonhomogeneity at a temperature as low as −29 °C (−20 °F).

3.8 Manufacturer's recommended application procedure(s) shall ensure that the film thickness required for performance compliance with this specification be achieved in field application.

3.9 When tested as specified, the compound shall conform to the following requirements at the manufacturer's recommended film thickness for actual field application.

TABLE 1—

TEST	TEST METHOD	REQUIREMENT
Salt Spray	ASTM B 117-85	No more than 3 corrosion dots, each no larger than 1 mm (0.04 in) in diameter.
Detergent Resistance	ASTM B 117-85	1) No evidence of sagging or channeling and no more than a 10% area loss of the coating from the surface. 2) No more than 3 corrosion dots, each no larger than 1 mm (0.04 in) in diameter.
QUV Thermal Aging	ASTM B 117-85	1) No surface failure such as peeling, cracking, alligatoring or blistering. 2) No more than 3 corrosion dots, each no larger than 1 mm (0.04 in) in diameter.
Reverse Impact	Gardner	No apparent loss of adhesion or cracking.
High Temperature Flow Wet	Refer to section 3.15	No failure at 121 °C (250 °F) at manufacturer's recommended wet film thickness.
Dry	Refer to section 3.15	No failure at 150 °C (302 °F) at manufacturer's recommended dry film thickness.
SCAB	Refer to section 3.16	1) Rating of 8 minimum. 2) No more than 3 corrosion dots each no larger than 1 mm (0.04 in) in diameter.
Solvent-Washoff	POD VB65-1 Maintenance Bulletin V-5-65 MIL-C-62218A	The coating shall resist the washing action of its own solvent in enclosed areas. There shall be no evidence of washing, such as sagging, channeling, or removal of the coating from the test surface.

TABLE 1— (CONTINUED)

TEST	TEST METHOD	REQUIREMENT
Cleveland Condensing Humidity	ASTM D 4585-86a (formerly ASTM D 2247 Annex A2)	1) No more than 3 corrosion dots, each no larger than 1 mm (0.04 in) in diameter. 2) No film degradation such as alligatoring, cracking, peeling or blistering.

3.10 Panel Preparation—The panels used for evaluation of rust preventives against this specification shall conform to ASTM D 609-73, Type 1, and shall be prepared by Methods B or D according to that standard.

3.11 Salt Spray—Salt spray resistance shall be run in accordance with ASTM B 117-85.

3.11.1 SCOPE—This test provides a method for measuring the corrosion resistance of a coating.

3.11.2 Two steel panels, 100 mm x 300 mm x 0.8 mm (4 in x 12 in x 0.032 in) conforming to and cleaned as described in 3.10, shall be used.

3.11.3 The test surface of each panel shall be spray coated to the film thickness specified by the corrosion preventive manufacturer's or supplier's application procedure.

3.11.4 The panel edges and backside of each panel shall be coated with the product under test.

3.11.5 The coated panels shall be permitted to air dry for 7 days at 25 °C ± 2 (77 °F ± 5).

3.11.6 The coated panels shall be unscribed, and exposed in salt spray for 1000 h as described in section 3.11.

3.11.7 After exposure, the coating shall be stripped from the panels using an appropriate solvent and the surface examined for compliance with the requirement in 3.9. Corrosion at the outer 6.35 mm (0.25 in) of the panel shall not be included in the panel rating.

3.12 Detergent Resistance

3.12.1 This test provides a method for measuring the resistance of the coating to removal by detergent wash and its ability to protect against corrosion after exposure to detergent washes.

3.12.2 Two steel panels as described in 3.11.2 shall be coated as described in 3.11.3 and 3.11.4 and conditioned as described in 3.11.5.

3.12.3 The coated panels shall be immersed in detergent solution at 50 °C (122 °F). (The detergent solution shall be composed of 2.5 g/L of DuPont #7 Car Wash Compound or Bordens Rain Dance Car Wash.) Rinse under spray nozzle (Spray Systems Co., Full Jet # 1/2 GG-25 or equivalent) at 50 °C (122 °F) water temperature, 70 kPa (10 psi) water pressure and 250 mm (10 in) distance between the spray nozzle and the panel per the following cycle:

Immersion - 5 min
Rinse - 1 min
Immersion - 10 min
Rinse - 2 min
Immersion - 10 min
Rinse - 2 min

3.12.4 Criteria for a pass shall be no evidence of sagging or channeling and no more than 10% loss of coating from the surface.

3.12.5 If the coated panels pass the detergent wash and rinse according to 3.12.4, they shall then be exposed in salt spray in accordance with ASTM B 117-85 for 168 h.

3.12.6 After salt spray exposure, the panels shall be evaluated for compliance in the same manner as in 3.11.7.

3.13 QUV Thermal Aging

3.13.1 SCOPE—This test provides a method to determine the resistance of the coating to oxidative degradation.

3.13.2 Two steel panels as described in 3.11.2 shall be coated as described in 3.11.3 and 3.11.4 and conditioned as described in 3.11.5. For the apparatus which cannot take 100 mm x 300 mm x 0.8 mm (4 in x 12 in x 0.032 in) panels, 75 mm x 300 mm x 0.8 mm (3 in x 12 in x 0.032 in) panels can be used.

3.13.3 The coated panels shall be exposed for 100 h in the QUV cabinet using the following cycle:

a. Ultraviolet lights "on"
   Temperature : 50 °C (122 °F)
   Time : 8 h
b. Ultraviolet lights "off"
   100% Humidity (condensing)
   Temperature : 46 °C (114.8 °F)
   Time : 4 h
   One cycle = 12 h of exposure

3.13.4 The cycle in 3.13.3 shall be repeated 8 times with the extra 4 h being ultraviolet exposure. Panel exposure shall always be started at the beginning of the ultraviolet light "on" portion of the cycle.

3.13.5 The criteria for passing the 100 h QUV exposure shall be no evidence of alligatoring, cracking, peeling, or blistering.

3.13.6 If the coated panels pass QUV exposure, they shall be exposed to salt spray in accordance with ASTM B 117-85 for 336 h.

3.13.7 After salt spray exposure, the panels shall be evaluated in the same manner as in 3.11.7.

3.14 Impact

3.14.1 SCOPE—This test provides a method to measure the adhesion of the coating to the substrate when subjected to impact at low temperature.

3.14.2 The apparatus used in this test is the Gardner Impact Tester or equivalent.

3.14.3 Two steel panels as described in 3.11.2 shall be coated as described in 3.11.3 and conditioned as described in 3.11.5.

3.14.4 The coated panels shall be conditioned at –29 °C (–20 °F) for 24 h. If possible, the Impact Tester shall also be conditioned at –29 °C (–20 °F).

3.14.5 The coated panels shall be impacted with a force of 2.3 J (20 in lb) on the uncoated side (reverse impact) of the panels. The impact test shall be carried out within 30 s after removal from the cold chamber.

3.14.6 The criteria for meeting the requirement of this specification shall be no cracking or loss of adhesion.

3.15 High Temperature Flow

3.15.1 SCOPE—This test provides a method to determine the high temperature flow resistance of wet and dry films of the rust preventive.

3.15.2 APPARATUS

3.15.2.1 Multinotch Applicator

3.15.2.1.1 The applicator is designed to lay down at least eight strips of coating of graduating thickness. The space between the strips shall be 1.6 mm (0.0625 in). A typical applicator of this type is a Leneta Antisag Meter or equivalent.

3.15.2.1.2 An applicator shall be chosen to draw down wet film thicknesses in the range recommended for application by the manufacturer or supplier.

3.15.2.2 Oven

3.15.2.2.1 A well ventilated, thermostatically controlled convection type oven shall be used. The oven shall be capable of being controlled through a temperature range of 20 °C ± 3 to 150 °C ± 3 (68 °F ± 5 to 302 °F ± 5).

3.15.2.3 Test panels shall conform to ASTM D 609 Type 1 as described in 3.11.2 and shall be cleaned with mineral spirits as described in ASTM D 609 Method D.

3.15.3 PROCEDURE

3.15.3.1 Application of Film

3.15.3.1.1 Sufficient rust preventive shall be applied by spatula or eyedropper at one edge of the test panel to cover the range of film thicknesses when applied by the multinotch applicator described in 3.15.2.11 and 3.15.2.1.2.

3.15.3.1.2 The multinotch applicator shall be drawn through the applied test material in one smooth movement such that the strips of rust preventive left on the panel shall be straight and without any waviness.

3.15.4 WET FILM PERFORMANCE

3.15.4.1 Immediately after the coating has been drawn down as in 3.15.3.1.1 and 3.15.3.1.2, the test panel shall be placed vertically such that the rust preventive strips are horizontal to the ground and with the thickest strip in the lowest position. The panel shall be left in this position for 5 min at 25 °C ± 3 (77 °F ± 5).

3.15.4.2 The test panel shall then be placed vertically in an oven as described in paragraph 3.15.2.2 at 121 °C ± 3 (250 °F ± 5) for 20 min. The thickest strip shall be in the lowest position.

3.15.4.3 Evaluation of Results—After removal of the test panel from the oven exposure described in 3.15.4.2, the strip of coating which sags or flows sufficiently to cross into the next thicker strip of coating shall be considered the thickness at which failure occurs. There shall be no failure at the manufacturer's or supplier's recommended wet film thickness.

3.15.5 DRY FILM PERFORMANCE

3.15.5.1 Immediately after the film has been applied and drawn-down, as in 3.15.3.1.1 and 3.15.3.1.2, the test panel shall be placed vertically such that the rust preventive strips are horizontal to the ground and with the thickest strip in the lowest position. The test panel shall be stored in this position for 7 days at 25 °C ± 3 (77 °F ± 5).

3.15.5.2 The test panel shall then be placed vertically in an oven as described in 3.15.2.2.1 at 150 °C ± 3 (300 °F ± 5) for 20 min. The thickest strip shall be in the lowest position.

3.15.5.3 *Evaluation of Results*—After removal of the panel from the oven exposure described in 3.15.5.2, the strip of coating which sags or flows sufficiently to cross into the next thicker coating shall be considered the thickness at which failure occurs. There shall be no failure at the manufacturer's or supplier's recommended dry film thickness.

3.16 SCAB Test

3.16.1 SCOPE—This test provides a method of measuring the corrosion resistance of a coating.

3.16.2 Two steel panels as described in 3.11.2 shall be coated as described in 3.11.3 and 3.11.4 and conditioned as described in 3.11.5.

3.16.3 After conditioning panel as described in 3.11.5 and prior to exposure, each test surface shall be diagonally scribed to 25 mm (1 in) from either corner. A straight edge shall be used to guide the scribing instrument, which can be a carbide tip scribe tool or a sharp knife. The scribe shall be made with sufficient pressure to cut completely through the coating and expose a bright line of bare metal.

3.16.4 Place the test panels with the 300 mm (12 in) dimension horizontal in a suitable wood or plastic rack. The rack shall hold panels at a 0 to 15 deg angle from the vertical and the panels shall be spaced a minimum of 13 mm (0.5 in) apart.

3.16.5 The racked panels shall be placed in test and the following procedures performed on a weekly basis.

a. Monday Only
— 1 h in a 60 °C ± 1 (140 °F ± 2) oven
— 30 min in a –23 °C (–10°F) cold cabinet
— 15 min immersion in 5% by weight sodium chloride solution
— 1 h 15 min drain at room temperature
— 21 h in a controlled humidity cabinet operating at 60°C ± 1 (140 °F ± 2) and 85% RH

b. Tuesday through Friday
— 15 min immersion in 5% by weight sodium chloride solution
— 1 h 15 min drain at room temperature
— 22 1/2 h in a controlled humidity cabinet operating at 60 °C ± 1 (140 °F ± 2) and 85% RH

c. Saturday/Sunday
— Samples remain in the humidity cabinet operating as above

3.16.6 The test panels shall be exposed to 30 cycles in the exposure described in 3.16.5. A + B + C constitutes 5 cycles.

3.16.7 After completion of the 30 cycles, the panels shall immediately be rinsed with warm flowing water not exceeding 38°C (100°F).

3.16.8 Within 15 min of removal from the exposure test, the test panel shall be air blown along the entire scribe line and any other points of indicated failure with a nozzle held lightly against and approximately 45 deg to the surface. The air supply shall be capable of obtaining an open line pressure of 550 kPa (80 psi) through a nozzle with a 3.0 mm (0.12 in) orifice. The length of hose between the nozzle and the air regulator shall be less than 3 m (10 ft) and it is recommended that the inside diameter of the hose shall be between 6 mm and 10 mm (0.25 in and 0.375 in).

3.16.9 EVALUATION

3.16.9.1 To evaluate the creepback, the distance between the unaffected coating on each side of the scribe line shall be measured to the nearest mm in several places. Each value shall be divided by two and then a mean value calculated. The number of measurements shall be dependent on the uniformity of corrosion creepback. A minimum rating of 8 shall constitute a pass using the following rating scale:

Rating	Corrosion Creepback (mm)
10	0
9	0 to less than 0.5
8	0.5 to less than 1.5
7	1.5 to less than 2.5
6	2.5 to less than 3.5
5	3.5 to less than 5.0
4	5.0 to less than 6.5
3	6.5 to less than 8.0
2	8.0 to less than 10.0
1	10.0 to less than 12.0
0	12.0 and greater

3.16.9.2 Field corrosion shall be evaluated in the same manner as in 3.11.7 and shall meet the same compliance requirement.

3.17 Solvent Washoff

3.17.1 SCOPE—To determine resistance of the coating to be washed off in enclosed areas by reflux action from its own solvent.

3.17.2 EQUIPMENT—An empty cylindrical, tin plated 0.946 L (1 qt) paint can shall be affixed, approximately centered, to the bottom or inside face of the cover for a cylindrical tin plated 3.785 L (1 gal) paint can. Joining may be by bolting or soldering. The bottom or seam closed end of the 0.946 L (1 qt) can shall be away from the 3.785 L (1 gal) cover plate. Two 25 mm (1 in) holes shall be drilled in the sides of the cylindrical, tin plated 3.785 L (1 gal) paint can:

1. one hole centered 63 mm (2.5 in) from the top edge of the can and
2. one hole centered 25 mm (1 in) from the bottom chime of the can and on the side opposite the upper hole. The upper half of the outer face of the 3.785 L (1 gal) can shall be insulated, leaving an opening over the 25 mm (1 in) hole.

3.17.3 TEST PROCEDURE—A wet film, meeting the manufacturer's or supplier's recommended application thickness, shall be sprayed-applied uniformly onto the entire outside face of the sides and bottom of an empty cylindrical, tin-plated 0.946 L (1 qt) paint can. The film shall not exceed a dry film thickness of 0.15 mm (0.006 in). The coated test piece shall be conditioned for 2 h at a temperature of 25 °C ± 3 (77 °F ± 5). At the end of this period, a 6.3 mm (0.25 in) layer of the test compound shall be poured into the bottom of the 3.785 L (1 gal) can and the 3.785 L (1 gal) can cover tightly affixed with the coated 0.946 L (1 qt) can test piece suspended inside the 3.785 L (1 gal) can. The entire test assembly shall be placed in an oven stabilized at 121 °C ± 3 (250 °F ± 5). After 15 min residence time in the oven maintained at 121 °C ± 3 (250 °F ± 5), the test assembly shall be removed from the oven and allowed to cool at room temperature for 15 min. The cover shall be removed from the 3.785 L (1 gal) can and the test piece withdrawn and inspected.

3.17.4 Criteria for a pass shall be in conformance with the requirement in 3.9.

3.18 Cleveland Condensing Humidity

3.18.1 SCOPE—This test provides a measure of the resistance of the coating to cyclic conditions of condensing humidity and dry-off.

3.18.2 EQUIPMENT—Cleveland Condensing Humidity Cabinet.

3.18.3 PANEL PREPARATION—Two steel panels as described in 3.11.2 shall be coated as described in 3.11.3 and 3.11.4 and conditioned as described in 3.11.5.

3.18.4 The panels shall be positioned in the cabinet in conformance with ASTM D 4585-86a (formerly ASTM D 2247 Annex A2).

3.18.4.1 The coated flat panels with straight and coated or taped edges shall be butted together with the test side facing down across the top of the cabinet. Properly installed, the panels will be in a slightly sloped position to return excess condensation to the water tank without running on other test panels.

3.18.5 CYCLIC TEST CONDITIONS—A cycle shall consist of 3 h of continuous condensation and 3 h of air dry-off. Four cycles shall be performed every 24 h.

3.18.6 CABINET CONDITIONS

3.18.6.1 The temperature of the saturated air during continuous condensation shall be 38 °C ± 1 (100 °F ± 2).

3.18.6.2 There shall be 100% relative humidity with continuous condensation on the test panels 50% of the time.

3.18.6.3 The cabinet shall be allowed to equilibrate to ambient conditions during the dry-off cycle(s).

3.18.7 The test panels shall be examined daily. If there is evidence of film degradation (for example, cracking, peeling, alligatoring, or blistering) prior to 1 000 h, the test shall be terminated and that point considered as the time to failure.

3.18.8 After a total of 1 000 h, the test panels shall be removed from test, allowed to stand for 24 h in an atmosphere of 25 °C ± 1 (77 °F ± 2) having a relative humidity of 50% ± 5.