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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-STD-753

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Corrosion-Resistant Steel Parts: Sampling, Inspection and Testing for Surface Passivation

NOTICE

This document has been taken directly from U.S. Military Standard MIL-STD-753C and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-STD-753C. Any part numbers established by the original specification remain unchanged.

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1. SCOPE:

1.1 Scope:

This standard describes general and detailed methods of sampling and testing for surface passivity of corrosion-resistant steel parts. These tests may also be useful to determine if there is a need for passivation.

2. APPLICABLE DOCUMENTS:

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

2.1 ASTM Publications:

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

ASTM B 117 Salt Spray (Fog) Testing

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes

3. DEFINITIONS:

3.1 Passivation:

Passivation is a final treatment/cleaning process used to remove free iron or other anodic contaminants from the surfaces of corrosion resistant steel parts such that uniform formation of a passive surface is obtained. This treatment induces a more noble (cathodic) potential onto the part thus enhancing corrosion resistance.

3.2 Corrosion-resistant steel:

The term “corrosion-resistant steel” as used herein refers to those alloyed steels containing chromium in excess of 10.5%.

4. GENERAL REQUIREMENTS:

4.1 Sampling and testing:

4.1.1 Sampling for tests: Unless otherwise specified, samples used for the tests specified in 4.1.2 shall be chosen in accordance with MIL-STD-105, Inspection Level S-4 with an Acceptable Quality Level (AQL) of 1.0 percent defective.

4.1.2 Test methods:

4.1.2.1 Visual examination for surface contamination: Samples chosen in accordance with 4.1.1 shall be visually inspected to determine that none of the surfaces show evidence of contamination such as the presence of metal particles, paint, oil, grease, flux and other contaminants.

4.1.2.2 Surface contaminant tests (free iron or other contaminants): Unless a particular test is specified, samples chosen in accordance with 4.1.1 shall be subjected to one of the test methods specified in 5.1 to determine the presence of free iron or other anodic surface contaminants.

4.1.2.2.1 Test chemicals: All required test chemicals shall be American Chemical Society reagent grade purity.

4.2 Failure:

Any lot failing to comply with the requirements specified shall be rejected. A lot having failed the specified requirements may be resubmitted for inspection provided that the contractor has removed all defective material or has reworked the lot. Resubmitted lots shall be subjected to tightened inspection in accordance with MIL-STD-105.

5. DETAILED REQUIREMENTS:

5.1 Test methods:

All detailed test requirements for the determination of free iron or other anodic surface contaminants shall be as specified in the following test methods:

Test Method	Title
100	Water Immersion Test
101	High Humidity Test
102	Copper Sulfate Test
103	Potassium Ferricyanide-Nitric Acid Solution Test
104	Salt Spray Test

6. NOTES:

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use:

This standard is intended to provide methods for testing the effectiveness of passivation. This standard can also be used to determine if there is a need for passivation.

6.2 Copper sulfate test:

The purpose of the copper sulfate test is to determine the presence of free iron which is usually induced onto the surface of a part during fabrication with steel components. The principle of the test is based on an oxidation-reduction reaction which causes the aqueous copper ions to deposit or plate out onto the free iron particles. This method is not recommended for use on martensitic 400 series alloys or lower chromium grades (less than 16%) of ferritic 400 series alloys because the copper may plate out onto the parts even though all the free iron has been removed from the surface during passivation. This is due to the higher amount of iron used in the composition of these alloys which makes it difficult to differentiate between a copper deposit that is the result of free iron and one that is the result of the nature of the alloy.

6.3 Potassium ferricyanide test:

This test is more sensitive to the presence of metallic iron than the copper sulfate test, see 6.2. Because of its sensitivity, it is recommended for use only on austenitic AISI 200 and 300 series alloys and only when the determination of trace amounts of free iron is required. Due to the higher amounts of iron used in the composition of the martensitic and ferritic 400 series alloys, this test may show a positive reaction on these alloys even though all the free iron has been removed from the surface during passivation.

6.4 Subject term (keyword) listing:

Corrosion Resistant Steel
Passivation
Stainless Steel

PREPARED UNDER THE JURISDICTION OF AMS COMMITTEE “F”

METHOD 100

WATER IMMERSION TEST

1. SCOPE

1.1 This method is used for the detection of any anodic surface contaminants on corrosion resistant steel, including free iron.

2. APPARATUS AND MATERIALS

2.1 A non-rusting tank.

2.2 Distilled water.

3. PROCEDURE

3.1 Parts shall be alternately immersed in distilled water for one hour and allowed to dry for one hour for a minimum of twenty-four hours.

3.2 After completion of the test, parts shall show no evidence of rust or corrosion.

METHOD 101

HIGH HUMIDITY TEST

1. SCOPE

1.1 This method is used for the detection of any anodic surface contaminant of corrosion resistant steel, including free iron.

2. APPARATUS AND MATERIALS

2.1 A humidity cabinet capable of maintaining the test conditions specified herein.

3. PROCEDURE

3.1 Parts shall be placed in a humidity cabinet and subjected to 97 ± 3 percent humidity at a temperature of 100 ± 5°F. The parts shall be exposed to these conditions for a minimum of 24 hours.

3.2 After completion of the test, parts shall show no evidence of rust or corrosion.

METHOD 102

COPPER SULFATE TEST

1. SCOPE

1.1 This method is recommended to detect the presense of free iron on the surface of austenitic chromium-nickel steels of the AISI Type 200 and 300 series alloys, precipitation hardened types, and ferritic AISI 400 series alloys having a minimum of 16% chromium. It is not recommended for use on martensitic AISI 400 series alloys or ferritic AISI 400 series alloys with less than 16% chromium since the test will show a positive reaction on these materials. This test is sensitive and should be used and interpreted only by personnel familiar with its limitations.

WARNING

DO NOT USE THIS TEST ON PARTS TO BE USED IN FOOD PROCESSING.

2. APPARATUS

2.1 10 ml Graduate
500 ml Graduate
1000 ml Beaker
Swab
Balance

3. MATERIAL

3.1 Copper Sulfate ($CuSO_4:5H_2O$)
Distilled Water
Sulfuric Acid (sp gr 1.84)

4. PROCEDURE

4.1 Prepare the test solution as follows: Dissolve 8g of copper sulfate in 500 ml of distilled water to which 2 to 3 ml of sulfuric acid has been added.

NOTE: Aqueous copper sulfate solutions more than two weeks old shall not be used for the purposes of this test.

4.2 Swab the surface to be inspected with test solution, applying additional solution, if needed, to keep the surface wet for a period of 6 minutes.

4.3 At the end of this 6-minute period, carefully rinse and dry the surface such that no copper deposits are removed.

4.4 A copper deposit indicates the presence of metallic iron.