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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3156C
Superseding AMS 3156B

Issued 8-15-58
Revised 10-1-83

OIL, FLUORESCENT PENETRANT
Water Washable

1. SCOPE:

1.1 Form: This specification covers a stable, non-corrosive oil or oil-like substance together with a dye or additives necessary to provide a water-washable, highly-penetrating fluorescent solution.

1.2 Application: Primarily for use in penetrant inspection of parts and assemblies for detection of surface discontinuities and imperfections.

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 SAE, 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)
AMS 4375 - Magnesium Alloy Sheet and Plate, 3.0Al - 1.0Zn (AZ31B-O)
AMS 6350 - Steel Sheet, Strip, and Plate, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)

REAFFIRMED

Printed in U.S.A.

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

ASTM D91 - Precipitation Number of Lubricating Oils
ASTM D93 - Flash Point by Pensky-Martens Closed Tester
ASTM D95 - Water in Petroleum Products and Bituminous Materials by Distillation
ASTM D129 - Sulfur in Petroleum Products (General Bomb Method)
ASTM D130 - Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test
ASTM D287 - API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
ASTM D445 - Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ASTM D808 - Chlorine in New and Used Petroleum Products (Bomb Method)

2.3 U.S. 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: Shall be composed of suitable oil or oil-like components together with a dye or other additives necessary to provide a stable, highly-penetrating, fluorescent solution having the properties specified in 3.2.

3.2 Properties: Penetrant shall conform to the following requirements; tests shall be performed on the penetrant supplied and in accordance with specified test methods:

3.2.1 Flash Point: Shall be not lower than 150°F (65°C), determined in accordance with ASTM D93.

3.2.2 Water Content: Shall be not greater than 1.0%, determined in accordance with ASTM D95.

3.2.3 After initial approval of vendor's product as in 4.4.1, subsequent shipments shall not deviate from the preproduction test values for the following characteristics in excess of the percentages indicated:

3.2.3.1	Gravity, deg API	±5%	ASTM D287
3.2.3.2	Viscosity, Kinematic at 100°F (38°C), Centistokes	±10%	ASTM D445
3.2.3.3	Precipitation Number	±10%	ASTM D91

3.2.3.4 Ø	Sulfur Content, residue, max	1%	ASTM D129
3.2.3.5 Ø	Halogen Content, residue, max	0.25%	ASTM D808

3.2.4 Toxicity: The penetrant shall have no adverse effect on the health of Ø personnel when used for its intended purpose and with adequate ventilation.

3.2.5 Water Solubility: Shall be such that the droplets produced when 1 or 2 drops of the penetrant are dropped into a beaker of water maintained at 100°F ± 5 (38°C ± 3) shall disperse immediately, leaving only a smoky appearance in the water. There shall be no separated oil on the surface.

3.2.6 Color: Shall be predominantly green when examined by reflected white Ø light, yellow by transmitted light, and yellowish-green under black light.

3.2.7 Fluorescent Brightness: Shall be not less than 90% of that found in the Ø original product on which source approval was granted, determined in accordance with 4.5.1. Other test methods may be used when agreed upon by purchaser and vendor.

3.2.8 Fluorescent Stability: The fluorescent stability of the exposed specimens Ø shall be not less than 90% of the same specimens before exposure, determined in accordance with 4.5.2.

3.2.9 Temperature Stability: Penetrant shall not separate or precipitate after Ø each of two 8-hr cycles of -4° to + 150°F (-18° to +66°C)

3.2.10 Resistance to Acids: Penetrant shall tolerate the addition of at least Ø 2% acid etchant without loss of fluorescent brightness below 50% of initial value.

3.2.11 Fluorescent Dye Content: Shall conform to the spot diameter tolerance of Ø 5.0 - 6.9 mm for medium sensitivity and less than 5.0 mm for high sensitivity, determined by the Meniscus Method.

3.2.12 Electrical Resistance: Shall be greater than 20 megohm-centimetres. Ø

3.2.13 Washability: Penetrant shall be water washable and leave no residual fluorescence on the surface of a part or test panels of AMS 4045 aluminum Ø alloy, AMS 4375 magnesium alloy, and AMS 6350 steel after soaking 20 min. ± 1 in the penetrant, draining 15 min. ± 1, rinsing for 60 sec. ± 5 in a cold tap water spray at 30 - 60 psi (310 - 515 kPa) directed at a 45 deg angle to the part, drying, coating with applicable developer, and examining under black light and white light.

3.2.14 Water Tolerance: Penetrant for use in open tanks, after being mixed with Ø up to 5% by volume of tap water, shall show no evidence of gelling, separation, coagulation, effect on washability, or impairment in its ability to detect defects in standard reference samples of materials.

3.2.15 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 procedure of ASTM D130. Tarnishing shall be no greater than that found by conducting similar tests using tap water.

3.2.16 Storage Life: A closed, filled container of each penetrant submitted for preproduction approval shall meet the requirements of 3.2.1 through 3.2.15 after being stored for one year at 60° - 100°F (16° - 38°C).

3.3 Quality: Penetrant, 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 penetrant shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure that the penetrant conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for flash point (3.2.1), water content (3.2.2), gravity (3.2.3.1), viscosity (3.2.3.2), sulfur content (3.2.3.4), halogen content (3.2.3.5), water solubility (3.2.5), fluorescent brightness (3.2.7), washability (3.2.13), and corrosiveness (3.2.15) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for precipitation number (3.2.3.3), color (3.2.6), fluorescent stability (3.2.8), temperature stability (3.2.9), resistance to acids (3.2.10), fluorescent dye content (3.2.11), electrical resistance (3.2.12), and water tolerance (3.2.14) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of the penetrant to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

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

4.3 Sampling: Sufficient penetrant shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if Ø not specified therein, not less than three. A lot shall be all penetrant produced in a single production run from the same batches of raw materials under the same fixed conditions and presented for vendor's inspection at one time. A lot may be packaged in smaller quantities and delivered separately under the basic lot approval provided the lot identity is maintained.

4.4 Approval:

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

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production penetrant which are essentially the same as those used on the approved sample penetrant. If necessary to make Ø any change 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 or processing, or both, and, when requested, sample penetrant. Production penetrant 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, and reflectance sample holder or equivalent.

4.5.1.2 Preparation of Specimens: Small amounts of an approved reference penetrant and the penetrant to be tested shall be diluted with a non-fluorescent volatile solvent, such as methylene chloride, in separate containers, in the ratio of one part sample to nine parts solvent. Both penetrants shall be soluble in the same solvent. The solutions shall be agitated and poured into separate wide-mouthed containers. Immediately after the solutions have been poured into the test containers, test paper specimens, Munktell's No. 5 or equivalent, cut to fit the sample holder for the photofluorometer, shall be dipped into each solution, withdrawn, and held in a fixture to air dry. When

4.5.1.2 Preparation of Specimens (Cont'd.):

the samples are dry, they shall be placed for 5 min. ± 0.5 in a preheated oven at 225°F ± 5 (107°C ± 3). Six paper specimens shall be prepared for the reference sample and five for the test material.

4.5.1.3 Test Procedure:

4.5.1.3.1 Under black light, compare the reference sample specimens with the test material specimens, then use one of the reference specimens as a master for setting the instrument. Place the master specimen under the leaf of the specimen holder, insert into the instrument, and press the shutter button down. If, under the black light, the test specimen appears brighter than the reference specimen, adjust the aperture control on the instrument so that, by rotating the specimen holder, the peak reading on the meter will be near 50. Adjust the reading to near 100 if the reference specimen appeared to be brighter than the test specimen. When a peak reading is obtained, the stop screw may be installed at a point which will engage the pin in the rotated specimen holder. Installation of a stop screw is not essential if the specimen holder is rotated for each specimen and all readings are taken at peak of meter swing.

4.5.1.3.2 Remove the master specimen from the holder, place a clean blank piece of the same type of filter paper in the holder, and reinsert into the instrument. By means of the blanking controls (BLK), adjust the instrument so that the meter reads zero. Replace the blank filter paper with the master specimen and reinsert into the instrument. Using the standard control (STD), set the instrument so that all readings will be taken in the upper two-thirds of the meter range and then remove the master specimen. Place the remaining specimens in the holder, one at a time, read each specimen on one side only, and record the results. The five reference specimens and the five test specimens should be read alternately to compensate for instrument drift. After all readings have been recorded, average the readings of the specimens. Compare the average of the test specimens with the average of the reference specimens to determine conformance to the brightness requirements of 3.2.7.

4.5.2 Fluorescent Stability: After reading the specimens for brightness as in 4.5.1, they shall be exposed to black light, defined as the invisible radiant energy in that portion of the spectrum just beyond the blue of the visible spectrum, having a wave length of 3200 - 4000 Angstrom units (320 - 400 nm). The intensity of the light shall be 90 - 150 ft-candles (970 - 1615 lx) in the center of the beam, approximately 15 in. (375 mm) from the specimen to be tested, when measured using an unfiltered Weston #703 illumination meter or equivalent. After the specimens have been exposed to black light for 1 hr ± 0.1, they shall be read again on the equipment used in 4.5.1.3 to determine any loss in brightness. Prior to measuring the exposed specimens, the equipment shall be restandardized, using the unexposed master specimen.