

AEROSPACE MATERIAL SPECIFICATION

Issued NOV 1996
Revised OCT 2005
Superseding AMS 3167A and
AMS 3166B

(R) Solvents, Wipe
for Cleaning Prior to Application of Primer and Top Coat Materials,
or Sealing Compounds

1. SCOPE:

1.1 Form:

This specification covers liquid wipe solvent cleaners.

1.2 Application:

These wipe solvents have been typically used for cleaning aircraft primary and secondary structural surfaces prior to application of adhesion promoters, sealing materials, primer materials, and topcoat materials over primed surfaces. However, usage is not limited to such applications.

1.3 Classification:

Solvents covered by this specification are classified as follows (see 8.4):

Type 1 – Cleaning prior to primer or topcoat materials.

Type 2 – Cleaning prior to sealing compounds.

Form 1 – Hydrocarbon-based. Wipe solvents composed of a mixture of photochemically reactive hydrocarbons and/or oxygenated hydrocarbons and/or exempt solvents.

Form 2 - Aqueous. Wipe solvents in which water content is 80% or more by volume of the wipe solvent solution as applied.

Class 1 – Most environmentally preferable (low vapor pressure and/or low HAP/VOC).

Containing de minimis HAP (Hazardous Air Pollutants) and VOC (Volatile Organic Compound) defined as concentrations less than 0.1 percent by weight for carcinogens and 1.0 percent for non-carcinogens, or as defined by the following: for Form 1 - maximum vapor pressure of 7 mm Hg at 68 °F (20 °C) and no HAPs; for Form 2 - flash point greater than 200 °F (93 °C) and the solution must be miscible with water. Class 1 is exempt from housekeeping measures as defined by the Environmental Protection Agency (see 8.4).

Class 2 – Moderately environmentally preferable (moderate vapor pressure). Maximum vapor pressure of 45mm Hg at 68 °F (20 °C).

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2005 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER:

Tel: 877-606-7323 (inside USA and Canada)

Tel: 724-776-4970 (outside USA)

Fax: 724-776-0790

Email: custsvc@sae.org

SAE WEB ADDRESS:

<http://www.sae.org>

1.3 (Continued):

Class 3 – Least environmentally preferable (HAPs and/or high vapor pressure). Vapor pressure greater than 45mm Hg at 68 °F (20 °C).

1.4 Safety:

Hazardous Materials: While the materials, methods, applications and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to insure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order form a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superceding document has been specified, the last published issue shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2470	Anodic Treatment of Aluminum Alloys, Chromic Acid Process
AMS 2473	Chemical Film Treatment for Aluminum Alloys, General Purpose Coating
AMS 2629	Fluid, Jet Reference
AMS 2825	Material Safety Data Sheets
AMS 3100	Adhesion Promoter for Polysulfide Sealing Compounds
AMS 3276	Sealing Compound, Integral Fuel Tanks and General Purpose, Intermittent Use to 360 °F (182 °C)
AMS 3375	Adhesive/Sealant, Fluorosilicone, Aromatic Fuel Resistant, One- Part, Room Temperature Vulcanizing
AMS 3819	Cloths, Cleaning, for Aircraft Primary and Secondary Structural Surfaces
AMS 4037	Aluminum Alloy Sheet and Plate 4.4Cu-1.5Mg-0.60Mn (2024; -T3 Flat Sheet, -T351 Plate) Solution Heat Treated
AMS 4045	Aluminum Alloy Sheet and Plate 5.6Zn 2.5Mg 1.6Cu 0.23Cr (7075-T6 Sheet, -T651 Plate) Solution and Precipitation Heat Treated
AMS 4101	Aluminum Alloy, Plate, 4.4Cu 1.5Mg 0.60Mn, Solution Heat Treated, Stretch, and Precipitation Heat Treated (T851)
AMS 4202	Aluminum Alloy, Plate, 5.7Zn 2.2Mg 1.6Cu 0.22Cr, Solution Heat Treated, Stress Relieved by Stretching, and Precipitation Heat Treated (T7351)
AMS 4911	Titanium Sheet, Strip and Plate 6Al-4V, Annealed
AMS 5046	Steel Sheet, Strip, and Plate, Carbon Steel Annealed

2.1 (Continued):

AMS 6419	Steel, Bars, Forgings, and Tubing, 1.6Si 0.82Cr 1.8Ni 0.40Mo 0.08V (0.40-0.45C), Consumable Electrode Vacuum Remelted
AMS-C-27725	Coating, Corrosion Preventive, for Aircraft Integral Fuel Tanks
AMS-QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet
AMS-QQ-A-250/13	Aluminum Alloy Alclad 7075, Plate and Sheet
AMS-QQ-P-416	Plating, Cadmium
AMS-T-9046	Titanium and Titanium Alloy, Sheet, Strip, and Plate
AS5127	Methods for Testing Aerospace Sealants
AS5127/1	Methods for Testing Aerospace Sealants, Two-Component Synthetic Rubber Compounds

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM D 56	Standard Test Method for Flash Point by Tag Closed Cup Tester
ASTM D 329	Standard Specification for Acetone
ASTM D 740	Standard Specification for Methyl Ethyl Ketone
ASTM D 1193	Standard Specification for Reagent Water
ASTM D 1218	Standard Test Method for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids
ASTM D 1353	Standard Test Method for Nonvolatile Matter in Volatile Solvents for Use in Paint, Varnish, Lacquer, and Related Products
ASTM D 1364	Standard Test Method for Water in Volatile Solvents (Karl Fischer Reagent Titration Method)
ASTM D 1475	Standard Test Method for Density of Liquid Coatings, Inks, and Related Products
ASTM D 1613	Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paints, Varnish, Lacquer, and Related Products
ASTM D 2344	Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and their Laminates
ASTM D 3359	Standard Test Methods for Measuring Adhesion by Tape Test
ASTM D 3545	Standard Test Method for Alcohol Content and Purity of Acetate Esters by Gas Chromatography
ASTM D 3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D 4420	Standard Test Method for Determination of Aromatics and Finished Gasoline by Gas Chromatography
ASTM F 483	Standard Test Method for Total Immersion Corrosion Test for Aircraft Maintenance Chemicals
ASTM F 502	Standard Test Method for Effects of Cleaning and Chemical Maintenance Materials on Painted Aircraft Surfaces

2.2 (Continued):

ASTM F 519	Standard Test for Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments
ASTM F 945	Standard Test Method for Stress-Corrosion of Titanium Alloys by Aircraft Engine Cleaning Materials
ASTM F 1110	Standard Test Method for Sandwich Corrosion Test

2.3 U. S. Government Publications:

Available from DODSSP Subscription Service Desk, Building 4D, 700 Robins Avenue Philadelphia, PA 19111-5094 or www.assist.daps.dla.mil.

A-A-58054	Abrasive Mats, Non-Woven, Non-Metallic
A-A-59281	Cleaning Compound, Solvent Mixtures (s/s MIL-C-38736)
CCC-C-419	Cloth, Duck, Cotton, Unbleached, Plied Yarns, Army and Numbered
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
MIL-PRF-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-PRF-22750	Coating; Epoxy, High Solids
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base
	MIL-DTL-83133 Turbine Fuels, Aviation, Kerosene Types, NATO
	F-34(JP-8), NATO F-35, and JP-8 + 100
MIL-PRF-85285	Coating: Polyurethane, High Solids
MIL-PRF-85582	Primer Coatings, Epoxy, VOC Compliant, Chemical and Solvent Resistant
MIL-STD-290	Packaging, Packing and Marking of Petroleum Products
MIL-DTL-81381	Wire, Electric, Polyimide-Insulated, Copper or Copper Alloy
FED-STD-595	Colors Used in Government Procurement

2.4 U. S. Government Printing Office Publications:

Available from Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

Environmental Protection Agency (EPA), National Emissions Standards for Hazardous Air Pollutants (NESHAP): 40 CFR, Chapter I, Subchapter C, Part 63, Subpart GG National Emission Standards for Aerospace Manufacturing and Rework Facilities

Section 63.741	Applicability and designation of affected sources
Section 63.742	Definitions
Section 63.744	Standards: Cleaning operations

2.5 PRI Publications:

Available from PRI, 161 Thornhill Road, Warrendale, PA 15086-7527, www.pri.sae.org

PD 2000 Procedures For An Industry Qualified Product Management Process
 PRI-QPL-AMS3167 Products Qualified Under AMS 3167

3. TECHNICAL REQUIREMENTS:

3.1 Material:

The wipe solvent shall be a liquid formulated to meet the requirements of this specification.

3.2 Properties:

The wipe solvent shall conform to the requirements found in Table 1.

TABLE 1 - Properties

Paragraph	Property	Requirement	Test Method
3.2.1	Refractive Index	± 2% of qualification test value*	ASTM D 1218
3.2.2	Density	± 2% of qualification test value*	ASTM D 1475
3.2.3	Acidity	0.05% maximum, expressed as acetic acid	ASTM D 1613
3.2.4	Vapor Pressure, mm Hg	Defined by Form and Class, Ref 1.3	4.5.6
3.2.5	VOC, grams/L	Defined by Form and Class, Ref 1.3	ASTM D 3960
3.2.6	Flash Point	Defined by Form and Class, Ref 1.3	ASTM D 56
3.2.7	Nonvolatile Matter	5mg/100 ml maximum	4.5.7
3.2.8	Stress Corrosion , Ti 6-4 titanium	No Failure/Breakage	ASTM F 945, Method A
3.2.9	Sandwich Corrosion	Shall not cause a corrosion rating greater than one (1) on any test panel	4.5.8
3.2.10	Total Immersion Corrosion	Weight Change less than 0.03 mg/cm ² /24 hrs; no pitting, corrosion or heavy stain	4.5.9
3.2.11	Dissimilar Metal Corrosion	No pitting, etching, or formation of corrosion products on faying surfaces of panels above and beyond those formed on control panels	4.5.10
3.2.12	Hydrogen Embrittlement	No rupture of specimens	4.5.11

TABLE 1 (con't.)

Paragraph	Property	Requirement	Test Method
3.2.13	Type 1: Cleaning prior to painting – removal of contaminants	No separation of primer from substrate or separation of topcoat from primer	4.5.12.1
3.2.14	Type 2: Cleaning prior to sealant – removal of contaminants	20 lbf/inch width (3580 N/m), 100% cohesive failure for AMS 3276 Sealant 8 lbf/inch width (1401 N/m), 100% cohesive failure for AMS 3375 Sealant	4.5.12.2
3.2.14.1	Type 2: Removal of Uncured Sealant	Sealant removal Same as control wipe solvent	4.5.12.3
3.2.14.2	Type 2: Removal of AMS 3100 Adhesion Promoter	Promoter removal same as control wipe solvent	4.5.12.4
3.2.15	Effects on Painted Surfaces	No more deterioration than with the control wipe solvent	4.5.13
3.2.16	Effects on Fuel Tank Sealants	No more deterioration than with the control wipe solvent	4.5.14
3.2.17	Effects on Carbon/Epoxy Composites	Solvent shall not cause a greater loss in interlaminar shear strength than the control solvent	4.5.15
3.2.18	Effects on Polyimide Insulated Wire	No dielectric leakage, no visual effect greater than that of distilled water	4.5.16
3.2.19	Cold Storage Stability	All components shall be miscible	4.5.17

* "Qualification Test Values" shall be obtained from Qualification Test Report (ref 4.2.2)

3.3 Shelf Life Stability:

When stored in its original unopened container at 80 °F (27 °C) or below, the material shall retain properties capable of meeting all Table 1 requirements for at least 12 months from date of packaging.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The manufacturer of the wipe solvent shall supply all samples for supplier's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests:

- 4.2.1 Acceptance Tests: Tests for the requirements in Table 2 are acceptance tests and shall be performed on each lot. A lot shall be all wipe solvent produced in a single production run under the same fixed conditions and presented for vendor's inspection at one time.

TABLE 2 - Acceptance Tests

Property	Requirement
Refractive Index	3.2.1
Density	3.2.2
Acidity	3.2.3
Flash Point (Form 2, Class 1 only)	3.2.6
Nonvolatile Matter	

- 4.2.2 Qualification Tests: Qualification testing consists of all the tests listed in Table 1. Material must meet all the requirements of Table 1, less 3.2.1 and 3.2.2, to be listed in the Qualified Products List (See paragraph 4.4.1). Refractive Index (3.2.1) and Density (3.2.2) values shall be recorded as "qualification test values" for comparison with subsequent acceptance test values. Requalification shall be required every five years in accordance with PD 2000, and shall consist of all qualification requirements.

Shelf life stability shall be verified by the following: The supplier shall store a sample of material from the qualification lot per 3.3. After a minimum of 12 months from date of packaging, the supplier shall perform the Table 2 acceptance tests and provide the data to the qualifying authority (see 8.2). Failure to provide satisfactory acceptance test data may be grounds for removal of the material from the Qualified Products List.

4.3 Sampling and Testing:

Shall be as follows:

- 4.3.1 For Acceptance Tests: Sufficient wipe solvent shall be taken at random from each lot to permit performing all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.
- 4.3.1.1 A lot of wipe solvent shall not exceed 10000 gallons (37850 L) and may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.
- 4.3.1.2 When a statistical sampling plan has been agreed upon by purchaser and supplier, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

- 4.3.2 For Qualification Tests: Samples shall consist of approximately 2 gallons (7.6 L) of material. The material shall be furnished in containers of the type to be used in filling contract orders. Samples shall be identified as follows and forwarded to the activity responsible for testing as designated in the letter of authorization from the activity responsible for qualification:

SOLVENT, WIPE, CLEANING PRIOR TO APPLICATION OF PRIMER MATERIALS, TOP COAT MATERIALS OR SEALING COMPOUNDS

AMS 3167B Type _____ Form _____ Class _____

QUANTITY _____

MANUFACTURER'S IDENTIFICATION _____

LOT NUMBER _____

VAPOR PRESSURE _____

VOC CONTENT _____

FLASH POINT _____

DATE OF PACKAGING _____

APPROPRIATE WARNINGS AND PRECAUTIONARY NOTICES

SUBMITTED BY (NAME) (DATE) FOR QUALIFICATION TESTS IN ACCORDANCE WITH AMS 3167B UNDER AUTHORIZATION (REF AUTHORIZING LETTER)

4.4 Approval:

- 4.4.1 Wipe solvents supplied to this specification shall be listed, or approved for listing, on the qualified products list, PRI-QPL-AMS3167. The qualified products list shall be in accordance with PD 2000.
- 4.4.2 Manufacturer shall use ingredients, manufacturing procedures, processes, and methods of inspection on production products that are essentially the same as those used on the qualification sample. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, manufacturer shall submit for re-approval a statement of the proposed changes in ingredients and/or processing and, when requested, sample product. Production product made by the revised procedure shall not be shipped prior to receipt of requalification.

4.5 Test Methods:

- 4.5.1 Standard Conditions: Standard laboratory conditions are $77^{\circ}\text{F} \pm 2$ ($25^{\circ}\text{C} \pm 1$) and $50\% \pm 5$ relative humidity. All test specimens shall be prepared and cured under these conditions. In addition, all uncured property tests shall be conducted under these conditions. Other tests may be conducted at $77^{\circ}\text{F} \pm 5$ ($25^{\circ}\text{C} \pm 3$) with no control on humidity.
- 4.5.2 Standard Cure: Except as otherwise specified, standard cure shall be 14 days at standard conditions specified in 4.5.1.
- 4.5.3 Control Wipe Solvent: The control wipe solvent shall be ASTM D 740 methyl ethyl ketone for Type 1 applications. The control wipe solvent shall be A-A-59281 Type 1 for Type 2 applications.

- 4.5.4 Standard Contaminant: Standard contaminant shall be formulated as in Table 3 for Type 1 and Type 2 wipe solvents. For Type 1 wipe solvents, two additional contaminants shall be used separately for testing: jet fuel (JP-8+100) and hydraulic fluid (MIL-PRF-5606). This requires three sets of three panels for Type 1 wipe solvents, where a set of panels is contaminated by one and only one contaminant. (See 8.6).

TABLE 3 - Standard Contaminant

Ingredient	Parts by Weight
Glycerol Monostearate	3.0
Glycerol Trioleate	9.0
Caprylic Acid	3.0
Lauryl Alcohol	1.3
Cholesterol	1.2
Mineral Oil	2.7
Petrolatum	3.0
Lecithin	0.3
Water	70.0

Heat and blend and add 0.5% by weight lamp black.
Do not heat above 200°F (93°C)

- 4.5.5 Test Panels: Test panels shall be prepared as in Table 4.

TABLE 4 - Test Panels

Panels, Type 1/	Substrate	Pre-Treatment	Primer, and Dry Film Thickness, 0.001 x Inches (mm)	Top Coat, and Dry Film Thickness, 0.001 x Inches (mm)	Sealant, and Thickness, Inches (mm)
A	AMS 4037 (2024-T3)	Conversion Coating AMS 2473	None	None	None
B	AMS 4037 (2024-T3)	Anodize AMS 2470	None	None	None
C	AMS 4037 (2024-T3)	AMS 2473	MIL-PRF-23377 0.6 to 0.9 (0.015 to 0.203)	None	None
D	AMS 4037 (2024-T3)	AMS 2473	MIL-PRF-85582 0.6 to 0.9 (0.015 to 0.203)	None	None
E	AMS 4037 (2024-T3)	AMS 2473	AMS-C-27725 0.8 to 1.5 (0.020 to 0.038)	None	None
F	AMS 4037 (2024-T3)	AMS 2473	MIL-PRF-23377 0.6 to 0.9 (0.015 to 0.203)	MIL-PRF-85285 Color 36173 1.6 to 3.2 (0.041 to 0.081)	None

TABLE 4 (con't.)

Panels, Type 1/	Substrate	Pre-Treatment	Primer, and Dry Film Thickness, 0.001 x Inches (mm)	Top Coat, and Dry Film Thickness, 0.001 x Inches (mm)	Sealant, and Thickness, Inches (mm)
G	AMS 4037 (2024-T3)	AMS 2473	MIL-PRF-23377 0.6 to 0.9 (0.015 to 0.203)	MIL-PRF-85285 Color 17925 1.6 to 3.2 (0.041 to 0.081)	None
H	AMS 4037 (2024-T3)	AMS 2473	MIL-PRF-85582 0.6 to 0.9 (0.015 to 0.203)	MIL-PRF-85285 Color 36173 1.6 to 3.2 (0.041 to 0.081)	None
I	AMS 4037 (2024-T3)	AMS 2473	MIL-PRF-85582 0.6 to 0.9 (0.015 to 0.203)	MIL-PRF-85285 Color 17925 1.6 to 3.2 (0.041 to 0.081)	None
J	AMS 4037 (2024-T3)	AMS 2473	AMS-C-27725 0.8 to 1.5 (0.020 to 0.038)	None	AMS 3276 per 4.5.5.1 0.125 (3.18)
K	AMS 4037 (2024-T3)	AMS 2473	AMS-C-27725 0.8 to 1.5 (0.020 to 0.038)	None	AMS 3375 per 4.5.5.2 0.125 (3.18)
L	Graphite- Epoxy, 4.5.5.3	None	None	None	None
M (Panel dimensions per Figure 1)	Aluminum, AMS-QQ-A- 250/13 (T6 Temper)	None	None	None	None
N (Panel dimensions per Figure 1)	Aluminum, AMS-QQ-A- 250/4 (T3 Temper)	None	None	None	None
O (Panel dimensions per Figure 1)	Titanium, AMS-T-9046 AB-1 (6A1- 4V)	None	None	None	None
P (Panel dimensions per Figure 1)	Steel, AMS 5046	Cadmium Plated Per AMS-QQ-P- 416 Type II Class 2	None	None	None

^{1/} Unless otherwise noted, all panel dimensions: 0.040 x 3.0 x 6.0 inches (10 x 76 x 302 mm)

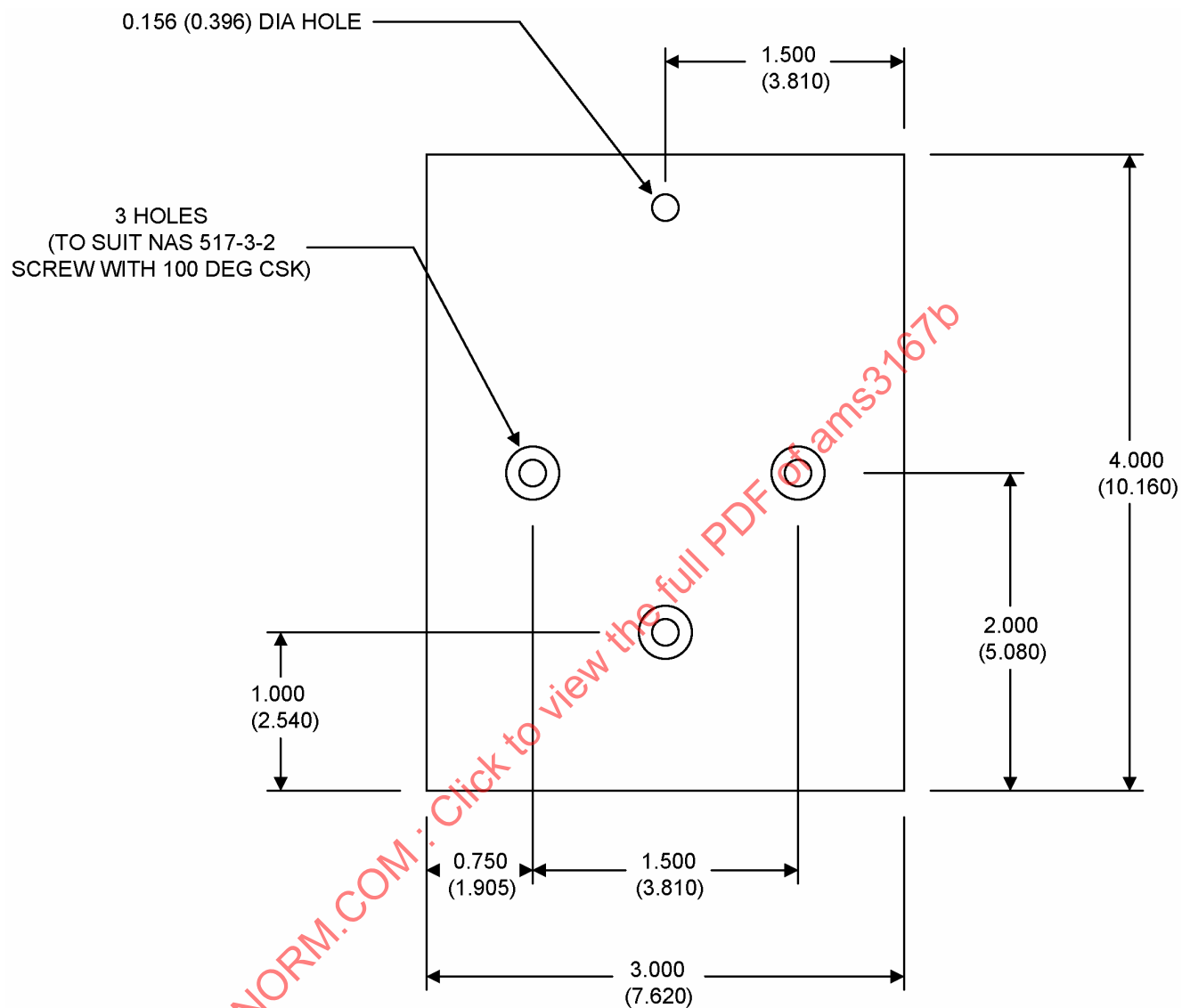


FIGURE 1 - Dimensions of Dissimilar Metal Test Panels

Notes:

1. Dimensions in inches (cm).
2. Unless otherwise specified, dimensions/tolerances shown shall be nominal, except that tolerances for the screw holes shall be within limits that will permit assembly of the panels as shown in Figure 2.
3. The three holes on offset panels shall be positioned to allow for 1 inch overlap when coupled (see Figure 2).
4. The 0.156 (0.396) hole shall not be drilled on offset panels.

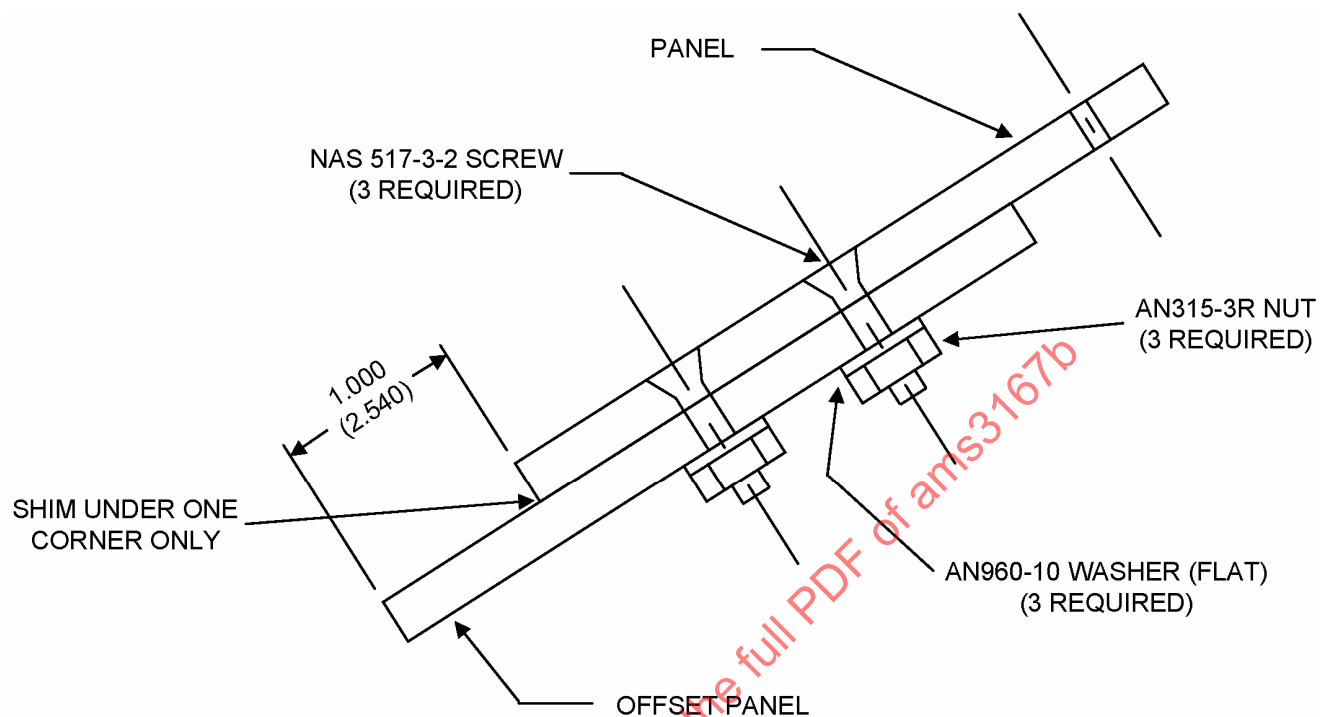


FIGURE 2 - Coupling of Dissimilar Metal Test Panels

Notes:

1. Dimensions in inches (cm).
2. Screws, nuts, and washers shall be cadmium plated per AMS-QQ-P-416 Type II Class 2.
3. Shim shall be made from 0.01 in (0.025 cm) polyethylene sheet material.
4. The fasteners shall be finger tight.

- 4.5.5.1 AMS 3276 Sealant Coating (Type J): Aluminum alloy panels as in 4.5.5, Type E, shall be cleaned in accordance with AS5127, para 6.2.2.1 "Cleaning of MIL-P-23377 Surface for Sealing" but using control wipe solvent (4.5.3) and using AMS 3819 Grade A cleaning cloths. The panel shall then be coated with AMS 3276 sealant to an approximate thickness of 0.125 inch (3.18 mm) and cured for not less than 14 days at standard conditions.
- 4.5.5.2 AMS 3375 Fluorosilicone Sealant Coating (Type K): Aluminum alloy panels as in 4.5.5, Type E, shall be cleaned in accordance with AS5127, para 6.2.2.1 "Cleaning of MIL-P-23377 Surface for Sealing" but using control wipe solvent (4.5.3) and using AMS 3819 Grade A cleaning cloths. The panel shall then be coated with AMS 3375 primer and then be coated with AMS 3375 sealant to an approximate thickness of 0.125 inch (3.18 mm) and cured for not less than 14 days at standard conditions.
- 4.5.5.3 Graphite Epoxy (Type L): Prepare graphite-epoxy (AS4/3501-6) test panels in accordance with AS5127, para 6.5 "Preparation of Organic Composite Test Surfaces".
- 4.5.6 Vapor Pressure: The vapor pressure of the volatile organic compounds (VOC) in the wipe solvent at 68 °F (20 °C) shall be calculated from equation below:

$$V.P. = \sum_{i,j} \left(\frac{\frac{(V.P.)_i \times (W)_i}{(M.W.)_i}}{\sum_i \frac{(W)_i}{(M.W.)_i} + \sum_j \frac{(W)_j}{(M.W.)_j}} \right)$$

- V.P. = Composite vapor pressure of the VOC in the wipe solvent.
 (V.P.)_i = Vapor pressure at 68 °F (20 °C) of the "i"th component in the wipe solvent.
 (W)_{i(j)} = The weight in grams of the "i"th ("j"th) component in the wipe solvent.
 (M.W.)_{i(j)} = The molecular weight of the "i"th ("j"th) component in the wipe solvent.
 i = VOC components in the wipe solvent.
 j = Exempt components in the wipe solvent as defined by appropriate federal, state, and local regulations.

- 4.5.7 Nonvolatile Matter: Nonvolatile matter content shall be determined as specified by ASTM D 1353 except that a hot plate shall be used to boil the sample to near dryness and the sample shall then be dried to constant weight in oven at 392 °F ± 2 (200 °C ± 1).
- 4.5.8 Sandwich Corrosion: The sandwich corrosion test will be conducted in accordance with ASTM F 1110. Test coupons shall be fabricated from 0.032 inch (0.8 mm) thick 7075-T6 bare and 2024-T3 bare aluminum sheets. Any corrosion in excess of that shown by the control set shall be rejected. Corrosion at the edge of the panel will be disregarded.
- 4.5.9 Total Immersion Corrosion: Total immersion corrosion tests shall be conducted according to ASTM F 483 on AMS 4037 aluminum, AMS 4045 aluminum, AMS 4911 titanium, and AMS 5046 steel.

- 4.5.10 Dissimilar Metal Corrosion: Clean Table 4 test panels and offset panels by solvent wiping with ASTM D 329 acetone, and couple per Table 5 and Figure 2. Make two sets each of the coupled panels.

TABLE 5 - Dissimilar Metal Corrosion Test Couples

Panel	Offset Panel
Panel Type M	Panel Type O
Panel Type N	Panel Type P
Panel Type O	Panel Type P

One set of coupled panels shall be completely immersed in ASTM D 1193 Type IV distilled water as a control and the other set immersed in wipe solvent. After one hour, remove coupled panels, allow to drip dry, and place in an oven maintained at $100^{\circ}\text{F} \pm 2$ ($38^{\circ}\text{C} \pm 1$) for 48 hours. Remove coupled panels from oven and immediately suspend them in a clean dessicator having the lower portion filled with distilled water; close the dessicator, and maintain temperature at $77^{\circ}\text{F} \pm 2$ ($25^{\circ}\text{C} \pm 1$). After 48 hours, the coupled panels shall be removed, disassembled, washed with distilled water, and dried with acetone before examining.

- 4.5.11 Hydrogen Embrittlement: Hydrogen embrittlement tests shall be conducted according to ASTM F 519 using Type 1a.1 notched on high strength 4340 bare steel with ion vapor deposited aluminum, high strength 4340 bare steel and high strength 4340 cadmium plated steel.

4.5.12 Cleaning Efficiency:

- 4.5.12.1 Cleaning prior to painting: Removal of contaminants: Apply standard contaminant (4.5.4) to six each Type A, Type B, Type C, and Type D test panels (See 4.5.5) and expose to $120^{\circ}\text{F} \pm 2$ ($49^{\circ}\text{C} \pm 1$) for 24 hours ± 2 . Cool to Standard Conditions and wipe panel surface to remove gross contaminant with a dry AMS 3819, Grade A cleaning cloth. Wet a clean AMS 3819, Grade A cleaning cloth with wipe solvent and wipe panel surfaces (single stroke, one direction) five times using a clean wet cloth each time. Air dry panels a minimum of 30 minutes at standard conditions. Apply MIL-PRF-23377 and MIL-PRF-85582 primers to three each Type A and Type B panels. Apply MIL-PRF-22750 and MIL-PRF-85285 (FED-STD-595 color 17925 - gloss white) topcoats to three each Type C and Type D panels. Conduct wet tape adhesion test as specified in ASTM D 3359 after four days immersion in ASTM D 1193 Type IV distilled water at $120^{\circ}\text{F} \pm 5$ ($49^{\circ}\text{C} \pm 3$).
- 4.5.12.2 Cleaning prior to sealant: Peel test panels are prepared after cleaning with wipe solvent. Peel test specimens and test method are the same as described in AS5127/1 under (8.) "Peel Strength Properties".

- 4.5.12.2.1 Removal of contaminants: Apply standard contaminant (4.5.4) to test substrates Type C, Type D, Type E, Type J, Type K, and Type L and expose to $120^{\circ}\text{F} \pm 2$ ($49^{\circ}\text{C} \pm 1$) for 24 hours. Cool to room temperature and wipe panel surface to remove gross contaminant with a dry AMS 3819, Grade A cleaning cloth. Wet a clean AMS 3819 Grade A cleaning cloth with wipe solvent and wipe panel surfaces (single stroke, one direction) five times using a clean wet cloth each time. Substrate Type L shall be additionally scuff sanded with abrasive mats conforming to A-A-58054, Type I, Class 1, Grade A followed by wipe solvent cleaning using AMS 3819 Grade A cloth in the manner described above. Air dry panels a minimum of 30 minutes at standard conditions.
- 4.5.12.2.2 Peel Strength Specimens: Prepare peel strength specimens using substrates Type C, Type D, Type E, and Type L by applying a $0.125 \text{ inch} \pm 0.016$ ($3.18 \text{ mm} \pm 0.41$) thickness of AMS 3276 sealant to the center 4 inches (102 mm) of the cleaned panel and as shown in AS5127/1 (Fig. 22). Only a thin layer of sealant to wet the surface shall be applied to substrate Type J. An optional configuration consists of coating the bottom approximate 5 inches (127 mm) of the panel with sealant as shown in AS5127/1 (Fig. 23). A 2.75×12 inch ($69.8 \times 305 \text{ mm}$) strip of aluminum woven wire fabric, 15 to 20 mesh with wire diameter of 0.10 to 0.011 inch (0.25 to 0.28 mm) or cotton duck conforming to CCC-C-419, Type III, shall be impregnated with sealant so that approximately 4 inches (102 mm) [5 inches (127 mm) for optional configuration] at one end is completely covered on both faces. The sealant shall be worked well into the screen or fabric. The sealant impregnated end of the screen or fabric shall be placed on the sealant coated panel and smoothed down on the layer of sealant, taking care not to trap air beneath the screen or fabric.
- 4.5.12.2.2.1 An additional coating of sealant, approximately 0.125 inch (3.18 mm) thick, shall be applied over the screen or fabric. Peel specimen configuration shall be as shown in AS5127/1 (Fig. 22 or 23).
- 4.5.12.2.2.2 Substrate Type K shall be prepared the same as substrate Type J except the sealant used shall be AMS 3375.
- 4.5.12.2.2.3 Following a standard cure, peel specimens prepared from substrates Type E, Type J, Type K, and Type L shall be immersed in a covered glass vessel containing equal parts AMS 2629 Jet Reference Fluid and 3% salt water and exposed to $140^{\circ}\text{F} \pm 2$ ($60^{\circ}\text{C} \pm 1$) for 7 days. Substrates, Type C and Type D, shall be immersed in a covered glass vessel containing ASTM D 1193 Type IV distilled water at $140^{\circ}\text{F} \pm 2$ ($60^{\circ}\text{C} \pm 1$) for 7 days. Specimen to fluid ratio shall be approximately one panel per pint (0.5 L) of fluid. Immersion in wide-mouth quart (liter) jars with two panels in each jar has been found suitable. After exposure, the specimens shall be cooled for 24 hours at Standard Conditions in the fluid.

- 4.5.12.2.2.4 The peel strength of the conditioned panels shall be measured within 30 minutes after removal from the test fluid. Two 1-inch (25-mm) wide sections shall be prepared by cutting completely through the sealant and fabric to the panel, lengthwise, along the panel and continuing completely along the free end of the fabric. The specimens shall be stripped back at an angle of approximately 180 degrees to the panel in a suitable tensile test machine. Jaw separation rate shall be two inches (51 mm) per minute. During peel strength testing, three cuts shall be made through the sealant to the panel in an attempt to promote adhesive failure. The cuts shall be made at approximately 1-inch (25-mm) intervals.
- 4.5.12.2.2.5 The peel strength for each specimen shall be the numerical average of the peak loads required to separate the strips of sealant from the test substrate or to cause cohesive failure of the sealant. Failure of the sealant to screen or fabric shall not be included in the peel strength values.
- 4.5.12.3 Removal of Uncured Sealant: Apply a thin coating, approximately 0.06 inch (1.5 mm) of AMS 3276 Class B-2 sealant to a substrate Type E. Allow sealant to cure two hours $\pm$ 5 minutes at standard conditions (4.5.1), then clean the panel using AMS 3819, Grade A cloth wet with wipe solvent. Repeat test using control wipe solvent (4.5.3).
- 4.5.12.4 Removal of AMS 3100 Adhesion Promoter: Apply AMS 3100 Class 1 and AMS 3100 Class 2 adhesion promoters to substrates Type E. Allow promoters to dry 24 hours. Clean the panel using AMS 3819 Grade A cloth wet with the wipe solvent. Repeat test using control wipe solvent (4.5.3).
- 4.5.13 Effects on Painted Surfaces: Subject one panel each of Type C, Type D, Type F, Type G, Type H, and Type I substrates to the test specified in ASTM F 502 using the candidate test cleaner as the test solution. Repeat the test using the control wipe solvent (See 4.5.3) as the test solution.
- 4.5.14 Effects on Fuel Tank Sealants: Using fuel tank sealant qualified to AMS 3276 Class B-2, prepare two panels as specified in paragraph 4.5.28 of AMS 3276 except delete primer and topcoat application. Allow sealant to cure 14 days $\pm$ 2 under standard conditions (See 4.5.1). Immerse one panel in the candidate test cleaner in such a manner that one-half of the panel is exposed to the liquid phase and one-half of the panel is exposed to the air-cleaner vapor phase for 24 hours $\pm$ 2 at 75 °F $\pm$ 5 (24 °C $\pm$ 3). Expose the other panel in like manner using the control wipe solvent (See 4.5.3). After exposure, remove the panels and observe the sealant for any signs of deterioration such as softening, blistering, loss of adhesion, etc.
- 4.5.15 Effects on Carbon/Epoxy Composites: A sheet of carbon/epoxy laminate with parallel fibers shall be prepared as specified by ASTM D 2344 using standard processing procedures, i.e. press, bag, or autoclave. The sheet shall then be cut into three sets of ten specimens each as specified in ASTM D 2344. Immerse one set of specimens in the test solvent for 24 hours $\pm$ 2 at 75 °F $\pm$ 5 (24 °C $\pm$ 3). Immerse another set of specimens in the control solvent for 24 hours $\pm$ 2 at 75 °F $\pm$ 5 (24 °C $\pm$ 3). Retain the third set for dry controls. Determine shear strengths of the immersed and dry specimens as specified by ASTM D 2344. Compare the loss of interlaminar shear strength by immersion in the test solvent with that of the control solvent.