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AEROSPACE MATERIAL SPECIFICATION

AMS 3151

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Revised

FLUID, AIRCRAFT COMPASS

1. SCOPE:

1.1 Form: This specification covers one grade of hydrocarbon compass fluid.

1.2 Application: Primarily for use as a filling medium for magnetic compasses.

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 2825 - Material Safety Data Sheets

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

ASTM D56 - Flash Point by Tag Closed Tester
ASTM D86 - Distillation of Petroleum Products
ASTM D130 - Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test
ASTM D156 - Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
ASTM D445 - Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ASTM D1093 - Acidity of Distillation Residues or Hydrocarbon Liquids
ASTM D1319 - Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption

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-290 - Packaging of Petroleum and Related Products

3. TECHNICAL REQUIREMENTS:

3.1 Material: The fluid shall be a refined fraction of crude petroleum without admixtures of other compounds not naturally occurring in crude petroleum.

3.2 Properties: The fluid shall conform to the following requirements, determined in accordance with specified test methods, insofar as practicable:

3.2.1 Color: Shall be water white, not darker than No. 25 Saybolt, determined in accordance with ASTM D156.

3.2.2 Flash Point: Shall be not lower than 32°C (90°F), determined in accordance with ASTM D56.

3.2.3 Distillation: Upon distillation, the fluid end point shall not exceed 260°C (500°F), determined in accordance with ASTM D86.

3.2.4 Corrosion: Shall be not greater than Class 1, determined in accordance with ASTM D130 at 100°C ± 1 (212°F ± 2).

3.2.5 Aromatics: Fluid shall contain not more than 10% by volume of aromatics, determined in accordance with ASTM D1319.

3.2.6 Viscosity: Shall be as follows, determined in accordance with ASTM D445:

Temperature ±1°C (±2°F)	Value, cSt (mm^2/s)
38°C (100°F)	0.90 - 1.15
0°C (32°F)	2.30 max

3.2.7 Cloudiness and Freeze Point: The fluid shall not gel, crystallize, or solidify when tested in accordance with 4.5.1. In addition, at the completion of the test outlined in 4.5.1, turbidity or haze shall not exceed that exhibited by the turbidity standard described in 4.5.1.1.

3.2.8 Light Stability: No precipitate shall be visible in the fluid after completion of the light stability test in 4.5.2 and the color shall be not darker than No. 21 Saybolt, determined in accordance with ASTM D156.

3.2.9 Oxygen Stability: No precipitate shall be visible in the fluid after completion of the oxidation stability test in 4.5.3 and the color of the fluid shall be not darker than No. 21 Saybolt, determined in accordance with ASTM D156.

3.2.10 Fluorescence: The fluorescence of the fluid shall not exceed 1.0 microlambert, determined in accordance with 4.5.4.

3.2.11 Neutrality: After completion of the oxygen stability test of 3.2.9, the residual fluid shall exhibit a neutral reaction, determined in accordance with ASTM D1093.

3.3 Quality: The fluid, as received by purchaser, shall be uniform in quality and free of undissolved water, sediment, or suspended matter and free from foreign materials and other contaminants detrimental to usage of the fluid. No substance of known dangerous toxicity under normal conditions of handling shall be present.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of fluid 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 fluid conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and as preproduction tests and shall be performed prior to or on the initial shipment of fluid to a purchaser, on each lot, 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.

4.3 Sampling: Sufficient fluid 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 not specified therein, not less than three.

4.3.1 A lot shall be all fluid 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 and shall not exceed 1000 gal (3785 L). A lot may be packaged in smaller quantities and delivered under the basic lot approval provided the lot identification is maintained.

4.4 Approval:

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

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

4.5 Test Methods:

4.5.1 Cloudiness and Freeze Point:

4.5.1.1 Turbidity Standard: 25 mL of a 0.00322 molar solution of barium chloride shall be measured into a 250-mL volumetric flask. Add 200 mL of distilled water and 25 mL of 0.50 normal sulfuric acid. Shake the solution well to ensure complete precipitation of the barium sulfate. Pour the resultant suspension into a small bottle and seal. The turbidity standard shall be used within 30 min. of preparation.

4.5.1.2 Specimen Preparation: Place a clean 4-oz (120-mL) bottle in an oven and condition for not less than 24 hr at 100°C ± 3 (212°F ± 5). Place not less than 3 fl oz (90 mL) of the fluid to be tested in the dried bottle and stopper tightly.

4.5.1.3 Test Procedure: Place the bottle containing the fluid sample in a cold chamber maintained at -55°C (-65°F) or lower temperature and hold for 30 min. ± 1.

4.5.1.4 Examination of Specimen: After the prescribed time of low temperature conditioning, the specimen shall be removed from the cold chamber and immediately shaken for approximately 10 seconds.

4.5.1.4.1 There shall be no visual evidence of gelling, crystallization, or solidification of the fluid. Turbidity of the fluid shall not exceed that of the standard prepared in accordance with 4.5.1.1. The turbidity standard shall be shaken vigorously within 5 min. of the time it is used for making comparisons.

4.5.1.4.2 If frost formation on the specimen bottle interferes with the turbidity comparison or other visual determination, the bottle may be quickly dipped in a 1:1 mixture, by volume, of glycerine and methyl alcohol which has previously been cooled and held at the test temperature.

4.5.1.4.3 The fluid evaluation shall be completed within 1 min. after the specimen is removed from the cold chamber.

4.5.2 Light Stability: Fill a Vycor test tube of approximately 1 in. (25 mm) OD and 4 in. (200 mm) long with the fluid. Expose the tube containing the fluid to the light of a 13-amp carbon arc lamp using Fad-O-Meter No. 70 or No. 20 carbons, or equivalent, enclosed in a Corex D globe. Place the tube containing the fluid sample in a vertical position in approximately the same horizontal plane with the arc at a distance of 1 ft (300 mm) from the arc. Color determination shall be made after 18 hr of exposure.

4.5.3 Oxidation Stability: A suitable glass container, such as an oil sample bottle, shall be nearly filled with the fluid. Place the bottle containing the fluid to be tested in a suitable metal bomb having a capacity about 1-1/2 times the external volume of the test specimen container. Seal the bomb, test for leaks, purge, and back fill with oxygen to a pressure of 95 - 100 psig (655 - 690 kPag). Place the bomb in a temperature chamber maintained at 95° to 100°C (203° to 212°F) and hold at heat for 6 - 6.5 hours. Cool the bomb rapidly in room temperature water with the charging valve still closed. Release the pressure slowly, open the bomb, and remove the specimen from the container to permit examination of the fluid.

4.5.4 Fluorescence: A MacBeth illuminometer or similar low brightness photometer of equivalent precision shall be used for the brightness measurement. The fluid sample shall be placed in an absorption cell, having a light path through the liquid of 10 mm and a 32-mm ID. The glass used in the cell shall be nonfluorescing. The brightness shall be measured at an angle of 45 deg to the plane of the flat surface of the absorption cell. The illumination shall be incident at an angle of 45 deg to the flat surface of the absorption cell and shall approach the sample at right angles to the direction of observation. A non-fluorescing white paper backing may be used behind the cell to create better field uniformity. The specimen shall be excited in this position with ultra-violet light of 365 millimicrons (nm) wavelength until it reaches a constant brightness. The intensity of the excitation lamp and specimen shall be determined with the aid of a reference precalibrated plaque. The brightness calibration method shall be as agreed upon by purchaser and vendor.

4.6 Reports:

4.6.1 The vendor of fluid shall furnish with each shipment three copies of a report showing the results of tests on each lot to determine conformance to the technical requirements of this specification. This report shall include the purchase order number, AMS 3151, vendor's material designation, lot number, and quantity.

4.6.2 A material safety data sheet conforming to AMS 2825 or equivalent shall be supplied to each purchaser prior to, or concurrent with, the report of preproduction test results or, if preproduction testing be waived by purchaser, concurrent with the first shipment of fluid for production use. Each request for modification of fluid formulation shall be accompanied by a revised data sheet for the proposed formulation.

4.7 Resampling and Retesting: If any sample used in the above tests fails to meet the specified requirements, disposition of the fluid may be based on the results of testing three additional samples for each original non-conforming sample. Failure of any retest sample to meet the specified requirements shall be cause for rejection of the fluid represented and no additional testing shall be permitted. Results of all tests shall be reported.