METRIC

MIL-L-5020C
27 March 1991
SUPERSEDING
MIL-L-5020B
4 November 1975

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 describes the characteristics and provides the requirements for the compass liquid intended for use in aircraft magnetic compasses (6.1). This product is identified by military symbol FDC and NATO Code No. S-712, (see 6.7).

APPLICABLE DOCUMENTS

2 1 Government documents

2 1 1 Specifications and standards. The following specification and standard forms a part of this document to the extent specified herein Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6 2)

SPECIFICATIONS

FEDERAL

PPP-C-96 Can, Metal, 28 Gage and Lighter

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to ASD/ENES, Wright-Patterson AFB OH 45433-6503 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

AMSC N/A FSC 9150

DISTRIBUTION STATEMENT A. Approved for public release, distribution is unlimited

MILITARY

MIL-L-25142 Luminescent Material, Fluorescent

STANDARDS

FEDERAL

FED-STD-313 Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

FED-STD-791 Lubricant, Liquid Fuel and Related Products, Methods of Testing

MILITARY

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from Military Specifications and Standards, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2 2 Non-Government publications The following document(s) form a part of this document to the extent specified herein Unless otherwise specified, the issues of the documents which are DOD adapted are those listed in the issue of the DODISS specified in the solicitation Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6 2)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 56 Flash Point by Tag Closed Tester

ASTM D 86 Distillation of Petroleum Products (DoD adopted)

ASTM D 130 Copper Strip Corrosion Test

ASTM D 156 Petroleum Products, Saybolt Color of

ASTM D 445 Viscosity of Transparent and Opaque Liquids

ASTM D 1319 Hydrocarbon Types in Liquid Petroleum Products Fluorescent Indicator Adsorption

ASTM D 4057 Manual Sampling of Petroleum and Petroleum Products

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

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents These documents also may be available in or through libraries or other informational services)

2 3 Order of precedence In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence Nothing in this document, however, supersedes applicable laws and regulation unless a specific exemption has been obtained

3 REQUIREMENTS

3 1 First article. When specified (see 6.2) a sample shall be subjected to first article inspection in accordance with 4.4.

3 2 Material The liquid shall be a refined fraction of crude petroleum and shall be entirely suitable for the intended purpose.

3 3 Physical properties. The properties of the compass liquid shall conform to the requirements specified in table I and 3.4.

TABLE I. Properties of the compass liquid.

Characteristics	Specified value
Copper Corrosion (max)	1a
Flash point (min)	32.2°C
Distillation range.	260°C
End point (max)	
Reaction after oxidation	Neutral
Color, saybolt (min)	
Original	+25
After light stability test 1/	+21
After oxygen stability test 2/	+21
Kinematic viscosity, centistokes	
at 38°C	0.90 to 1 15
at 0°C	2.30 max.
Aromatics, vol percent max	10.0

1/ Requirement shall be met after 18 hours exposure See 4 6 3 1

2/ See 4 6 3 2

3 4 Performance

3 4.1 Cloudiness and freezing point. When tested as specified in section 4, the compass liquid shall not gel, crystallize or solidify after being maintained at a temperature at or below -53.9°C for a period of 30 minutes. At the end of the test, turbidity or haze shall not be greater than the turbidity standard for barium sulfate suspension.

3 4 2 Fluorescence The fluorescence shall not exceed 1.0 microlambert

3 5 Toxicity. The compass liquid shall have no adverse effect on the health of personnel when used for its intended purpose. The liquid shall contain no elements that produce noxious vapors nor irritate personnel during formulation or use under conditions of adequate ventilation while exercising caution to avoid prolonged contact with the skin and while observing Occupational Safety and Health Administration (OSHA) guidelines Questions pertaining to the toxic effects shall be referred by the procuring activity to the appropriate departmental medical service who will act as an advisor to the procuring activity, Material safety data sheets shall be prepared and submitted in accordance with FED-STD-313

3 6 Workmanship The compass liquid shall be uniform in quality and shall meet all requirements of this specification.

4 QUALITY ASSURANCE PROVISIONS

4 1 Responsibility for inspection Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 ensure supplies and services conform to prescribed requirements

4 1 1 Responsibility for compliance All items must meet all requirements of sections 3 and 5 The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material

4 2 Classification of inspection The inspection requirements specified herein are classified as follows

a First article inspection (see 4 4)

b Quality conformance inspection (see 4 5)

4 3 Inspection condition

4.3 1 Bulk lot. A bulk lot (batch) is an indefinite quantity of a homogeneous mixture of material (see 3.2) offered for acceptance in a single, isolated container or manufactured in a single-plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material

4 3.2 Packaged lot. A packaged lot is an indefinite number of one-gallon drums, or smaller unit containers (such as a one-quart can) of identical size and type, offered for acceptance and filled with a homogeneous mixture of material (see 3.2) from one isolated container or filled with a homogeneous material mixture manufactured in a single-plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

4.4 First article inspection

4.4 1 First article samples. When required, first article inspection shall be performed on the first one-quart bulk lot (see 4 3 1)

4 4 2 First article tests First article sample(s) shall be subjected to all those tests specified under 4 6 and table II

4 5 Quality conformance inspection. Quality conformance inspection shall consist of sampling plans A, B and C. Samples shall be labeled completely with the name of the product, specification number, lot and batch number, date of sampling and contract number.

TABLE II Test methods for compass liquid properties.

Characteristic	Test Method	
	FED-STD-791	ASTM
Flash point by tag closed tester		D 56
Distillation of petroleum products		D 86
Saybolt color of petroleum products		D 156
Copper corrosion by petroleum products (copper strip test)		D 130
Viscosity of transparent and opaque liquids (kinematic and dynamic viscosities)		D 445
Neutrality (qualitative)	5101	
Hydrocarbon types in liquid petroleum products by fluorescent indicator absorption		D 1319

4 5 2 Sampling plan A. A one-quart bulk lot (see 4.3.1) shall be selected in accordance with ASTM D 4057 and shall be subject to the quality conformance tests in

4 6 2. If the test sample fails any of the quality conformance tests, the inspection lot shall be rejected.

4 5.3 Sampling plan B. A random sample of filled unit containers and a sample of shipped containers fully prepared for delivery shall be selected from each packaged lot (see 4.3.2) of liquid in accordance with table III. The samples shall be subject to the inspections specified in 4 6.6 If any sample fails, the lot shall be rejected.

Table III. Sampling plan

Lot Size	Sample Size
1-4	all
5-50	5
51-90	7
91-150	11
151-280	13
281-500	16
501-12,000	19
[acceptance number is zero, (c = 0)]	

4 5.4 Sampling plan C A random sample of base oil shall be selected in accordance with ASTM D 4057 from each lot of the finished liquid and shall be subjected to all the applicable quality conformance tests for base oil in 4 6 1.

4 6 Methods of inspection

4.6.1 Inspection The following steps shall be performed for inspection·

a Measure two quarts of the liquid in accordance with the method described in ASTM D 4057

b Conduct the inspection in accordance with method 9601, FED-STD-791 and 4.6.6 of this specification

4 6 2 Test samples Samples shall be subject to the following tests Test methods specified in table II shall be conducted in accordance with the applicable methods specified in FED-STD-791.

4 6 3 Stability

4 6 3 1 Light stability The following test procedures shall be performed

a Fill a Vycor test tube, or equivalent, measuring approximately 25-mm outside diameter and 200-mm long with compass liquid

b Enclose the compass liquid in a Corex D globe, or equivalent and expose it to the light of a 13-ampere carbon arc lamp using Fad-O-Meter No 70 and No 20 carbons, or equivalent.

c. Hold the test tube in a vertical position 1 foot from the arc and in approximately the same horizontal plane Make color determinations after exposure of 1, 4 and 18 hours.

4 6 3 2 Oxygen stability. The following test procedures shall be performed:

a Nearly fill a suitable glass container, such as an oil sample bottle, with the compass liquid and place it into a suitable metal bomb having an internal capacity of about one and one half times the external volume of the bottle.

b Arrange the bomb so that it can be tightly closed and charged with oxygen after the sample is in place, and then charge the bomb with oxygen at 95 to 100 pounds per square inch pressure at room temperature.

c. Test the bomb for leaks, and if the test shows negative results, place the bomb in a suitable bath maintained at 95°C to 100°C for six hours.

d Cool the bomb in cold water and remove the sample, which shall be subjected to the color and reaction tests specified.

NOTE· There shall be no precipitation after the light stability and oxygen stability tests have been performed as specified in 4 6.3.1 and 4.6 3.2, respectively.

4 6 4 Cloudiness and freezing point.

4 6 4.1 Preparation of turbidity standard. The following test procedures shall be performed:

a Pour 25 ml of a 0.00322-molar solution of barium chloride into a 250-ml volumetric flask Add 200 ml of distilled water and 25 ml of 0.50-normal sulfuric acid

b Shake the solution well to ensure complete precipitation and pour it into a 4-ounce bottle Stopper the bottle and use the suspension within one-half hour after preparation

4 6 4 2 Storage of compass liquid A sample of the compass liquid shall be placed into a clean 4-ounce sample bottle that has previously been dried in an oven at 100°C for not less than 24 hours. The bottle shall be tightly stoppered and stored at a temperature at or below -53.9°C for 30 minutes.

4 6 4 3 Examination of cloud samples. The following examination procedures shall be performed:

a After 30 minutes remove the sample from storage and shake it vigorously for ten seconds

b Examine the sample to ensure that there is no evidence of gelling, crystallization or solidification of the liquid, and that the turbidity of the compass liquid sample is not greater than that of the standard as specified in 4 6.2.

c Shake the turbidity standard vigorously within five 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 glycerin-methanol, previously cooled to the storage temperature.

d. Ensure that no more than one minute has elapsed between removing the compass liquid sample from the low temperature storage and completing the test

4 6 5 Fluorescence The following measuring procedures shall be performed using a Macbeth illuminometer or other low-brightness photometer of equivalent precision

a Place the sample in an absorption cell constructed of nonfluorescent glass having a 10-mm light path through the liquid and an inside diameter of 32 mm.

b Measure the brightness at a 45° angle along the plane of the flat surface at the absorption cell The illumination shall be incident at a 45° angle 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

c Excite the specimen in this position with ultraviolet light of 365-nm 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

4.6 6 Examination of filled containers. Each sample, selected in accordance with 4 5 3, shall be examined for defective construction, evidence of leakage and net content. Any container in the sample having one or more defects or under required fill shall be rejected, and if the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of table III, the lot represented by the sample shall be rejected. Rejected lots may be resubmitted for quality conformance inspection provided that the contractor has removed or repaired all nonconforming containers

4 7 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 PACKAGING

5 1 Preservation packaging Preservation-packaging of the compass liquid shall be in accordance with MIL-STD-290 The levels of packaging and packing shall be as specified in 6 2 Unless otherwise specified, the fluid shall be furnished in one-quart and one-gallon metal cans conforming to type I of PPP-C-96 All materials used in the construction of the containers shall be such that they will not affect or be affected by the contained compass liquid Just prior to filling, all containers shall be thoroughly cleaned, rinsed with clean filtered fluid and examined to ensure absolute absence of loose solder, dirt, fibers, linet, metal particles seaming compound, corrosion products, water or other foreign contaminants. The bottom seam shall show no extruded seaming compound and there shall be no seaming compound on the body immediately adjacent to the side seam Visible seaming compound, evenly distributed and forming a very fine edge at the point of contact of the seam with the body, shall not be cause for rejection If a soldered seam is used in the fabrication of the can, residual soldering flux shall not be present on the inside seam of the container

5 2 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 information·

NATO CODE S-712

6 NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6 1 Intended use. The material covered by this specification is intended for use in aircraft magnetic compasses.

6.2 Acquisition requirements. Acquisition documents should specify the following information:

a. Title, number and date of this specification

b Type and size of container (see 5.1 and 6 2)

c. Quantity

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

e. Whether a first article sample is required.

f. Issue of DODISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.1 and 2.2).

6.3 Data requirements. The following Data Item Description (DID) must be listed, as applicable, on the Contract Data Requirements List (DD Form 1423) when this specification is applied on a contract, in order to obtain the data, except where DOD Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference paragraph	DID number	DID title	Suggested tailoring
4.3			

The above DID was cleared as of the date of this specification. The current issue of DOD 5010 12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only a current, cleared DID is cited on the DD Form 1423.

6 4 Unit of purchase The material should be purchased by volume, the unit being one U.S. gallon at 15 6°C

6 5 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, or a standard production item from the contractor's current inventory and the number of items to be tested as specified in 4.4. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles Invitations for bids should provide that the Government reserves the right to waive the requirements for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6 6 Subject term (key word) listing

Cloudiness and freezing point

Corrosion

Crude petroleum

Fluorescence

6 7 International standardization Certain provision 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

6 8 Changes from previous issues. Marginal notations are not used in this revisions to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians

Army - AV
Navy - AS
Air Force - 11

Preparing activity

Air Force - 11

International interest:
(see section 6)

Proj No. 9150-1069

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-L-5020C	910Mar 27

3. DOCUMENT TITLE

Liquid, Compass, Aircraft

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code) (1) Commercial	(2) AUTOVON
ASD/ENES	(513) 255-6295	785-6295
c. ADDRESS (Include Zip Code) Wright-Patterson AFB OH 45433-6503	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	