

METRIC

MIL-DTL-5020D
31 July 2003
SUPERSEDING
MIL-L-5020C
27 March 1991

DETAIL SPECIFICATION

LIQUID, COMPASS, AIRCRAFT

Inactive for new design as of 4 August 1995.

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 a refined fraction of crude petroleum, intended for use in fluid-filled aircraft magnetic compasses.

1.2 Classification.

1.2.1 Military symbol. The product represented under this specification is identified by military symbol FDC.

1.2.2 NATO code. The product represented under this specification is identified by NATO code number S-712.

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to: Defense Supply Center Richmond, ATTN: DSCR-VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6810

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

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents should be 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

TT-P-54C - Paint, Phosphorescent, Ready-Mixed (Non-Radioactive).

STANDARDS

FEDERAL

FED-STD-791 - Lubricants, Liquid Fuels and Related Products, Methods of Testing.

DEPARTMENT OF DEFENSE

MIL-STD-1916 - DoD Preferred Methods for Acceptance of Product.

(Unless otherwise indicated, copies of the above specifications and standards are available from the Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Electronic copies of military and federal standards and specifications may be obtained from <http://assist.daps.dla.mil/quicksearch/>.)

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2.2.2 Other government publications. The following other government publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation (see 6.2).

CODE OF FEDERAL REGULATIONS

29 CFR 1910 - Occupational Safety and Health Standards.

(Application for copies should be addressed to the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. Electronic copies may be obtained from <http://www.access.gpo.gov/>.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of documents that are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

ASTM INTERNATIONAL

ASTM D 56	- Standard Test Method for Flash Point by Tag Closed Cup Tester (DoD adopted).
ASTM D 86	- Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure (DoD adopted).
ASTM D 130	- Standard Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test (DoD adopted).
ASTM D 156	- Standard Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method) (DoD adopted).
ASTM D 445	- Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity) (DoD adopted).
ASTM D 1319	- Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption (DoD adopted).
ASTM D 4057	- Standard Practice for Manual Sampling of Petroleum and Petroleum Products.

(Application for copies should be addressed to ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959. Electronic copies may be obtained from <http://www.astm.org/>.)

2.4 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 regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Material. The liquid shall be a refined fraction of crude petroleum, filtered to be free of visible contamination, and entirely applicable and appropriate 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. Compass liquid properties.

Characteristic		Specified
Copper corrosion (max.)		1a
Flash point °C (min.)		32.2
Distillation range end point °C (max.)		260
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 (max.)	2.30
Aromatics, vol % (max.)		10.0

¹Requirements shall be met after 18 hours of exposure (see 4.4.2).

²See 4.4.3.

3.4 Liquid performance. The performance of the compass liquid shall conform to the following requirements.

3.4.1 Freezing point and cloudiness. When tested as specified in 4.4.4, the compass liquid shall not gel, crystallize, or solidify after being maintained at a temperature at or below -53.9 °C for a time period of 30 minutes. At the end of the test, the turbidity or haze of the liquid shall not be greater than the turbidity standard for barium sulfate suspension as determined in 4.4.4.1.

3.4.2 Fluorescence. The fluorescence of the compass liquid shall not exceed 1.0 microlambert as determined in accordance with 4.4.5.

3.5 Toxicity. The compass liquid shall have no adverse effect on the health of personnel when used for its intended purpose. The compass liquid shall not contain elements that produce noxious vapors or irritate personnel during formulation or use under conditions of adequate ventilation. Caution shall be exercised to avoid prolonged contact with the skin. Occupational Safety and Health Administration (OSHA) standards and guidelines shall be observed in accordance with 29 CFR 1910. Questions pertaining to any toxic effects of the liquid shall be referred by the procuring activity to the appropriate departmental medical service that will act as an advisor to the procuring activity.

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

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. When first article inspection is required (see 3.1 and 6.2), the number and type of units shall be specified (see 6.2). Each submitted unit shall undergo the examination for defects specified in table II, the examinations specified in paragraphs 4.4.1 through 4.4.6, and the tests specified in 4.5. Any unit displaying any major defect shall be rejected. Any unit failing any of the tests in 4.5 shall be rejected.

4.3 Conformance inspection. Conformance inspection shall consist of the visual examination for defects listed in table II as well as the examinations of paragraphs 4.4.1 through 4.4.6. Unless otherwise specified (see 6.2), the manufacturer shall select the type of sampling plan (attribute, variable, or continuous) in accordance with MIL-STD-1916. The sample size shall be selected in accordance with verification level I of MIL-STD-1916.

TABLE II. Classification of defects.

Examination	Defect	Major
Contamination	Contamination is visible in the liquid	101
Color and precipitation determination for light stability	Saybolt color scale minimum value less than +21	102
	Precipitation is present after light stability test	103
Color and reaction determination for oxygen stability	Color and reaction not as specified	104
	Precipitation is present after oxygen stability test	105
Freezing point and cloudiness	Gelling, crystallization, or solidification of the liquid is present	106
	The turbidity of the compass liquid sample is greater than that of the turbidity standard	107
Fluorescence	Fluorescence exceeds 1.0 microlambert	108
Filled container	Construction is defective	109
	Container is leaking	110
	Container is not filled to proper level	111

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4.4 Examinations.4.4.1 Test preparation.

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

b. Conduct the examinations in accordance with method 9601 of FED-STD-791.

4.4.2 Color and precipitation determination for light stability. The following test procedures shall be performed.

a. Fill a Vycor[®] test tube, or an equivalent high temperature test tube, measuring approximately 25 millimeters (mm) outside diameter and 200 mm long with compass liquid.

b. Enclose the compass liquid in a Corex D[®] globe, or equivalent filtering globe, and expose it to the light of a 13-ampere carbon arc lamp using Atlas Fade-Ometer[®] No. 70 and No. 20 carbons, or equivalent.

c. Place the test tube in a vertical position 1 foot from the arc, or a distance recommended by the manufacturer of the test instrument as applicable, and in approximately the same horizontal plane. Make color determinations after exposure of 1, 4, and 18 hours.

d. Examine the sample for precipitation after the light stability test has been performed. There shall be no precipitation.

4.4.3 Color and reaction determination for oxygen stability. The following test procedures shall be performed.

a. Fill a suitable glass container, such as an oil sample bottle, to nearly the top of the container with compass liquid and place it into a suitable metal bomb having an internal capacity of approximately one and one half times the external volume of the bottle.

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

c. Test the metal bomb for leaks. If the test displays no leaks then place the bomb in a suitable bath maintained at 95 °C to 100 °C for 6 hours.

d. Cool the metal bomb in cold water and remove the sample. Subject the sample to the Saybolt color and oxidation reaction tests in this specification.

e. Examine the sample for the presence of precipitation after the oxygen stability test has been performed. There shall be no precipitation.

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4.4.4 Freezing point and cloudiness. The following test procedures shall be performed.

4.4.4.1 Preparation of barium sulfate turbidity standard. The following test procedures shall be performed.

a. Pour 25 milliliters (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 as the turbidity standard.

4.4.4.2 Storage of compass liquid for examination. 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.

4.4.4.3 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 10 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 4.4.4.1.

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.

4.4.5 Fluorescence. The following measuring procedures shall be performed using an illuminometer or low-brightness photometer capable of accurately measuring ultraviolet light in the spectral region of 365 nanometers (nm). The illuminometer or photometer shall have the capability of taking brightness or luminance measurements at a 45-degree angle of incidence, or the manufacturer of the test system shall provide an equivalent method for brightness measurement.

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

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b. Measure the brightness at a 45-degree angle to the plane of the flat surface at the absorption cell. The illumination shall be incident at a 45-degree angle to the plane of the flat surface of the absorption cell and shall approach the sample at right angles to the direction of observation. A non-fluorescent 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 wavelength until it reaches a constant brightness. The proper intensity of the light source and specimen shall be determined with the aid of a pre-calibrated reference standard designed for ultraviolet light intensity calibration. The method of calibrating the light source intensity shall be one acceptable to the customer. The luminance or brightness value shall be reported in effective microlamberts as defined in TT-P-54.

4.4.6 Examination of filled containers. Each sample container shall be examined for defective construction, evidence of leakage, and net content.

4.5 Tests. Tests shall be performed in accordance with the applicable methods specified in table III to determine conformance with the requirements specified in 3.3.

TABLE III. Test methods for inspections.

Characteristic	ASTM methods	Other methods
Copper corrosion	ASTM D 130	
Flash point	ASTM D 56	
Distillation	ASTM D 86	
Reaction after oxidation		FED-STD-791 method 5101
Color	ASTM D 156	
Kinematic viscosity	ASTM D 445	
Aromatic content	ASTM D 1319	

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the inventory control point's packaging activity within the military department or defense agency, or within the military department's system command. Packaging data retrieval is available from the managing military department's or defense agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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

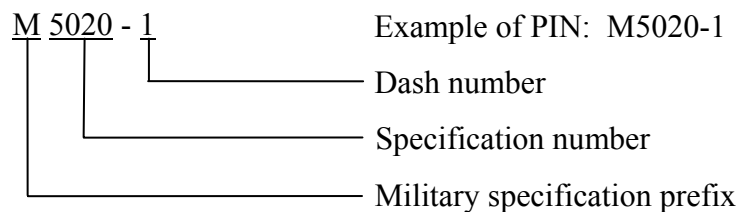
6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1, 2.2.2, and 2.3).
- c. When first article inspection is required (see 3.1 and 4.2).
- d. Number and type of units required for first article inspection (see 4.2).
- e. Sampling plan, if different (see 4.3).
- f. Packaging requirements (see 5.1).
- g. Hazardous material identification and MSDS (see 6.4).
- h. Activities requiring a copy of the MSDS (see 6.4).

6.3 Recommended packaging. It is recommended that the aircraft compass liquid be packaged in one quart and one gallon containers chemically resistant to the solvent effects of the liquid.

6.4 Material safety data sheet (MSDS). Contracting officers will identify those activities requiring copies of the completed MSDS prepared in accordance with FED-STD-313 and meeting the requirements of 29 CFR 1910.1200. The pertinent government mailing addresses for submission of the data are listed in FED-STD-313, and 29 CFR 1910.1200 requires that the MSDS for each hazardous chemical used in an operation must be readily available to personnel using the material. Contracting officers will identify the activities requiring copies of the MSDS (see 6.2).

6.5 Part or identifying number (PIN). The PIN to be used for the aircraft compass liquid acquired to this specification is created as follows:



6.6 Subject term (key word) listing.

magnetic
mineral spirits
naphtha
petroleum

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6.7 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreements ASCC Air Standard 15/9 and NATO STANAG 1135. When an amendment, revision, or cancellation of this specification is proposed that will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:

Army - AV

Navy - AS

Air Force - 11

Preparing Activity:

DLA - GS3

(Project 6810-1696)

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
MIL-DTL-5020D

2. DOCUMENT DATE (YYYYMMDD)
20030730

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) DSN
(if applicable)

7. DATE SUBMITTED
(YYYYMMDD)

8. PREPARING ACTIVITY

a. NAME
Defense Supply Center Richmond

b. TELEPHONE *(Include Area Code)*
Commercial: (804) 279-5019 DSN: 695-5019

c. ADDRESS *(Include Zip Code)*
ATTN: DSCR-VEB (C. Hammond)
8000 Jefferson Davis Highway
Richmond, VA 23297-5616

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
DEFENSE STANDARDIZATION PROGRAM OFFICE (DLSC-LM)
8725 John J. Kingman Road, Suite 2533
Fort Belvoir, VA 22060-6221
Commercial: (703) 767-6888 DSN: 427-6888