The Engineering Resource For Advancing Mobility

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE RECOMMENDED PRACTICE

ARP 1755

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Revised

EFFECT OF CLEANING AGENTS ON AIRCRAFT ENGINE MATERIALS
Stock Loss Test Method

1. SCOPE:

1.1 This recommended practice covers the determination of the amount of stock loss caused by use of chemical cleaning agents on aircraft turbine engine materials.

1.2 The evaluation is conducted on representative engine materials by determination of weight loss during total immersion in the cleaning solution with the weight-loss measurement converted to stock loss by calculation.

1.3 Test conditions are based upon manufacturer's recommended operating parameters for maximum concentration, maximum temperature, and twice the maximum immersion time.

1.4 Chemical cleaning solutions and compounds used for pre-inspection cleaning of aircraft turbine engine parts shall be subject to requirements of this test practice.

1.5 The test does not give consideration to cleaning performance of the compounds.

1.6 Classification: Examples of types of cleaning materials to be qualified under the requirements of this test procedure are:

Category 1. Cold carbon and paint remover
Category 2. Alkaline rust remover
Category 3. Alkaline scale conditioner
Category 4. Acidic scale conditioner
Category 5. Alkaline permanganate scale oxidizer
Category 6. Inhibited phosphoric acid
Category 7. Hot carbon and paint remover
Category 8. Silicone rubber remover
Category 9. Anti-gallant compound remover
Category 10. Other

2. SIGNIFICANCE: This recommended practice establishes a test procedure for determining the metal removal characteristics of aircraft turbine engine cleaning materials when used on a representative list of aircraft turbine engine alloys and coatings. This test result shall be compared with the following maximum stock loss per surface to establish acceptability for overhaul shop evaluation of cleaning performance characteristics:

Bare Panels or Discs	0.000025 in.	(0.625 µm)
Electroplated Panels	0.000025 in.	(0.625 µm)
Plasma Coated Panels or Bars	0.0001 in.	(2.5 µm)

3. APPLICABLE DOCUMENTS: The following publications form a part of this recommended practice to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

3.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

3.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2400 - Cadmium Plating
AMS 2406 - Chromium Plating, Hard Deposit
AMS 2410 - Silver Plating, Nickel Strike, High Bake
AMS 2416 - Nickel-Cadmium Plating, Diffused
AMS 2418 - Copper Plating
AMS 2424 - Nickel Plating, Low-Stressed Deposit
AMS 2437 - Coating, Plasma Spray Deposition
AMS 2470 - Anodic Treatment of Aluminum Alloys, Chromic Acid Process
AMS 3065 - Compound, Corrosion Preventive, Thin Film, Fingerprint Removing
AMS 3075 - Compound, Corrosion-Preventive, Hard Film, Hot Application
AMS 4037 - Aluminum Alloy Sheet and Plate, 4.4Cu - 1.5Mg - 0.60Mn (2024; -T3 Flat Sheet, -T351 Plate)
AMS 4375 - Magnesium Alloy Sheet and Plate, 3.0Al - 1.0Zn (AZ31B-0)
AMS 4442 - Magnesium Alloy Castings, Sand, 3.3Ce - 2.5Zn - 0.70Zr (EZ33A-T5)
AMS 4507 - Brass Sheet, Strip, and Plate, 70Cu - 30Zn (CDA 260), Half Hard
AMS 4544 - Alloy Sheet, Strip, and Plate, Corrosion Resistant 67Ni - 30Cu, Annealed
AMS 4640 - Aluminum Bronze Bars, Rods, Forgings, and Tubing, 81.5Cu - 10.3Al - 5.0Ni - 2.8Fe
AMS 4911 - Titanium Alloy Sheet, Strip, and Plate, 6Al - 4V, Annealed
AMS 5040 - Steel Sheet and Strip, 0.15 max Carbon, Deep Forming Grade
AMS 5382 - Alloy Castings, Investment, Corrosion and Heat Resistant, 54Co - 25.5Cr - 10.5Ni - 7.5W
AMS 5504 - Steel Sheet, Strip, and Plate, Corrosion and Moderate Heat Resistant, 12.5Cr (SAE 51410)
AMS 5508 - Steel Sheet, Strip, and Plate, Corrosion and Moderate Heat Resistant, 13Cr - 2.0Ni - 3.0W

3.1.1 (Continued):

AMS 5524 - Steel Sheet, Strip, and Plate, Corrosion and Heat Resistant, 18Cr - 13Ni - 2.5Mo (SAE 30316)
AMS 5525 - Steel Sheet, Strip, and Plate, Corrosion and Heat Resistant, 15Cr - 25.5Ni - 1.2Mo - 2.1Ti - 0.006B - 0.30V
AMS 5536 - Alloy Sheet, Strip, and Plate, Corrosion and Heat Resistant, 47.5Ni - 22Cr - 1.5Co - 9.0Mo - 0.60W - 18.5Fe
AMS 5537 - Alloy Sheet, Corrosion and Heat Resistant, 52Co - 20Cr - 10Ni - 15W
AMS 5544 - Alloy Sheet, Strip, and Plate, Corrosion and Heat Resistant, 57Ni - 19.5Cr - 13.5Co - 4.2Mo - 3.0Ti - 1.4Al - 0.05Zr - 0.006B, Consumable Electrode or Vacuum Induction Melted, Annealed
AMS 5596 - Alloy Sheet, Strip, and Plate, Corrosion and Heat Resistant, 52.5Ni - 19Cr - 3.0Mo - 5.1(Cb+Ta) - 0.90Ti - 0.5Al - 18Fe, Consumable Electrode or Vacuum Induction Melted, 1750°F (955°C) Solution Heat Treated
AMS 5661 - Alloy Bars, Forgings, and Rings, Corrosion and Heat Resistant, 42.5Ni - 12.5Cr - 5.8Mo - 2.9Ti - 0.015B - 35Fe, Consumable Electrode or Vacuum Induction Melted, Solution, Stabilization, and Precipitation Heat Treated
AMS 6431 - Steel Bars, Forgings, and Tubing, 1.05Cr - 0.55Ni - 1.0Mo - 0.11V (0.45 - 0.50C), Premium Quality, Consumable Electrode Vacuum Melted

4. MATERIALS: Test materials shall conform to specification requirements or to composition requirements in Table V, as applicable. Test materials shall be obtained from commercial sources as available. When a test material is not commercially available, it may be obtained from the relevant engine manufacturer as indicated under Test Material Sources, Table V.

5. SPECIMEN PREPARATION:

5.1 Materials: Shall be as listed in Tables II, III, and IV.

5.2 Preparation of Test Panels, Disks, and Electroplated Panels: Complete lists of test materials are given in Tables II and III. Test material requirements for specific cleaning compound categories are given in Table V. Use Table V to determine test material requirements for a specific cleaning compound category.

5.2.1 Prepare 2 x 5 in. (50 x 125 mm) panels from sheet or strip or cut transverse cross-section disks with parallel ground faces cut from conveniently sized bars, and drill or punch a 1/8-in. (3-mm) diameter hole near one end if needed for suspension.

5.2.2 Deburr edges after cutting and drilling or punching.

5.2.3 Wet abrasive blast test specimens all over, using approved alumina or silica abrasive or non-silicone treated glass beads nominally 0.001 - 0.003 in. (0.02 - 0.08 mm) in diameter.

5.2.3.1 Examples of approved abrasive media are: Novaculite No. 200 available from Wheelabrator-Frye, Inc., Mishawaka, IN 46544, or from Vapor Blast Manufacturing Co., Milwaukee, WI 53209, or UNI-SS (280 - 500 mesh) from Abrasive Developments, Henley-in-Arden, Solihull, Warwickshire, U.K.

5.2.4 Number each individual panel or disk for permanent identification.

5.3 Preparation of Plasma Coated Test Panels and Bars: A complete list of plasma spray materials is given in Table IV. Test material requirements for specific cleaning compound categories are given in Table V. Use Table V to determine test material requirements for a specific cleaning compound category.

5.3.1 Preparation of Test Panels:

5.3.1.1 Cut 1 x 3 in. (25 x 75 mm) panels and drill or punch a 1/8-in. (3-mm) diameter hole in each panel for suspension.

5.3.1.2 Deburr all edges.

5.3.1.3 Grind one side of panel flat to approximately 30 microin. (0.08 µm) finish.

5.3.1.4 Plasma spray coat the ground side of the panel to a thickness of 0.010 - 0.012 in. (0.25 - 0.30 mm).

5.3.1.5 Grind coated side to leave 0.003 - 0.005 in. (0.08 - 0.12 mm) of coating thickness.

5.3.1.6 Remove overspray from edges of panel.

5.3.1.7 Number panel and identify plasma coating type on the uncoated side of each individual panel for permanent identification.

5.3.2 Preparation of Test Bars:

5.3.2.1 Cut corrosion-resistant steel bar specimens 4.0 x 0.32 in. (100 x 8 mm).

5.3.2.2 Deburr all edges.

5.3.2.3 Grind the bar to approximately 30 microin. (0.08 µm) finish.

5.3.2.4 Vapor degrease.

5.3.2.5 Dry abrasive blast excluding end faces using 14/24 grade aluminum oxide grit and clean with a dry air blast to remove residual grit.

5.3.2.6 Apply plasma spray coating to a thickness of 0.010 - 0.012 in. (0.025 - 0.30 mm).

5.3.2.7 Grind the coating to leave 0.003 - 0.005 in. (0.08 - 0.12 mm) coating thickness.

5.3.2.8 Remove overspray from bar edges.

5.3.2.9 Number bar on end face and identify plasma coating type on each bar for permanent identification.

6. TEST PROCEDURES:

6.1 General Instructions: Evaluation testing of aircraft turbine engine cleaning chemicals shall be accomplished as follows:

6.1.1 Determine the category into which the cleaning chemical falls as shown in Table I.

6.1.2 Test the required panels, disks, or bars listed in Tables II, III, IV, and V, using the prescribed number of serialized specimens for each test.

6.1.3 Enter stock loss and related information on a stock loss data chart as in Fig. 1 and forward with letter of transmittal to applicable engine manufacturer(s).

6.1.4 If the results are within prescribed limits, the chemical cleaner shall receive preliminary approval of its applicability and engine manufacturer shall permit performance testing of cleaner in an appropriate engine overhaul facility. After the cleaner has been in use by a recognized overhaul shop on turbojet and turbofan engines for not less than 6 months and has been used for cleaning at least 10 engines or equivalent, with favorable service experience, the cleaner shall be approved by the engine manufacturer for service use.

6.1.5 Panels, disks, or bars representing stock loss data submitted to engine manufacturers on the stock loss data chart shall be serialized and retained by the cleaning compound manufacturer for not less than one year after completion of the cleaning compound approval procedure. The serial number of each specimen shall be recorded in the appropriate place on the form. A serialized specimen shall be used for one test only. Specimens retained by the vendor shall be preserved as described in 6.4 to prevent any change in physical condition.

6.1.6 Cleaning compound with revised formulation or operating parameters shall meet the requirements of this testing procedure and be approved by the engine manufacturer before cleaning compound may be submitted to engine overhaul facilities for service testing.

6.1.7 Do not submit samples of turbine cleaning materials to engine manufacturers or engine overhaul facilities unless specifically requested. Do not submit proprietary information relative to engine cleaning materials.

6.2 Test Requirements: Testing of any cleaning material for turbine engine use shall be conducted in accordance with the following:

6.2.1 Requirements are given in Tables II, III, IV, and V. If the vendor feels that the test specimen material or coating is incompatible with the cleaning solution, N.R. (Not Recommended) may be entered on the stock loss data chart of Fig. 1.

6.2.2 The strength of the chemical being tested shall be at the top limit of the vendor's recommended operating limits; e.g. if 12 to 16 oz per gal (95 - 125 mL/L) are recommended, use 16 oz per gal (125 mL/L) for testing.

6.2.3 The temperature of the chemical being tested, if other than room temperature, shall be at the top limit of the vendor's recommended operating limits; e.g. if a range of 190° - 210°F (90° - 100°C) is recommended, use 210°F (100°C) for test purposes.

6.2.4 Exposure time for the test specimens shall be double the vendor's recommended engine part processing time. If vendor's instructions include a recommendation that the cleaning solution be agitated, the test shall be performed in vigorously agitated cleaning solution.

6.2.5 If chemical strength or processing time, or both, differs for application to titanium parts, all details regarding this difference shall be indicated in the remarks space on the stock loss data chart of Fig. 1 and stock loss figures based thereon entered on the chart for titanium.

6.2.5.1 The requirements of 6.2 shall apply for any modified procedure.

6.3 Stock Loss Test:

6.3.1 Sheet Alloy Panels or Disks and Electroplated Panels (3 Each):

6.3.1.1 Prepare specimens as in 5.2.

6.3.1.2 Degrease using any degreasing method approved by engine manufacturer or overhaul facility.

6.3.1.3 Rinse in alcohol or acetone.

6.3.1.4 Air dry for 15 - 20 min. and immediately weigh panel or disk to nearest milligram and record weight (W_i).

6.3.1.5 Suspend test panel or disk not less than 2 in. (50 mm) below the surface of the cleaning solution being tested for the time specified.

6.3.1.5.1 In order to avoid possible error by galvanic action between the specimen and the tank or other grounding source, the specimen should be suspended without contact in the cleaning solution using a corrosion-resistant steel wire insulated from the tank or any grounding source.

6.3.1.6 Rinse in clean, cold tap water.

6.3.1.7 Brush with soft brush, apply pressure spray, or ultrasonically rinse.

6.3.1.8 Rinse in clean, cold tap water.

6.3.1.9 Rinse in clean, hot tap water.

6.3.1.10 Discard wire hanger and rinse or ultrasonically rinse specimen in alcohol or acetone.

6.3.1.11 Air dry for 15 - 20 min. and immediately reweigh specimen to the nearest milligram and record weight (W_f).

6.3.1.12 Determine the weight lost in the cleaning solution by subtracting weight (W_f) in 6.3.1.11 from weight (W_i) in 6.3.1.4.

6.3.1.13 From weight loss of 6.3.1.12, total surface area of test specimen, and density of metal alloy or electrodeposit shown in Table VI, determine stock loss in the cleaning solution as follows:

$$\text{Stock Loss} = \frac{W_i - W_f}{D \times A}$$

where W_i = initial weight of specimen
W_f = final weight of specimen
D = density of specimen
A = area of specimen

Example: (Inch/Pound Units) Weight of material lost from a standard 0.040 x 2 x 5 in. AMS 5504 panel was determined to be 0.060 gram.

$$W_i - W_f = 0.060 \text{ g}$$

$$= 0.060 \text{ g} \times \frac{1}{454 \text{ g per lb}} = 0.000132 \text{ lb}$$

Density = 0.279 lb per cu in.

Area = 20.5 sq in.
(Including 2 sides and all edges)

6.3.1.13 (Continued):

$$\frac{W_i - W_f}{D \times A} = \frac{0.000132 \text{ lb}}{0.279 \text{ lb per cu in.} \times 20.5 \text{ sq in.}}$$

Stock Loss = 0.000023 in.

Example: (SI Units) Weight of material lost from a standard 1 x 50 x 125 mm AMS 5504 panel was determined to be 0.060 gram.

$W_i - W_f = 0.060$ g

Density = 7.8 g/cm^3

$$= 7.8 \text{ g/cm}^3 \times \frac{1}{1000 \text{ mm}^3/\text{cm}^3}$$

$$= 0.0078 \text{ g/mm}^3$$

Area = 12,850 mm^2
(Including 2 sides and all edges)

$$\frac{W_i - W_f}{D \times A} = \frac{0.060 \text{ g}}{0.0078 \text{ g/mm}^3 \times 12{,}850 \text{ mm}^2}$$

Stock Loss = 0.00059 mm

6.3.1.14 The maximum allowable stock loss is 0.000025 in. (0.625 µm) for any alloy panel or disk or electroplated panel.

6.3.2 Plasma Coated Panels or Bars (3 Each):

6.3.2.1 Panels:

6.3.2.1.1 Prepare specimens as in 5.3.1.

6.3.2.1.2 Determine weight loss from uncoated AMS 4911 or AMS 5504 panels processed through 6.3.1.2 through 6.3.1.11, inclusive.

6.3.2.1.3 Determine weight loss of AMS 5504 or AMS 4911 panels plasma coated on only one side and processed through 6.3.1.2 through 6.3.1.11, inclusive.

6.3.2.1.4 Calculate weight loss caused by cleaning process from plasma coated side of panel only as follows:

6.3.2.1.4.1 Weight loss from coated face equals weight loss in 6.3.2.1.3 minus one-half the weight loss in 6.3.2.1.2.

6.3.2.1.5 From weight loss in 6.3.2.1.4.1, determine material thickness loss from coated surface using the following computation:

$$\text{Stock Loss} = \frac{W_i - W_f - 1/2\ (W_{si} - W_{sf})}{D \times 1/2\ A}$$

where W_i = initial weight of coated panel
W_f = final weight of coated panel
W_{si} = initial weight of uncoated AMS 5504 standard panel
W_{sf} = final weight of uncoated AMS 5504 standard panel
D = density of coating
A = total area of specimen

Example: (Inch/Pound Units) To determine the thickness loss for a plasma deposit on a standard 0.040 x 1 x 3 in. AMS 5504 panel, take one-half of the weight loss determined for the uncoated panel and subtract from weight loss determined for the coated panel so that only the weight change for the coated surface will be used for determining the dimensional decrease for the coated side. Use only the area of the coated side of the panel in calculating dimensional loss as follows:

$$W_i - W_f - 1/2\ (W_{si} - W_{sf}) = 0.060 \text{ g}$$

$$= 0.060 \text{ g} \times \frac{1}{454 \text{ g per lb}} = 0.000132 \text{ lb}$$

Density = 0.471 lb per cu in.

Area = 6.3 sq in.
(Including 2 sides and all edges)

$$\frac{W_i - W_f - 1/2\ (W_{si} - W_{sf})}{D \times 1/2\ A} = \frac{0.000132 \text{ lb}}{0.471 \text{ lb per cu in.} \times 1/2\ (6.3 \text{ sq in.})}$$

Stock Loss = 0.000089 in.

6.3.2.1.5 (Continued):

Example: (SI Units) To determine the thickness loss for a plasma deposit on a standard 1 x 25 x 75 mm AMS 5504 panel, take one-half of the weight loss determined for the uncoated panel and subtract from weight loss determined for the coated panel so that only the weight change for the coated surface will be used for determining the dimensional decrease for the coated side. Use only the area of the coated side of the panel in calculating dimensional loss as follows:

$$W_i - W_f - 1/2\ (W_{si} - W_{sf}) = 0.060\ g$$

$$\text{Density} = 13.2\ g/cm^3$$

$$= 13.2\ g/cm^3 \times \frac{1}{1000\ mm^3/cm^3}$$

$$= 0.0132\ g/mm^3$$

$$\text{Area} = 3950\ mm^2$$

(Including 2 sides and all edges)

$$\frac{W_i - W_f - 1/2\ (W_{si} - W_{sf})}{D \times 1/2\ A} = \frac{0.060\ g}{0.0132\ g/mm^3 \times 1/2\ (3950\ mm^2)}$$

Stock Loss = 0.0023 mm

6.3.2.1.6 The maximum allowable stock loss for plasma spray deposits is 0.0001 in. (2.5 μm).

6.3.2.2 Bars:

6.3.2.2.1 Prepare specimens as in 5.3.2.

6.3.2.2.2 Determine weight loss of plasma coated bar processed through 6.3.1.2 through 6.3.1.11, inclusive.

6.3.2.2.3 Calculate weight loss from cleaning process by subtracting weight (W_f) in 6.3.1.11 from weight (W_i) in 6.3.1.4.

6.3.2.2.4 From weight loss in 6.3.2.2.3, determine material thickness loss from coated bar using the following computation:

$$\text{Stock Loss} = \frac{W_i - W_f}{D \times A}$$

6.3.2.2.4 (Continued):

where W_i = initial weight of coated bar
W_f = final weight of coated bar
D = density of coating
A = area of coated bar

Example: (Inch/Pound Units) Weight of material lost from a 4 x 0.3345 in. diameter plasma coated bar was determined to be 0.060 gram.

$$W_i - W_f = 0.060 \text{ g}$$

$$= 0.060 \text{ g} \times \frac{1}{454 \text{ g per lb}} = 0.000132 \text{ lb}$$

Density = 0.471 lb per cu in.

Area = 4.203 sq in.

$$\frac{W_i - W_f}{D \times A} = \frac{0.000132 \text{ lb}}{0.471 \text{ lb per cu in.} \times 4.203 \text{ sq in.}}$$

Stock Loss = 0.000067 in.

Example: (SI Units) Weight of material lost from a 102 x 8.55 mm diameter plasma coated bar was determined to be 0.060 gram.

$$W_i - W_f = 0.060 \text{ g}$$

Density = 13.2 g/cm^3

$$= 13.2 \text{ g/cm}^3 \times \frac{1}{1000 \text{ mm}^3/\text{cm}^3}$$

$$= 0.0132 \text{ g/mm}^3$$

Area = 2740 sq mm

$$\frac{W_i - W_f}{D \times A} = \frac{0.060 \text{ g}}{0.0132 \text{ g/mm}^3 \times 2740 \text{ mm}^2}$$

Stock Loss = 0.00166 mm

6.3.2.2.5 The maximum allowable stock loss from plasma spray deposits is 0.0001 in. (2.5 μm).

6.4 Preservation of Test Specimens:

6.4.1 Record material or coating identification and serial number of specimen on a small tag.

6.4.2 Clean the specimen by vapor degreasing in trichloroethylene or by an acetone dip.

6.4.3 Apply AMS 3065 thin-film corrosion-preventive compound at room temperature by dipping, brushing, or spraying the specimen.

6.4.4 Drain excess compound.

6.4.5 Immerse specimen in a tank of AMS 3075 corrosion-preventive compound maintained at 180° - 200°F (80° - 90°C).

6.4.6 Allow specimen to attain the approximate temperature of the compound.

6.4.7 Remove specimen and allow excess compound to drain.

6.4.8 Make visual check for uniform coating.

6.4.9 Allow specimen to cool to room temperature. The compound sets into a medium thick film as it cools.

6.4.10 Place each specimen in a separate polyethylene bag, and attach the identifying tag of 6.4.1.

6.4.11 Retain specimens for not less than one year after completion of cleaning compound approval procedure.

7. REPORTS: The report shall consist of a fully executed copy of the stock loss data chart illustrated in Fig. 1. One copy shall be forwarded to the appropriate department of the applicable aircraft engine manufacturer(s).

This Aerospace Recommended Practice is under the jurisdiction of AMS Committee "J" (AMCM).

TABLE I

CLEANING COMPOUND CATEGORIES AND
OPERATING TEMPERATURES

Cleaning Solution Categories	Operation Temperature (Unless Otherwise Specified by Manufacturer)
1. Cold carbon and paint remover	Room temperature
2. Alkaline rust remover	190° - 210°F (90° - 100°C)
3. Alkaline scale conditioner	As specified
4. Acidic scale conditioner	120° - 130°F (50° - 55°C)
5. Alkaline permanganate scale oxidizer	180° - 200°F (80° - 95°C)
6. Inhibited phosphoric acid	Room temperature
7. Hot carbon and paint remover	130° - 150°F (55° - 65°C)
8. Silicone rubber remover	Room temperature
9. Anti-gallant compound remover	As specified
10. Other	As specified

TABLE II

ALLOY PANEL AND DISK REQUIREMENTS

Uncoated panels or disks (three of each material)

Dimensions: Sheet 0.040 - 0.060 in. (1.0 - 1.5 mm) thick by 2 x 5 in. ± 1/16 (50 x 125 mm ± 1.5) or disks cut from bar stock of convenient size with faces ground flat and parallel.

AMS 4037 Aluminum Sheet
AMS 4375 Magnesium Sheet
AMS 4442 Magnesium Alloy Castings
AMS 4507 Copper Alloy Sheet
AMS 4544 Nickel-Copper Alloy Sheet
AMS 4640 Aluminum Bronze Castings
AMS 4911 Titanium Sheet
AMS 5040 Carbon Steel Sheet
AMS 5382 Cobalt Alloy Castings
AMS 5504 Corrosion Resistant Steel Sheet
AMS 5508 Corrosion Resistant Steel Sheet
AMS 5524 Corrosion Resistant Steel Sheet
AMS 5525 Corrosion Resistant Steel Sheet
AMS 5536 Nickel Alloy Sheet
AMS 5537 Cobalt Alloy Sheet
AMS 5544 Nickel Alloy Sheet
AMS 5596 Nickel Alloy Sheet
AMS 5661 Nickel Alloy Bars
AMS 6431 Steel Bars
Bar Ni-9Cr-10Co-1.5Ti-5.5Al-10W-2.5Ta-1.5Hf (Mar-M™-002)
Bar Ni-15Cr-15Co-4Ti-5Al-4Mo (Nimonic™ 115)
Bar Ti-6Al-5Zr-0.5Mo-0.25Si (IMI™ 685)

TABLE III

ELECTROPLATED PANEL REQUIREMENTS

Coated AMS 5504 corrosion-resistant steel or anodized AMS 4037 panels (three of each).

Dimensions: 0.040 in. (1.0 mm) thick by 2 x 5 in. ± 1/16 (50 x 125 mm ± 1.5).

Specification	Description	Deposit Thickness	
		Inch	Millimetre
AMS 2400	Cadmium Plating	0.0005 - 0.0007	0.012 - 0.018
AMS 2406	Chromium Plating	0.0005 - 0.0010	0.012 - 0.025
AMS 2410	Silver Plating	0.0004 - 0.0006	0.010 - 0.015
AMS 2416	Nickel-Cadmium Plating	as specified	as specified
AMS 2418	Copper Plating	0.002 - 0.003	0.05 - 0.08
AMS 2424	Nickel Plating	0.0018 - 0.0022	0.045 - 0.055
AMS 2470	Anodic Treatment	0.00015 - 0.0002	0.0038 - 0.0050

TABLE IV

PLASMA SPRAYED PANEL REQUIREMENTS

Coated AMS 5504 stainless steel or AMS 4911 titanium panels (three of each).

Dimensions: Approximately 0.125 in. (3.0 mm) thick by 1 x 3 in. ± 1/16 (25 x 75 mm ± 1.5).

Specification	Powder Composition	Deposit Thickness	
		Inch	Millimetre
AMS 2437-3	88 tungsten carbide + 12 cobalt	0.003 - 0.005	0.08 - 0.12
AMS 2437-2	75 chromium carbide + 25 (80Ni-20Cr) alloy	0.003 - 0.005	0.08 - 0.12
Note 1	Cobalt 25.5Cr-10.5Ni-7.5W	0.003 - 0.005	0.08 - 0.12
Note 1	50 (88 tungsten carbide-12 cobalt) + 35 (70Ni-16.5Cr-4Fe-4Si-3.8B) 15 (80Ni-20Al)	0.003 - 0.005	0.08 - 0.12
Note 1	95Ni - 5Al (unalloyed composite powder)	0.003 - 0.005	0.08 - 0.12

Note 1: Deposits for which no Aerospace Material Specification is listed shall meet the requirements of AMS 2437-2 except that composition shall be as specified in this table and hardness testing shall not be required.

TABLE V

TEST MATERIAL REQUIREMENTS FOR CLEANING COMPOUND CATEGORIES

CATEGORY		1	2	3	4	5	6	7	8	9
Material	Test Material Source(s): (See Note 1)	Cold Carbon Solvent	Alkaline Rust Remover	Alkaline Descaler	Acidic Scale Conditioner	Alkaline Permanganate	Inhibited Phosphoric Acid	Hot Carbon Solvent	Silicone Rubber Remover	Anti-Gallant Compound Remover
UNCOATED PANELS										
AMS 4037 Aluminum	1, 2, 3, 4	R	NR	NR	NR	NR	NR	R	R	R
AMS 4375 Magnesium	1, 2, 3, 4	R	R	NR	NR	NR	NR	R	R	NR
AMS 4442 Magnesium	4	R	R	NR	NR	NR	NR	R	R	NR
AMS 4507 Copper Alloy	1, 2, 3	R	R	R	NA	R	R	R	NR	NR
AMS 4544 Nickel Alloy	1, 2, 3	R	R	R	R	R	R	R	NA	R
AMS 4640 Aluminum Bronze	4	R	R	NA	NA	NA	NA	R	NA	NA
AMS 4911 Titanium	1, 2, 3, 4	R	R	R	NA	NA	NA	NA	R	R
AMS 5040 Carbon Steel	1, 2, 3, 4	R	R	R	R	R	R	R	R	R

R - Required (panel is required for qualification)
NR - Not Recommended (may be detrimental)
NA - Not Applicable (panel not necessary for qualification)

TABLE V

TEST MATERIAL REQUIREMENTS FOR CLEANING COMPOUND CATEGORIES

Material	Test Material Source(s): (See Note 1)	1 Cold Carbon Solvent	2 Alkaline Rust Remover	3 Alkaline Descaler	4 Acidic Scale Conditioner	5 Alkaline Permanganate	6 Inhibited Phosphoric Acid	7 Hot Carbon Solvent	8 Silicone Rubber Remover	9 Anti-Gallant Compound Remover
UNCOATED PANELS (cont'd)										
AMS 5382 Cobalt Alloy	2, 4	R	R	R	R	R	R	R	NA	NA
AMS 5504 Corrosion-Resistant Steel	1, 2, 3, 4	R	R	R	R	R	R	R	R	R
AMS 5508 Corrosion-Resistant Steel	1, 2, 3, 4	NA	R	R	R	R	R	NA	NA	NA
AMS 5524 Corrosion-Resistant Steel	1, 2, 3, 4	R	R	R	R	R	R	R	R	R
AMS 5525 Corrosion-Resistant Steel	1, 2, 3	R	R	R	R	R	R	R	R	R
AMS 5536 Nickel Alloy	1, 2, 3, 4	R	R	R	R	R	R	R	NA	R
AMS 5537 Cobalt Alloy	1, 2, 3	R	R	R	R	R	R	R	NA	NA

TABLE V

TEST MATERIAL REQUIREMENTS FOR CLEANING COMPOUND CATEGORIES

CATEGORY		1	2	3	4	5	6	7	8	9
Material	Test Material Source(s): (See Note 1)	Cold Carbon Solvent	Alkaline Rust Remover	Alkaline Descaler	Acidic Scale Conditioner	Alkaline Permanganate	Inhibited Phosphoric Acid	Hot Carbon Solvent	Silicone Rubber Remover	Anti-Gallant Compound Remover
UNCOATED PANELS (cont'd)										
AMS 5544 Nickel Alloy	1, 2, 3, 4	R	R	R	R	R	R	R	NA	R
AMS 5596 Nickel Alloy	2	R	R	R	R	R	R	R	NA	R
AMS 5661 Nickel Alloy	4	R	R	R	R	R	R	R	R	R
AMS 6431 Steel	4	R	R	R	R	R	R	R	R	R
Ni-9Cr-10Co-1.5Ti-5.5Al-10W-2.5Ta-1.5Hf (Mar-M™-002)	4	R	R	R	R	R	NA	R	NA	R
Ni-15Cr-15Co-4Ti-5Al-4Mo (Nimonic™ 115)	4	R	R	R	R	R	NA	R	NA	R
Ti-6Al-5Zr-0.5Mo-0.25Si (IMI™ 685)	4	R	R	NA	NA	NA	NA	NA	R	R

TABLE V

TEST MATERIAL REQUIREMENTS FOR CLEANING COMPOUND CATEGORIES

CATEGORY		1	2	3	4	5	6	7	8	9
Material										
ELECTROPLATED PANELS										
AMS 5504/AMS 2400 Cadmium	1, 2, 3, 4	R	R	NA	NR	NA	NR	R	NA	NA
AMS 5504/AMS 2406 Chromium	1, 2, 3, 4	R	R	R	NR	NR	NA	R	NA	R
AMS 5504/AMS 2410 Silver	1, 2, 3, 4	R	R	R	NR	NR	NA	R	R	R
AMS 5504/AMS 2416 Nickel-Cadmium	1, 2, 3	R	R	NA	NR	NA	NA	R	NA	NA
AMS 5504/AMS 2418 Copper	4	R	R	R	R	R	NR	R	NR	R
AMS 5504/AMS 2424 Nickel	1, 2, 3, 4	R	R	R	R	R	R	R	NA	NA
AMS 4037/AMS 2470 Anodic Treatment	1, 2, 3, 4	R	NR	NR	NR	NR	NR	R	R	R