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MIL-STD-40009(AT)
8 November 1991
SUPERSEDING
(see 6.3)

MILITARY STANDARD

CLEANING AND PASSIVATION, PROCESS FOR (AM350 AND AM355 STAINLESS STEELS)

AMSC N/A AREA MFFP

FOREWORD

1. This military standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial Comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

C O N T E N T S

1. SCOPE

1.1 Purpose. The procedures covered by this standard are used to ensure passivation of precipitation hardenable stainless steels AM350 and AM355.

1.2 Scope. This standard covers the process of cleaning and passivation performed on parts fabricated from precipitation hardenable stainless steels AM350 and AM355.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

STANDARDS

FEDERAL

P-C-435	- Cleaning Compound, General Purpose (Powdered, Heavy Duty).
P-C-436	- Cleaning Compound, Alkali, Boiling Vat (Soak) or Hydrosteam.
P-C-535	- Cleaning Compound, Platers Electrocleaning, For Steel

MILITARY

MIL-D-26549	- Descaling Compound, Alkaline, Hot Section Jet Engine Parts.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Navy Publications and Printing Service Office, Standardization Document Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AEROSPACE MATERIAL SPECIFICATIONS (AMS)

AMS 1383	- Scale Conditioner, Alkaline Permanganate, Aircraft Turbine Engine Components.
AMS 1537	- Cleaner, Alkaline Hot-Tank Type.

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A380	- Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems.
ASTM D1748	- Standard Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Hot water. Water heated to a temperature of not less than 180 degrees Fahrenheit (°F) (82 degrees Celsius (°C).

3.2 Cold water. Unheated water as it comes from the water supply.

3.3 Room temperature. A temperature between 65° and 90°F (18° to 32°C).

4. GENERAL REQUIREMENTS

This section is not applicable to this standard.

5. DETAILED REQUIREMENTS

5.1 Equipment.

5.1.1 Humidity cabinet. The humidity cabinet shall conform to the requirements of ASTM D1748.

5.2 Materials.

5.2.1 Cleaners.

a. Vapor degreasing solvent. Stabilized 1-1-1 trichlorethane.

b. Abrasive blast:

1. Wet. Lorkonovaculite #200 for use in wet vapor abrasive blast cabinets. Concentration shall be 3 pounds (lbs) per 1 gallon (gl) of water.

2. Dry. Aluminum oxide (Al_2O_3) 220 grit.

c. Mild alkaline cleaner. Cleaning compound shall be in accordance with P-C-435, P-C-436 or AMS 1537. Concentration shall be 8 to 12 ounces (oz) per 1 gallon of water. Solution shall have a minimum temperature of 180°F (82°C) during application.

d. Amodic alkaline cyanide cleaner. Cleaning compound shall be in accordance with P-C-535. Concentration shall be 1 to 3 lbs per 1 gl of water. Cleaning shall be conducted at room temperature.

5.2.2 Alkaline permanganate solution. Alkaline permanganate solution shall be used as a scale conditioner for stainless steel at concentration of 2 to 2.5 lbs per gallon of water in accordance with MIL-D-26549 or AMS 1383. Solution shall have a temperature of 200° to 220°F (93° to 104°C) during application.

5.2.3 Hydrochloric acid pickle solution (or other equivalent pickling solutions):

Hydrochloric acid (HCI) commercial grade, concentrated.

5.2.4 Passivation solution:

Nitric acid (HNO_3), commercial grade, 40° Baume.
Concentration shall be 1 part HNO_3 to 4 parts water by volume.
Solution shall be conducted at room temperature.

5.2.5 Test solution. The formula for 1 liter of test solution shall be as follows:

Ingredients: Cupric sulfate ($CuSO_4 \cdot 5H_2O$) and Sulfuric acid (H_2SO_4), specific gravity 1.84.
Mixture: Dissolve 40 grams (g) of cupric sulfate in 900 Milliliter (ml) of distilled water to which 100 g of H_2SO_4 has been added.
Container: A dropping bottle equipped to be properly stoppered for storage when not in use.

5.2.5.1 Immersion formulation. When immersion application is required for small parts, the test solution shall be formulated in proportion to the tank size to provide complete coverage for parts being immersed. The test solution for immersion application shall be freshly made at the start of each day.

5.2.6 Water. Distilled or deionized water shall be used.

5.3 Required procedures and operations.

5.3.1 Cleaning. The extent and method of cleaning shall be determined by the amount of scaling found on part surfaces. Cleaning shall be performed as follows:

a. Scale free surfaces:

1. Vapor degrease (see 5.2.1.a).
2. Immerse in alkaline cleaner (see 5.2.1.c) for a period of 5 to 15 minutes.
3. Rinse in hot running water (see 3.1) and follow with a rinse in cold running water (see 3.2).

b. Lightly scaled surfaces:

1. Vapor degrease (see 5.2.1.a).
2. Clean in anodic alkaline cleaner (see 5.2.1.d) for a period of 3 to 5 minutes.
3. Rinse in hot running water.
4. Soak in alkaline permanganate solution (see 5.2.2) for a period of 1 to 1-1/2 hours.
5. Rinse in hot running water.
6. Reclean in accordance with steps 2 and 3.
7. Dip in hydrochloric acid pickle solution (see 5.2.3) for a period of 5 to 10 seconds.
8. Rinse in cold running water and follow with a rinse in hot running water.

CAUTION: Parts shall only be recycled once through this cleaning process.

c. Heavily scaled surfaces:

1. Vapor degrease (see 5.2.1.a).
2. Abrasive blast with an air pressure of 60 to 90 pounds per square inch (psi). Either wet or dry abrasive blast may be used, whichever is more practical.
3. Rinse in cold running water.
4. Immerse in alkaline cleaner for a period of 5 to 15 minutes.
5. Rinse in hot running water and follow with a rinse in cold running water.

NOTE: Parts may be brushed with a stiff fiber or stainless steel bristle brush after any cleaning process to ensure clean up.

5.3.2 Passivation. Passivation of part surfaces shall be as follows:

a. Immerse in passivation solution (see 5.2.4) for a period of 45 to 60 minutes.

b. Rinse in hot running water and follow with a rinse in cold running water.

5.4 Test methods.

5.4.1 Copper sulfate test. The copper sulfate test shall be performed at room temperature (see 3.3) as follows:

a. Apply test solution (see 5.2.5) to various locations of part surface.
b. Keep test areas wet with test solution for a period of 6 to 8 minutes.

5.4.1.1 Test results. Visual inspection shall verify that the tested area is devoid of free copper deposition.

5.4.1.2 Test solution removal. The test solution shall be removed from part surfaces as follows:

a. Rinse in cold running water.
b. Immerse in passivation solution for a period of 10 to 20 minutes.
c. Rinse in cold running water and follow with a rinse in hot running water.

5.4.2 High-humidity test. As an alternate to the copper sulfate test, the high-humidity test shall be performed on a part or test panel as follows:

a. The part or test panel shall be thoroughly cleaned with acetone and completely dried. An inert atmosphere or dessicated container may be used to hold sample prior to testing.
b. Samples shall be exposed to 100 percent humidity at 100°F (38°C) in a humidity cabinet (see 5.1.1) for 24 hours in the manner prescribed in ASTM D1748.

c. After completion of test, sample shall show no evidence of rust stains or corrosion of products.

5.5 Rework. Parts failing to meet passivity test shall be cleaned, passivated, and rinsed in accordance with the requirements of 5.3 and inspected in accordance with 5.4.

5.6 Safety. Cleaning operations often present numerous hazards to both personnel and facilities. Data sheets of the Manufacturing Chemists Association should be consulted to determine the hazards of handling specific chemicals in accordance with ASTM A380.

6. NOTES

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

6.1 Intended use. The procedures covered by this standard are intended to be used to insure passivation of AM350 and AM355 stainless steel meets prescribed requirements.

6.2 Issue of DODISS. When this standard is used in acquisition, the applicable issue of the DODISS must be cited in the solicitation (see 2.1.1 and 2.2).

6.3 Supersession data. This standard supersedes Textron Lycoming internal specification P6402E, SCN=1 dated 29 October 1982.

6.4 Subject term (key word) listing.

Abrasive blast
Alkaline cleaner
Alkaline permanganate
Anodic alkaline cyanide
Cleaning
Passivation
Vapor degreasing

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodian:
Army - AT

Preparing activity:
Army - AT

(Project MFFP-A495)

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DOCUMENT IDENTIFIER *(Number)* AND TITLE MIL-STD-40009(AT); Cleaning and Passivation, Process for (AM 350 and AM 355 Stainless Steels)

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

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