MIL-L-5020B
4 November 1975
SUPERSEDING
MIL-L-5020A(ASG)
13 February 1956

MILITARY SPECIFICATION

LIQUID, COMPASS, AIRCRAFT

This specification is approved for use by all Departments and Agencies of the Department of Defense

1. SCOPE

1.1 Scope. This specification covers one grade of compass liquid intended for use in aircraft magnetic compasses. This product is identified by Military Symbol FDC and NATO Code S-712.

2. APPLICABLE DOCUMENTS

2.1 The following specification and standards of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Military

MIL-L-25142	Luminescent Material, Fluorescent

STANDARDS

Federal

Federal Test Method Standard No. 791	Lubricants, Liquid Fuels, and Related Products; Methods of Testing

Military

MIL-STD-290	Packaging, Packing, and Marking of Petroleum and Related Products

FSC 1680

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D56	Flash Point by Tag Closed Tester
ASTM D86	Distillation of Petroleum Products
ASTM D130	Copper Strip Corrosion Test
ASTM D156	Saybolt Color of Petroleum Products
ASTM D445	Viscosity of Transparent and Opaque Liquids
ASTM D1319	Hydrocarbon Types in Liquid Petroleum Products Fluorescent Indicator Adsorption

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

3. REQUIREMENTS

3.1 Material. The liquid shall be a refined fraction of crude petroleum.

3.2 Physical properties. Physical properties of the fluid shall conform to table I, and 3.3 through 3.6.

Table I. Physical properties

PROPERTY	SPECIFIED VALUE
Flash point (min)	32.2°C (90°F)
Distillation range:	260°C (500°F)
End point (max)	
Reaction after oxidation	Neutral
Color, Saybolt (min)	
Original	+25
After Light stability test 1/	+21
After Oxygen stability test 2/	+21

Table I. Physical properties (CON'T)

PROPERTY	SPECIFIED VALUE
Kinematic viscosity, centistokes	
at 37.8°C (100°F)	0.90 to 1.15
at 0°C (32°F)	2.30 max.
Aromatics, vol. percent max	10.0

1/ See 4.4.2.1.

2/ See 4.4.2.2.

3.3 Corrosion. The liquid shall cause no discoloration or pitting of a copper strip when subjected to the Corrosion test specified in Section 4 (see 4.4).

3.4 Cloudiness and freezing point. The compass liquid shall not gel, crystallize, or solidify after being maintained at a temperature not above -53.9°C (-65°F) for a period of 30 minutes. At the end of the above test, turbidity or haze shall not be greater than that shown by the turbidity standard of barium sulphate suspension as specified in 4.4.3.

3.5 Fluorescence. The fluorescence shall not exceed 1.0 microlambert.

3.6 Workmanship. The liquid shall be free from moisture, acidity, glue, and suspended matter or other impurities.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 General. All the tests required herein for the testing of compass liquid are classified as Acceptance tests, for which necessary sampling techniques and method of testing are specified in this section.

4.3 Sampling. Two quarts of the liquid shall be taken in accordance with Method 8001 of Federal Test Method Standard No. 791.

4.4 Tests. Samples shall be subjected to the following tests. Those specified in table II shall be conducted in accordance with the applicable methods as given in Federal Test Method Standard No. 791 as indicated.

Table II. Test Methods

TEST	FTMS No. 791 Method No.	ASTM Designation
Flash Point (Tag Closed Tester)	1101	D56
Distillation	1001	D86
Saybolt Color	101	D156
Copper Strip Corrosion 1/	5325	D130
Viscosity	305	D445
Reaction (After Oxidation)	5101	-
Aromatics	3703	D1319

1/ 3-hour test duration at 212°F

4.4.1 Examination of product. All compass liquid shall be carefully examined to determine conformance with this specification with respect to material and workmanship.

4.4.2 Stability

4.4.2.1 Light stability. A Vycor test tube, or equivalent, of approximately 25 millimeters outside diameter by 200 millimeters length, shall be filled with the liquid and exposed to the light of a 13-ampere carbon arc lamp using Fad-O-Meter No. 70 and No. 20 carbons, or equivalent, enclosed in a Corex D globe, or equivalent. The tube shall be held in a vertical position in approximately the same horizontal plane with the arc and at a distance of 1 foot from the arc. Color determinations shall be made after exposure of 1, 4, and 18 hours.

4.4.2.2 Oxygen stability. A suitable glass container, such as an oil sample bottle, shall be nearly filled with the compass liquid and placed in a suitable metal bomb having an internal capacity of about 1-1/2 times the external volume of the bottle. The bomb shall be so arranged that it can be tightly closed and charged with oxygen after the sample is in place. The bomb containing the sample shall be charged with oxygen at 95 to 100 pounds per square inch pressure and at room temperature. After being tested for leaks with negative results, it shall be placed in a suitable bath maintained at 95° to 100°C (203° to 212°F) for 6 hours. The bomb shall then be cooled in cold water water and the sample removed and subjected to the color and reaction tests specified.

4.4.2.3 There shall be no precipitate after the Light stability and Oxygen stability tests as specified in 4.4.2.1 and 4.4.2.2, respectively.

4.4.3 Cloudiness and freezing point.

4.4.3.1 Preparation of turbidity standard. Twenty-five milliliters of a 0.00322-molar solution of barium chloride shall be measured into a 250-milliliter volumetric flask. To this shall be added 200 milliliters of distilled water and 25 milliliters of 0.50-normal sulfuric acid. Then the solution shall be shaken well to insure complete precipitation. Then the solution shall be poured into a 4-ounce bottle. The bottle shall be stoppered and the suspension used within 1/2 hour of being prepared.

4.4.3.2 Storage of compass liquid. A sample of the compass liquid shall be placed in a clean 4-ounce sample bottle which has previously been dried in an oven at 100°C (212°F) for not less than 24 hours. The bottle shall be tightly stoppered and stored at a temperature not higher than -53.9°C (-65°F) for 30 minutes.

4.4.3.3 Examination of cloud samples. At the end of the 30-minute storage period, the sample shall be removed from the storage and shaken vigorously for 10 seconds. There shall be no evidence of gelling, crystallization, or solidification of the liquid. Turbidity of the compass liquid sample shall be not greater than that of the standard as specified in 4.4.3.1. The turbidity standard shall be shaken vigorously within 5 minutes prior to making any comparisons.

If frosting interferes with the turbidity evaluation, the bottle containing the compass liquid may be quickly dipped into a 50-50 (by volume) mixture of flycerine-methanol, previously cooloed to the storage temperature. No more than 1 minute shall have elapsed between the time of the removal of the compass liquid sample from the low-temperature storage and the completion of the test.

4.4.4 Fluorescence. A Macbeth illuminometer or other low-brightness photometer of equivalent precision shall be used for the determination. The sample shall be placed in an absorption cell, having a light path through the liquid of 10 millimeters and having an inside diameter of 32 millimeters. The glass used in the cell shall be nonfluorescent. The brightness shall be measured at an angle of 45 degrees to the plane of the flat surface of the absorption cell. The illumination shall be incident at an angle of 45 degrees to the flat surface of the absorption cell and shall approach the sample at right angles to the direction of observation. A nonfluorescing white paper backing may be used behind the cell to create better field uniformity. The specimen shall be excited in this position with ultraviolet light of 365 millimicrons' wavelengths 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 standard used for calibration shall be one satisfactory for use in accordance with the method of MIL-L-25142.

4.5 Rejection. Failure of any sample of compass liquid to conform to any one of the requirements of this specification shall be cause for rejection of the lot represented.

5. PREPARATION FOR DELIVERY

5.1 Application. The requirements of Section 5 apply only to direct purchases by or direct shipments to the Government.

5.2 Preservation. There are no preservation requirements applicable to this specification.

5.3 Packaging and packing. The packaging and packing of the liquid shall be in accordance with MIL-STD-290. The type and size of the container shall be as specified by the procuring activity (see 6.2).

All materials used in the construction of the containers shall be such as will not affect or be affected by the contained liquid.

5.4 Marking. The marking of the liquid containers shall be in accordance with MIL-STD-290. In addition to any special marking required in the contract or order, the unit containers shall also be marked with the following:

NARO CODE S-712

6. NOTES

6.1 Intended use. The material covered by this specification is intended for use in aircraft magnetic compasses.

6.2 Ordering data. Procurement documents should specify:

a. Title, number, and date of this specification.

b. Type and size of container (see 5.1 and 6.2.1).

c. Quantity.

d. Applicable levels of packaging and packing (see 5.1).

6.2.1 Unit of purchase. The material should be purchased by volume, the unit being a U. S. Gallon at 15.6°C (60°F).

6.3 International standardization. Certain provisions of this specification are the subject of international standardization agreements ASCC Air Standard 15/1 and (NATO) STANAG 1135. When amendment, revision, or cancellation of this specification is proposed, which affects the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization channels, if required.

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Air Force - 11

Preparing activity:
Air Force - 11

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

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DOCUMENT IDENTIFIER AND TITLE

NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3. IS THE DOCUMENT RESTRICTIVE?

   ☐ YES ☐ NO *(If "Yes", in what way?)*

4. REMARKS

SUBMITTED BY *(Printed or typed name and address - Optional)*

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