

MIL-L-24518 (SHIPS)  
12 March 1975

## MILITARY SPECIFICATION

## LAMINATE, VINYL FILM-ALUMINUM, DECORATIVE

This specification is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This specification covers decorative vinyl film-aluminum laminate. The material is used as a decorative treatment for Naval shipboard bulkhead sheathing and miscellaneous furniture items, such as bookcases, partitions, and trim.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

## SPECIFICATIONS

## FEDERAL

QQ-A-250/8 - Aluminum Alloy 5052, Plate and Sheet.  
PPP-B-640 - Fiberboard-Corrugated Triple Wall.

## MILITARY

MIL-P-116 - Preservation-Packaging, Methods of.

## STANDARDS

## MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by  
**Attributes.**  
MIL-STD-129 - Marking For Shipment And Storage.  
MIL-STD-1623 - Fire Performance Requirements And Approved Specifications For Interior Finish Materials And Furnishing (Naval Shipboard Use).

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

B117 - Salt Spray (Fog) Testing.  
D618 - Conditioning Plastics and Electrical Insulating Materials  
for Testing.  
D792 - Specific Gravity and Density of Plastics by Displacement,  
Tests for.  
D1044 - Resistance of Transparent Plastics to Surface Abrasion,  
Test for.  
D1499 - Operating Light- and Water-Exposure Apparatus (Carbon-Arc  
Type) for Exposure of Plastics, Rec. Practice For.  
E84 - Surface Burning Characteristics of Building Materials,  
Test for.

(Copies may be obtained from the American Society For Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

FSC 9330

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UNIFORM CLASSIFICATION COMMITTEE  
Uniform Freight Classification Rules.

(Copies may be obtained from the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, Illinois 60606.)

U.S. DEPARTMENT OF COMMERCE  
Commercial Standard CS 245-62 - Vinyl-Metal Laminates

(Copies may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Material. The laminate shall consist of a polyvinyl chloride (PVC) film that is bonded under heat and pressure to an aluminum sheet base that conforms to temper H32 of QQ-A-250/8.

3.2 Form. The laminate shall be in the form of rectangular sheets. Maximum size shall be 4 by 8 feet.

3.3 Dimensions.

3.3.1 Width. The PVC film shall be held to a tolerance of plus 1/2 inch, minus 0 inch, of the nominal width specified (see 6.2). This tolerance shall apply when the material is in roll form on the core during the manufacturing process.

3.3.2 Film thickness. The average thickness of the PVC film shall be 0.009 inch  $\pm$  20 percent of that specified as determined in accordance with 4.3.1.

3.3.3 Aluminum thickness. The thickness of the aluminum sheet shall be as specified (see 6.2).

3.4 Physical properties.

3.4.1 Adhesion strength. The bond between the PVC film and the aluminum sheet shall be considered acceptable if the material meets the following requirements when tested in accordance with 4.3.2.

3.4.1.1 Ball test. The PVC film shall securely adhere to the aluminum sheet at the point of greatest elongation so that an area not more than 1/4 inch square of completely bare aluminum shall show when tested in accordance with 4.3.2.1.

3.4.1.2 Salt spray. The laminate shall show no blisters, delamination, or rust creepage in excess of 1/8 inch along the score marks when exposed for 200 hours in a salt spray fog test in accordance with 4.3.2.2.

3.4.1.3 Boiling water. The laminate (see 4.3.2.1) shall withstand one hour exposure to boiling water without visual delamination when tested in accordance with 4.3.2.3.

3.4.2 Abrasion resistance. The abrasion resistance of the PVC film shall be not less than that specified under 4.3.3.

3.4.2.1 Printed film. The printed PVC film shall show no print wear after 100 cycles on the Taber Abraser using wheels in accordance with CS 17 of CS 245 and a 1,000 gram load when tested in accordance with 4.3.3.

3.4.2.2 Unprinted film. The unprinted PVC film shall have not more than an average loss of 0.050 grams for 100 cycles on the Taber Abraser using wheels in accordance with C 17 of CS 245, and a 1,000 gram load when tested in accordance with 4.3.3.

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3.4.3 Light stability. The PVC film shall exhibit no discoloration or pigment fadeout after exposure in the fadeometer for 150 hours when tested in accordance with 4.3.4.

3.4.4 Plasticizer loss. The plasticizer loss from the PVC film shall not exceed an average of 5 percent by weight when tested in accordance with 4.3.5.

3.4.5 Stain resistance. The PVC film shall be stain resistant to the following materials when tested in accordance with 4.3.6:

Orange peel	1 percent iodine in alcohol
Lemon peel	10 percent sulfuric acid
10 percent nitric acid	10 percent hydrochloric acid
10 percent citric acid	10 percent sodium hydroxide
Mineral oil	Cola beverage
Sodium hydrochlorite	Tea (hot)
Milk	Coffee (hot)
50 percent ethyl alcohol	Catsup

3.4.6 Fire performance. The fire performance characteristics of the laminate shall conform to the fire requirements set forth in MIL-STD-1623 (see 4.3.7).

3.4.7 Color and pattern. The color and pattern of the PVC film shall be as specified (see 6.2).

3.4.8 Surface finish. The surface finish of the PVC film shall be as specified (see 6.2).

3.4.9 Workmanship. The decorative surface of the laminate shall be examined in accordance with 4.2.2 for defects such as cold checks, crows feet, "pine trees", streaks, blisters, pinholes, particles of foreign matter, and undispersed raw materials.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

#### 4.2 Quality conformance inspection.

##### 4.2.1 Sampling.

4.2.1.1 Lot. For the purpose of sampling, examinations, and tests, a lot shall consist of all sheets of the same type produced under essentially the same conditions and offered for delivery at one time.

4.2.1.2 Sample. For the purpose of sampling, examination, and tests, a sample shall be defined to be the specified quantity of material from a lot selected in accordance with 4.2.1.3 and 4.2.1.4 necessary to perform an examination or test required by 4.2.2, 4.2.3, and 4.2.4.

4.2.1.3 Sampling for examination. Representative samples shall be selected at random from each lot, in accordance with MIL-STD-105 at inspection level I, and Acceptable Quality Level (AQL) = 4.0 percent defective for the examination specified in 4.2.2.

4.2.1.4 Sampling for tests. Representative samples shall be selected at random from lots found acceptable, in accordance with 4.2.2, in sufficient quantities to conduct the production check tests and quality conformance test, specified in 4.2.3 and 4.2.4 on all applicable lots.

4.2.1.4.1 Conditioning. Test specimens shall be conditioned in accordance with procedure A of ASTM D618 and shall be tested under these conditions.

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4.2.2 Examination. Each sample sheet shall be examined for form, dimensions, tolerances, color and pattern, surface finish, appearance, and workmanship to determine and evaluate visual defects. If the total number of visual defects exceeds the applicable acceptance number specified in 4.2.1.3, this shall be cause for rejection of the lot which the samples represent.

4.2.3 Production check tests. Production check tests shall be conducted on samples from the first lot of sheets and on samples from every tenth lot thereafter. All the tests specified in 4.3 shall be conducted with the exception of 4.3.6 and 4.3.7, on the applicable lots.

4.2.4 Quality conformance tests. Quality conformance tests shall be conducted on samples from lots not subjected to production check tests. The tests specified in 4.3.3, 4.3.4, 4.3.6, and 4.3.7 shall be conducted.

### 4.3 Tests.

#### 4.3.1 Thickness (weight method).

##### 4.3.1.1 Apparatus.

- (a) Analytical balance, equipped with pan straddle or other stationary support, sensitive to 0.0005 gram.
- (b) Die or template, for cutting test specimens, 3.94 by 3.94 inches (10 by 10 centimetres (cm)) with a dimensional tolerance of +0.004 inch (0.01 cm) per side.
- (c) Sharp knife or razor.

4.3.1.2 Test specimens. Five 3.94 by 3.94 inches (10 by 10 cm) specimens of PVC film taken uniformly across the width of the film shall be tested.

4.3.1.3 Procedure. By means of the die or template and the sharp knife or razor, cut five specimens from the sample of film. Weigh each specimen to the nearest 0.5 milligram (mg) on the analytical balance. Record the weight as W. Following the procedure of ASTM D792, method A, determine the specific gravity of each specimen and record as D. Use of a wetting agent is recommended.

4.3.1.4 Calculations. Calculate the average thickness of each test specimen, using the following formula, and average the five values:

$$T = \frac{394W}{100D} = 3.94 \frac{W}{D}$$

Where

- T = average thickness of test specimen in mils.
- W = weight of test specimen in gram.
- D = density of test specimen in gram/cm (specific gravity = density in metric units).
- 394 = conversion factor, cm to mils.
- 100 = area of specimen in square cm.

#### 4.3.2 Adhesion strength.

##### 4.3.2.1 Ball test.

##### 4.3.2.1.1 Apparatus.

- (a) Die stock steel block 3 by 3 by 1 inch with a hole in the center 1.060 inch in diameter. The edges of the hole shall be rounded to a radius of not less than .060 inch.
- (b) A rubber pad to fit around the ball with a 1 inch diameter hole in the center.
- (c) Ball. A 1 inch diameter steel ball bearing.
- (d) Hydraulic pressure jack for applying pressure, such as the Erickson or equal.

4.3.2.1.2 Test specimens. Three 3 by 3 inches specimens shall be cut from the same area of the laminate to be tested.

- (a) One specimen shall be tested in accordance with the procedure described in 4.3.2.1.3 to determine the depth of fracture of the laminate in inches. The depth of fracture shall be the vertical distance in inches from the flat upper surface of the laminate to the top of the dome formed by the ball when fracture occurs.
- (b) The two specimens of the laminate shall be scored (see figure 1) by two lines cut through the vinyl and adhesive layers. Care should be exercised not to score the aluminum. The cuts shall be parallel to one side, each 2 inches long and 1/4 inch apart along the center line of the specimen. Two additional cuts shall be made at right angles, also 1/4 inch apart along the center line to the initial scoring. The cuts in the surface shall intersect to form a 1/4 inch square.

4.3.2.1.3 Procedure. The ball test apparatus is shown in figure 2. The laminate specimens shall be placed on the rubber block, with the scored vinyl side up. The ball bearing shall be held firmly in place by the rubber pad and the lower steel block, and then when it meets the upper steel block the ball shall be forced upward to form a dome 1/16 inch below the previously determined fracture point (see 4.3.2.1.2 (a)) or to a maximum of 3/8 inch. One formed specimen shall be set aside for use in the boiling water test (see 4.3.2.3). The second specimen shall be inspected in accordance with 4.3.2.1.4.

4.3.2.1.4 Inspection. The formed ball test specimen (see figure 3) shall be cut through the vinyl and adhesive layers between the two parallel lines halfway up the dome and an attempt shall be made to pull the vinyl away from the aluminum in each of the quadrants.

#### 4.3.2.2 Salt spray.

4.3.2.2.1 Apparatus. The salt spray chamber shall conform to the requirements of ASTM B117.

4.3.2.2.2 Test specimen. The specimen shall (see figure 4) be 4 by 6 inches with the bare edges protected by beeswax or other suitable sealing material. Score marks at right angles shall be cut through the vinyl and adhesive layers on the lower half of the specimen.

4.3.2.2.3 Test procedure. The specimen shall be placed in the chamber at the angle specified in ASTM B117 with the vinyl side up. The specimen shall be exposed for 200 hours under the conditions as stated in ASTM B117.

4.3.2.2.4 Inspection. After washing the specimen with warm water and mild abrasive conforming to P-S-311, the specimen shall be examined for blisters on the vinyl, signs of delamination at the juncture of the score marks, and rust creepage (where ferrous metal is used) along the score marks.

4.3.2.3 Boiling water test. A formed ball test specimen prepared and cut in accordance with 4.3.2.1.3 shall be placed in boiling water for one hour, removed and allowed to cool to 73.4° + 1.8°F for one hour. At the end of that time the specimen shall be examined for delamination of the vinyl from the aluminum at the score marks.

4.3.3 Abrasion resistance. The abrasion resistance of the vinyl shall be determined in accordance with ASTM D1044, except that CS-17 wheels, 1,000-gram-weight load, and 100 cycles shall be used. In the case of free vinyl, it shall be attached to a metal plate by means of double sided contact pressure sensitive adhesive (such as PS-5502 furnished by Interchemical Corporation Finishes Division or equal). Three specimens shall be tested and the average loss in grams for the 100 cycles shall be calculated.

4.3.3.1 Resurfacing of the wheels shall be done with the S-11 Tabor Abrasion paper for 25 cycles at the beginning of each test.

4.3.4 Light stability. The light stability shall be determined in accordance with ASTM D1499 using an Atlas Fadeometer Type FDA-R or equal.

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4.3.4.1 Test specimens. Two specimens 8 by 2-5/8 inches shall be cut from the sample film to be tested. The one specimen shall be placed in an envelope and filed as a standard for comparison. The second specimen shall be placed in the Fadeometer.

4.3.4.2 Procedure. The specimen shall be exposed under the conditions specified in ASTM D1499 for 150 hours. The black panel temperature shall be 145° + 9°F. The water reservoir shall be filled with water at all times so that the wicks in the chamber are kept wet constantly.

4.3.4.3 Inspection. After the specimen has been exposed in the Fadeometer for 150 hours, it shall be compared to the standard retained (see 4.3.4.1) for visual evidence of discoloration or pigment fadeout.

4.3.5 Plasticizer loss. Three 3 by 3 inch specimens of the vinyl shall be conditioned (see 4.2.1.4.1) and weighed to the nearest 0.01 gram. The specimens shall be immersed in an upright position so that they are not touching each other, the bottom, or the sides of a one pint jar containing technical grade hexane. The immersion shall be at a temperature of 73.4° + 1.8°F for one hour. After the immersion period, each specimen shall be dried at a temperature of 220° + 5°F for one hour in circulating air oven, removed and cooled to standard conditions for one hour, and weighed to the nearest 0.01 gram. The plasticizer loss, expressed as percentage weight loss as compared to the original specimen weight shall be computed as follows to the nearest 0.01 gram.

Where

$$\text{Weight loss, percent} = \frac{W_1 - W_2}{W_1} \times 100$$

$W_1$  = initial weight of test specimen and

$W_2$  = final weight of test specimen.

The values obtained for the three test specimens shall be averaged and reported as percentage weight loss of the sample tested.

4.3.6 Stain resistance. Each of the materials listed in 3.4.5 shall be applied to a specimen of laminate or vinyl so as to cover a minimum area of 1/2 by 1/2 inch. After one hour of contact, the surface shall be cleaned with soap and water and visually inspected. Any remaining stained areas may be further cleaned by using a mild abrasive conforming to P-S-311, hexane, or ethyl or isopropyl alcohol. A tested area that fails to return to the original color shall be considered to be permanently stained.

4.3.7 Fire performance. Specimens shall be tested in accordance with the procedure set forth in MIL-STD-1623 (see requirement for vinyl film-aluminum laminate). The test shall be performed by a non-profit independent laboratory acceptable to the Naval Ship Engineering Center, Materials Development and Applications Office, Center Building, Prince George's Center, Hyattsville, Maryland 20782.

4.4 Inspection of preparation for delivery. The packaging, packing, and marking shall be inspected to determine conformance to the requirements of section 5 of this specification. The packaging, packing, and marking requirements of section 5 identified to referenced specifications and standards shall be inspected in accordance with the applicable specifications and standards. The packaging requirements of section 5 not identified to referenced specifications shall be examined for the defects listed in table I on the basis of the sampling procedures and inspection levels used to determine examination requirements under MIL-P-116. The packing and marking requirements of section 5 not identified to referenced specifications and standards shall be examined for the defects listed in table I in accordance with MIL-STD-105, using an AQL of 4.0 percent defective.

Table I - Classification of defects.

Category	Defects
Critical	None defined
Major	Packaging: 101 Incorrect level 102 Quantity not as specified; weight exceeded 103 Sheets not arranged as specified, not interleaved when required 104 Improper wrap material, closure not sealed Packing: 105 Incorrect level 106 Incorrect box, improper closure 107 Pallet not constructed as specified, nail heads protruding 108 Steel strapping improperly applied Marking: 109 Not as specified, missing, not legible
Minor	Packing: 201 Skid ends not beveled or notched

#### 5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.3.)

##### 5.1 Packaging. Packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A. Unless otherwise specified (see 6.2), sheets shall be packaged in bundles not to exceed 250 pounds with a minimum of ten sheets per bundle. Sheets shall be arranged vinyl face to vinyl face. Bundles exceeding 250 pounds shall have the sheets interleaved with kraft paper. Each bundle shall be totally enclosed in a flexible waterproof wrap with the wrap closure and the flaps sealed with a waterproof adhesive or waterproof pressure-sensitive tape.

5.1.2 Level C. Packaging shall be sufficient to afford protection against deterioration and physical damage during shipment from the supply source to the using activity for early installation. This level may conform to the supplier's normal packaging practice when such meets the requirements of this level.

##### 5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

5.2.1 Level A. Sheets, packaged as specified (see 6.2), shall be packed one bundle to a triple wall, Class weather resistant, fiberboard box conforming to PPP-B-640. Box style shall be at the suppliers option. Box closure shall be in accordance with the appendix to the box specification. Each box shall be strapped with a minimum of three girthwise 5/8 by .020 inch galvanized steel straps to a wood pallet. The wood pallet shall be constructed of three nominal 1 by 6 inch lengthwise deck boards with three nominal 3 by 4 inch crosswise skids. Two straps, one on each end, shall be placed approximately three inches in from each pallet load end and one strap at approximately the middle of the pallet load. Strapping shall pass over the box and under the crosswise skids. Skid ends shall be beveled or knotted with bottom of skid dadoed or rabbited to retain the strapping. Intersections of deck boards and skids shall be fastened with three nails. Nails shall be cement coated or equal and minimum 10 penny size and approximately 2-7/8 inches in length. Nails shall be driven so that the heads will not project above the deckboard surface. Occasional over-driving of nails is permitted but no nail shall be driven more than 1/2 inch the thickness of the deckboard. Lumber shall be seasoned to a moisture content of 8 to 19 percent of its oven dry weight; skids may exceed 19 percent.



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5.2.2 Level B. Sheets shall be packed as specified in 5.2.1 except, (a) boxes shall be of the class nonweather resistant and, (b) steel strapping may be enameled in lieu of galvanized.

5.2.3 Level C. Sheets, packaged as specified in 5.1.2, shall be packaged in a manner which will insure acceptance by common carrier at the lowest rate, and will afford protection against physical or mechanical damage during direct shipment from the supply source to the first receiving activity for immediate use. The method of packing shall conform to the Uniform Freight Classification Rules or other carrier regulations as applicable to the mode of transportation and may be the supplier's normal packaging practice when such meets the requirements of this level.

5.3 Marking. In addition to any special marking required (see 6.2), interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129. In addition, interior packages and exterior shipping container markings shall include specification number.

## 6. NOTES

6.1 Intended use. The vinyl film-aluminum laminate is used for bulkhead sheathing to reduce maintenance and improve sanitation and appearance.

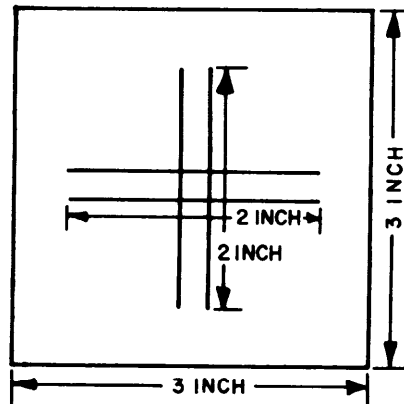
6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Width of laminate required (see 3.3.1).
- (c) Thickness of aluminum sheet required (see 3.3.3).
- (d) Color and pattern required (see 3.4.7).
- (e) Surface finish (see 3.4.8).
- (f) Level of packing and level of packaging required (see 5.1 and 5.2).
- (g) Quantity other than specified (see 5.1.1).
- (h) Special marking (see 5.3).

6.3 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in section 2 do not apply when material and parts are procured by the supplier for incorporation into the equipment and lose their separate identity when the equipment is shipped.

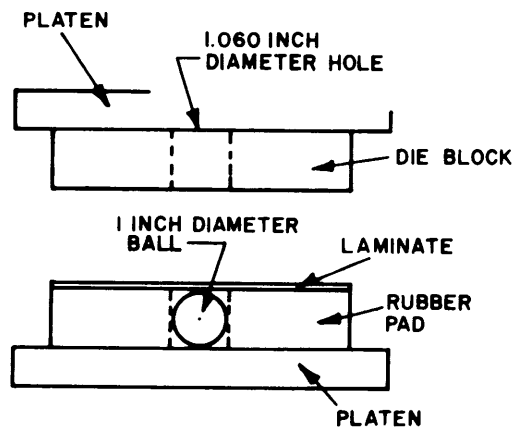
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SH 10835

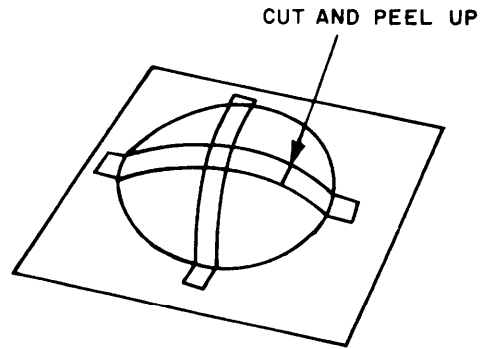
Figure 1 - Ball test specimen.



SH 10836

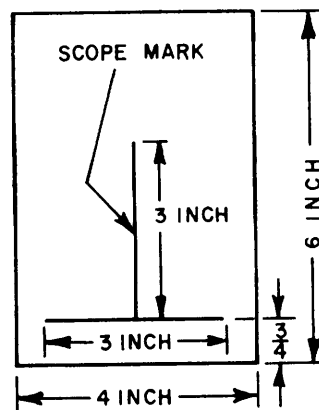
Figure 2 - Ball test apparatus.

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SH 10837

Figure 3 - Formed ball test specimen.



SH 10838

Figure 4 - Salt spray specimen.

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<p><b>1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?</b></p> <p><b>A. GIVE PARAGRAPH NUMBER AND WORDING.</b></p>           <p><b>B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES</b></p>		
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