

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

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SOLUTION, FLUORESCENT PENETRANT Water Base

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This cover sheet should be attached to the published copy of the subject specification.

Noncurrent refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division does not recommend these as standard materials for future use in new designs. Each of these "Noncurrent" specifications is available on request.

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SOLUTION, FLUORESCENT PENETRANT
Water Base

1. SCOPE:

1.1 Form: This specification covers a stable, noncorrosive, water-soluble, highly-penetrating, fluorescent solution which may, but need not, be diluted with an appropriate amount of water for use.

1.2 Application: Primarily for use in fluorescent penetrant inspection of parts and assemblies for detection of surface discontinuities and imperfections, particularly on parts, such as those in oxygen systems, which must not be exposed to oils.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification 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.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

AMS 4045 - Aluminum Alloy Sheet and Plate, 5.6Zn - 2.5Mg - 1.6Cu - 0.26Cr (7075; -T6 Sheet, -T651 Plate)

AMS4375- Magnesium Alloy Sheet and Plate, 3.0Al - 1.0Zn (AZ31B-0)

AMS 6350 - Steel Sheet, Strip and Plate, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D92 - Flash and Fire Points by Cleveland Open Cup

ASTM D130 - Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test

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

ASTM D1298 - Density, Specific Gravity, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

ASTM D1500 - ASTM Color of Petroleum Products (ASTM Color Scale)

ASTM D2512 - Compatibility of Materials with Liquid Oxygen (Impact Sensitivity Threshold Technique)

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: The product shall be composed of suitable vehicles (including water), dyes, and additives necessary to provide a product having the properties specified in 3.2.

- 3.2 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with the specified test method:
- 3.2.1 ASTM Color: Shall be not darker than 6 on the ASTM color scale, determined in accordance with ASTM D1500.
- 3.2.2 Flash Point: Shall be not lower than 250°F (121°C), determined in accordance with ASTM D92.
- 3.2.3 Color: Shall be predominantly green when examined by reflected white light, yellow by transmitted white light, and yellowish-green under black light.
- 3.2.4 Toxicity: The product shall contain no materials of known toxicity. The vapor shall not cause discomfort or injury to persons using the product.
- 3.2.5 Water Solubility: The product shall be completely soluble in water in all proportions and, when diluted with water, shall form a clear, yellow solution with no visible cloudiness. No scum or separate layer shall form on the surface or on the bottom.
- 3.2.6 Specific Gravity: Shall be within $\pm 5\%$ of the qualification value established as in 4.4.1, determined in accordance with ASTM D1298.
- 3.2.7 Kinematic Viscosity: Shall be within $\pm 10\%$ of the qualification value established as in 4.4.1, determined in accordance with ASTM D445 at 100° F ± 2 (38° C ± 1).
- 3.2.8 Corrosiveness: Specimens of AMS 4045 aluminum alloy, AMS 4375 magnesium alloy, and AMS 6350 steel shall reveal no evidence of etching, pitting, or corrosion products after being exposed to a sample of the penetrant solution at 122° F ± 2 (50° C ± 1) in accordance with the test procedures of ASTM D130. Tarnishing shall be no greater than that found by conducting similar tests using tap water.
- 3.2.9 Impact Sensitivity: The product shall show no adverse reactions to 20 test drops at 72 ft-lb (97.6 J), determined in accordance with ASTM D2512.
- 3.2.10 Fluorescent Brightness: Shall be not less than 85% of the qualification value established as in 4.4.1, determined in accordance with 4.5.1. Other test methods may be used when agreed upon by purchaser and vendor.
- 3.2.11 Storage Stability: The product shall meet the requirements of 3.2.1 through 3.2.10 after being stored in a closed, filled container at 60° - 100° F (16° - 37° C) for one year from date of receipt by purchaser.
- 3.3 Quality: The product, as received by purchaser, shall be uniform in quality and condition, homogeneous, and free from contaminants and foreign material detrimental to its use or function.
4. QUALITY ASSURANCE PROVISIONS:
- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.
- 4.2 Classification of Tests:
- 4.2.1 Acceptance Tests: Tests to determine conformance to requirements for ASTM color (3.2.1), flash point (3.2.2), specific gravity (3.2.6), and viscosity (3.2.7) are classified as acceptance tests and shall be performed on each lot.

- 4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests and shall be performed on the initial shipment of a product to a purchaser, when a change in material or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

- 4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant qualification agency as directed by the procuring activity, the contracting officer, or the request for procurement.

- 4.3 Sampling: Each lot of fluorescent penetrant solution shall be sampled to provide sufficient material to perform required testing. The number of specimens for each test shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

- 4.3.1 A lot shall be all product produced in a single production run from the same batches of raw materials under the same fixed conditions, or all material subjected to the same unit chemical or physical process intended to make the final product homogeneous, and submitted for vendor's inspection at one time.

4.4 Approval:

- 4.4.1 Sample solution shall be approved by purchaser before solution for production use is supplied, unless such approval be waived. Results of tests on production solution shall be essentially equivalent to those on the approved sample.

- 4.4.2 Vendor shall use ingredients, manufacturing procedures and processes, and methods of inspection on production solution which are essentially the same as those used on the approved sample solution.
- Ø If any change is necessary in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material and processing and, when requested, sample solution. Production solution made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Fluorescent Brightness:

- 4.5.1.1 Test Apparatus: Shall be a photoelectric photofluorometer, Coleman 12C or equivalent, equipped with a Coleman B-1-S primary filter (Corning 5874 glass) which has been sandblasted on the side toward the sample, a Corning CS-3-132 secondary filter, a standard 3/4 in. (19 mm) cuvette, and cuvette cover.

- 4.5.1.2 Preparation of Test Samples: Dilute sample solution and approved reference solution with water at the rate of one part penetrant solution in 2000 parts water (0.05% penetrant). Mix well and fill a clean sample cuvette with each mixture.

- 4.5.1.3 Test Procedure: Turn on instrument and allow at least 15 min. warmup. Turn all control knobs full right and set aperture control in center position. Insert tube of approved reference solution and cover with cuvette cover. Depress shutter button and move aperture control so needle is near top of scale. Remove approved reference solution and insert a clean cuvette filled with water, then cover. Again depress shutter and adjust meter to read zero with "Blk" controls. Remove water-filled cuvette, reinsert cuvette of approved reference solution, and cover. Again depress shutter and set needle at 50, using "Std" control. Remove cuvette of approved reference solution, insert cuvette of sample solution, cover, and depress shutter to read sample solution value. Double sample solution reading to compute sample solution value as a percent of approved reference solution.