AEROSPACE MATERIAL SPECIFICATION

AMS2644™	REV. J
Issued 1996-08 Revised 2024-08 Superseding AMS2644H	

(R) Inspection Material, Penetrant

RATIONALE

AMS2644J addresses methods that were recently developed for evaluating Method B and D penetrant water solubility and adds reference to Method A(W) throughout. The revision updates references (see Section 2), clarifies definitions (see 2.6.3), adds the water solubility test (see 3.3.8.6), clarifies water content testing (see 3.3.8.8), clarifies scope of concentration requirements (see 3.3.9.5), updates the requirements for acceptance testing (see 4.2.2.1), adds alternative material for testing (see 4.4.2 and 4.4.5.2.1), removes data validity evaluation (see 4.4.5.1.6), increases temperature range for testing (see 4.4.5.2.1), clarifies developer testing (see 4.4.12.1), adds language to address global shipping (see 5.3), updates Table 3 in line with text (Method C, Removers and Developers), revises Method C, Removers, removes specific Developer tests in Table 4, and adds Method A(W) to Tables 5 and 6.

1. SCOPE

1.1 Purpose

This specification establishes the classification, technical requirements, tests, and test procedures for the qualification, approval, and quality verification of all materials used in the liquid penetrant methods of inspection with the exception of those excluded in the application section.

1.1.1 The qualifying agency for direct U.S. Military procurement is the Materials and Manufacturing Directorate of the Air Force Research Laboratory AFRL/RXNS, 2179 12th Street, Wright-Patterson Air Force Base, OH, 45433-7718. AFRL/RXNS will maintain the qualified products list for military procurement of penetrant materials and will audit and approve other testing facilities to perform all or portions of the tests contained herein.

1.2 Application

This specification is applicable to penetrant materials used in manufacturing and maintenance operations. It is intended to be used by prime contractors in establishing an approved products list (QPL) for use by themselves and their suppliers. It does not cover such special application products as liquid oxygen compatible, high or low temperatures, thixotropic, reverse fluorescent, and dye precipitation penetrant systems.

1.3 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 that may be involved in such use. It is the sole responsibility of the user to ensure 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.

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1.4 Classification

Penetrant systems covered by this specification are to be classified as follows:

1.4.1 Penetrants shall be of the following types, methods, and sensitivity levels:

Type 1	Fluorescent Dye
Type 2	Visible Dye

Method A	Water washable
Method A(W)	Water washable - water containing (≥20% water by volume)
Method B	Post emulsifiable, lipophilic
Method C	Solvent removable
Method D	Post emulsifiable, hydrophilic

Sensitivity Level 1/2	Ultra low
Sensitivity Level 1	Low
Sensitivity Level 2	Medium
Sensitivity Level 3	High
Sensitivity Level 4	Ultra high

1.4.1.1 Sensitivity level 1/2 applies to Type 1, Method A, and Method A(W) penetrants only. There is no sensitivity level classification for Type 2 penetrant systems.

1.4.2 Developers shall be of the following forms:

Form a	Dry powder
Form b	Water soluble
Form c	Water suspendible
Form d	Nonaqueous Type 1 Fluorescent (solvent based)
Form e	Nonaqueous Type 2 Visible Dye (solvent based)
Form f	Special application

1.4.3 Solvent removers shall be of the following classes:

Class 1	Halogenated
Class 2	Nonhalogenated
Class 3	Special application

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms 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 cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS4045	Aluminum Alloy Sheet and Plate, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr 7075: (-T6 Sheet, -T65 Plate), Solution and Precipitation Heat Treated
AMS4120	Aluminum Alloy, Rolled or Cold Finished Bars, Rods, and Wire, 4.4Cu - 1.5Mg - 0.60Mn (2024), Solution Heat Treated and Naturally Aged (T4), Solution Heat Treated, Cold Worked, and Naturally Aged (T351)
AMS4377	Magnesium Alloy, Sheet and Plate, 3.0Al - 1.0Zn - 0.20Mn (AZ31B-H24), Cold Rolled, Partially Annealed

AMS4916 Titanium Alloy Sheet, Strip, and Plate, 8Al - 1Mo - 1V, Duplex Annealed

AMS4919 Titanium Alloy Sheet, Strip, and Plate, 6Al - 2Sn - 4Zr - 2Mo - 0.08Si, Duplex Annealed

AMS5391 Nickel Alloy, Corrosion and Heat-Resistant, Investment Castings, 73Ni - 0.14C - 13Cr - 4.5Mo - 2.3Cb (Nb) - 0.75Ti - 6.0 Al - 0.010B - 0.10Zr, Vacuum Cast, As-Cast

AMS6350 Steel Sheet, Strip, and Plate, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)

AS7766 Terms Used in Aerospace Metals Specifications

2.2 ANSI Accredited Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ANSI Z400.1/Z129.1 Hazardous Workplace Chemicals - Hazard Evaluation and Safety Data Sheet and Precautionary Labeling Preparation

2.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B211/B211M Aluminum and Aluminum Alloy Rolled or Cold Finished Bar, Rod or Wire

ASTM D93 Flash Point by Pensky-Martens Closed Cup Tester

ASTM D95 Water in Petroleum Products and Bituminous Materials by Distillation

ASTM D445 Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

ASTM D3828 Flash Point by Small Scale Closed Cup Tester

ASTM D4057 Manual Sampling of Petroleum and Petroleum Products

ASTM D4177 Automatic Sampling of Petroleum and Petroleum Products

ASTM E203 Test Method for Water Using Volumetric Karl Fischer Titration

ASTM E1135 Comparing the Brightness of Fluorescent Penetrants

ASTM E1316 Terminology for Nondestructive Examinations

ASTM E1417/E1417M Liquid Penetrant Inspection

ASTM E2275 Evaluating Water-Miscible Metalworking Fluid Bioresistance and Antimicrobial Pesticide Performance

ASTM E3022 Measurement of Emission Characteristics and Requirements for LED UV-A Lamps Used in Fluorescent Penetrant and Magnetic Particle Testing

ASTM G41 Determining Cracking Susceptibility of Metals Exposed Under Stress to a Hot Salt Environment