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MILITARY SPECIFICATION

ANTIFREEZE, ETHYLENE GLYCOL, INHIBITED, HEAVY DUTY, SINGLE PACKAGE

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 type of antifreeze compound for use in the cooling system of liquid-cooled internal combustion engines other than aircraft for protection against freezing in ambient temperatures as low as -51 °C (see 6.1). The antifreeze is identified by NATO code number S-750 (see 6.4). No military symbol is recorded.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form 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).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: USA Belvoir Research, Development, and Engineering Center, ATTN: STRBE-TSE, Fort Belvoir, VA 22060-5606 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6850

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SPECIFICATIONS

FEDERAL

NN-P-71	- Pallet, Material Handling, Wood, Stringer Construction, 2 Way and 4 Way (Partial).
UU-T-81	- Tag, Shipping and Stock.
PPP-B-601	- Boxes, Wood, Cleated Plywood.
PPP-B-636	- Box, Shipping, Fiberboard.
PPP-C-569	- Container, Plastic, Molded (for Liquids, Pastes and Powders), Overpacked.
PPP-C-1337	- Container, Composite, (Steel Drum with Polyethylene Insert).
PPP-D-1860	- Drum, Plastic, Molded Polyethylene.
PPP-T-60	- Tape, Packaging, Waterproof.

MILITARY

MIL-P-116	- Preservation, Methods of.
MIL-E-9500	- Ethylene Glycol, Technical.
MIL-F-16377	- Fixtures, Lighting; and Associated Parts; Shipboard Use, General Specification for.
MIL-B-26701	- Bottles, Screw Cap and Carboys, Polyethylene Plastic.
MIL-D-43703	- Drums, Shipping and Storage, Molded Polyethylene.

STANDARDS

FEDERAL

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

MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129	- Marking for Shipment and Storage.
MIL-STD-147	- Palletized Unit Loads.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 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.

CODE OF FEDERAL REGULATIONS

49 CFR 177 - 179	- Department of Transportation Rules and Regulations for the Transport of Explosives and Other Dangerous Articles.

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(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

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 adopted are those listed in the issue of the DODISS cited 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)

D 92 - Flash and Fire Points by Cleveland Open Cup.
D 929 - Borax.
D 1119 - Ash Content of Engine Coolants and Antirusts.
D 1120 - Boiling Point of Engine Coolants.
D 1121 - Reserve Alkalinity of Engine Antifreeze, Antirusts and Coolants.
D 1122 - Specific Gravity of Engine Coolants by the Hydrometer.
D 1123 - Water in Engine Coolant Concentrate by the Karl Fischer Reagent Method.
D 1176 - Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes.
D 1238 - Flow Rates of Thermoplastics by Extrusion Plastometer.
D 1287 - pH of Engine Antifreezes, Antirusts, and Coolants.
D 1881 - Foaming Tendencies of Engine Coolants in Glassware.
D 3321 - Use of the Refractometer for Field Test Determination of the Freezing Point of Aqueous Engine Coolants.
D 3634 - Trace Chloride Ion in Engine Coolants.
E 29 - Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.
E 202 - Analysis of Ethylene Glycols and Propylene Glycols.

(Application for copies should be addressed to the 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, (except for related associated detail specifications, specification sheets or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. Unless otherwise specified (see 6.2), a sample shall be subjected to first article inspection (see 6.6) in accordance with 4.5.

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3.2 Materials. Materials shall be as specified herein.

3.2.1 Recovered materials. For the purposes of this requirement, recovered materials are those materials which have been collected from waste materials and reprocessed to become a source of raw materials, as distinguished from virgin raw materials. The components used in the antifreeze may be newly fabricated from recovered materials, provided the antifreeze produced meets all the requirements of this specification.

3.3 Composition. The antifreeze compound shall consist of a blend of the materials specified in table I.

TABLE I. Chemical composition.

Components	Weight Percent	Applicable Test Para.
Total water	5.00 ±0.5	4.7.2.1
Trisodium phosphate, calculated as dodecahydrate	0.30 ±0.04	4.7.2.2
Ethylene glycol, technical, MIL-E-9500, minimum	77.6	4.7.2.3
Total vicinal glycols, minimum	87.6	4.7.2.4
Sodium tetraborate, decahydrate, technical, ASTM D 929	4.00 ±0.2	4.7.2.5
Sodium salt of tolyltriazole, 50% aqueous solution, by weight	0.25 ±0.05	4.7.2.6
Antifoaming agent 1/	0.02 ±0.005	3/
Dye 2/	0.007 ±0.001	3/

1/ The antifoaming agent shall be of the polyoxyalkylene glycol type such as Pluronic L-61 supplied by BASF, Wyandotte, Inc., Wyandotte, MI or an equivalent.
2/ The dye used shall be alizarine green G Extra 100 percent or an equivalent.
3/ Test not available.

3.4 Chemical requirements.

3.4.1 pH. The pH of undiluted antifreeze shall be 5.8 to 6.8 and a 30-percent aqueous solution (by volume) shall be 7.5 to 8.0 when determined as specified in 4.7.2.7.

3.4.2 Reserve alkalinity. The reserve alkalinity of undiluted antifreeze shall be not less than 20 when determined as specified in 4.7.2.8.

3.4.3 Ash. The ash content of undiluted antifreeze shall be not more than 2.0 percent by weight when determined as specified in 4.7.2.9.

3.4.4 Alkaline earths. The undiluted antifreeze shall form no immediate precipitate when tested as specified in 4.7.2.10.

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3.4.5 Sulfates and carbonates. There shall be no undissolved precipitate or effervescence when tested as specified in 4.7.2.11. A slight turbidity is allowed.

3.4.6 Chlorides. The undiluted antifreeze shall give a negative test for chlorides when tested as specified in 4.7.2.12.

3.5 Physical requirements.

3.5.1 Boiling point. The equilibrium boiling point of the undiluted antifreeze compound shall be not lower than 149 °C when determined as specified in 4.7.2.13.

3.5.2 Flash point. The flash point of the undiluted antifreeze compound shall be not lower than 110 °C when determined as specified in 4.7.2.14.

3.5.3 Specific gravity. The specific gravity of the undiluted antifreeze shall be 1.105 to 1.135 at 15.5/15.5 °C when determined as specified in 4.7.2.15.

3.5.4 Freeze point. The freeze point of aqueous solutions of the antifreeze shall be as specified in table II when tested as specified in 4.7.2.16.

TABLE II. Freeze point of aqueous solutions.

Concentration (percent by volume)	Freeze point (min °C)
50	Not above -34
30	Not above -14

3.5.5 Foaming. The undiluted antifreeze shall show a maximum of 150 mL of foam after 5 minutes and the foam shall break within 5 seconds when tested as specified in 4.7.2.17.

3.6 Toxicological product formulation. The material shall have no adverse effect on the health of personnel when used for its intended purpose. 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.

3.6.1 Material Safety Data Sheets. Material Safety Data Sheets shall be prepared and submitted in accordance with FED-STD-313 (see 6.5).

3.7 Transportability. Wherever and whenever applicable packaging, packing, and marking of antifreeze compound shall be prepared for delivery in accordance with the requirements of the Code of Federal Regulations 49 CFR, Parts 177-179.

3.8 Limiting values. The following applies to all specified limits in this specification: For purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand digit used in expressing the specification limit in accordance with the rounding-off method of ASTM E 29.

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3.9 Workmanship. The undiluted antifreeze shall meet all the chemical and physical requirements of this specification. In addition to these requirements, the undiluted antifreeze shall be translucent in appearance, but free of any insoluble suspensions, such as dirt, undissolved additive, or foreign matter. The undiluted antifreeze shall be free of visibly excessive amounts of antifoaming agent.

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 shall 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 acceptance of defective material.

4.2 Inspection lot. All compounded antifreeze of the same type manufactured as one batch and offered for delivery at one time shall be considered a lot for purposes of acceptance inspection and tests.

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

a. First article inspection (see 4.5).
b. Quality conformance inspection (see 4.6).
c. Inspection of packaging (see 4.8).

4.4 Toxicological product formulation review. The contractor shall have the toxicological product formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use through the submission of the material safety data sheet detailed in FED-STD-313 (see 3.6 and 6.5).

4.5 First article inspection.

4.5.1 First article examination. The first article shall be examined as specified in 4.7.1. If one or more defects are found, the lot will be rejected.

4.5.2 First article tests. The first article shall be tested as specified in 4.7.2.1 through 4.7.2.17. Failure of any test shall be cause for rejection.

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4.6 Quality conformance inspection.

4.6.1 Sampling. Sampling for examination and tests shall be in accordance with MIL-STD-105. Sample size shall be determined by using MIL-STD-105, table I and table IIa. A lot shall be accepted when zero defects are found and rejected when one or more defects are found.

4.6.2 Examination. Samples selected as specified in 4.6.1 shall be examined as specified in 4.7.1. Presence on one or more defects shall be cause for rejection.

4.6.3 Tests. Samples selected as specified in 4.6.1 shall be tested as specified in 4.7.2.1 through 4.7.2 17. Failure of any test shall be cause for rejection.

4.7 Inspection procedure.

4.7.1 Examination. The antifreeze extender additive shall be examined as specified herein for the following defects:

101. Material not as specified (see 3.2).
102. Workmanship not as specified (see 3.9).

4.7.2 Tests.

4.7.2.1 Water content. The water content of the undiluted antifreeze shall be determined in accordance with ASTM D 1123. Nonconformance to table I shall constitute failure of this test.

4.7.2.2 Trisodium phosphate dodecahydrate. Any quantitative spectrographic or wet chemical method that can be shown to produce the accuracy necessary to assure conformance of the antifreeze to the requirement in table I may be used to determine the trisodium phosphate dodecahydrate concentration. Certification of the test method is required prior to acceptance by the Government. Application for certification should be forwarded to US Army Belvoir Research, Development, and Engineering Center, ATTN: STRBE-VF, Ft. Belvoir, VA 22060-5606. Nonconformance to table I shall constitute failure of this test.

4.7.2.3 Ethylene glycol content. The ethylene glycol content of the undiluted antifreeze shall be determined in accordance with ASTM E 202. Nonconformance to table I shall constitute failure of this test.

4.7.2.4 Glycols having hydroxyls on adjacent carbons (vicinal glycols). The determination of the content of glycols having hydroxyls on adjacent carbons in their molecular structure shall be made using the reagents and procedure specified hereinafter.

4.7.2.4.1 Reagents.

a. 0.4 N sodium periodate solution (prepared by weight exactly 10.6 grams of metasodium periodate, $NaIO_4$, and dissolving in sufficient distilled water to make 1 liter of solution).
b. 0.2 N sodium thiosulfate solution.
c. 30 percent potassium iodide solution.

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d. Starch solution.
e. 20 percent sulfuric acid solution.

4.7.2.4.2 Procedure. Weigh, by differences, 2.6 to 2.8 grams of the undiluted antifreeze in a 250-mL volumetric flask. The weight shall be determined to the nearest tenth of a milligram. Make up to volume mark with distilled water and mix thoroughly. Transfer a 10-mL aliquot of the solution to a 500-mL iodine flask. Add exactly 50 mL of the sodium periodate solution. Stopper the flask and allow the mixture to react. Run 2 blanks in the same manner. After 1 hour, add 150 mL of distilled water followed by 20 mL of the sulfuric acid solution and 40 mL of the potassium iodide solution. (Note: The blanks should each require 95 to 100 mL of the thiosulfate solution for titration, while the sample mixture should require 78 to 90 mL.

4.7.2.4.3 Calculation of glycols having hydroxyls on adjacent carbons.

$$\text{percent by weight} = \frac{0.0317 \times 25 \times (B - S) \times N \times 100}{W}$$

Where: B = mL of thiosulfate solution required by the blank (average of 2 blank runs).
S = mL of thiosulfate solution required by the sample aliquot.
N = Normality of the thiosulfate solution.
W - Weight of the sample, grams.

Nonconformance to table I shall constitute failure of this test.

4.7.2.5 Sodium tetraborate decahydrate. Any quantitative spectrographic or wet chemical method that can be shown to produce the accuracy necessary to assure conformance of the antifreeze to the requirement in table I may be used to determine the sodium tetraborate decahydrate concentration. Certification of the test method is required prior to acceptance by the Government. Application for certification should be forwarded to US Army Belvoir Research, Development, and Engineering Center, ATTN: STRBE-VF, Ft. Belvoir, VA 22060-5606. Nonconformance to table I shall constitute failure of this test.

4.7.2.6 Quantitative test for sodium tolyltriazole. Any quantitative spectrographic or wet chemical method that can be shown to produce the accuracy necessary to assure conformance of the antifreeze to the requirement in table I may be used to determine the sodium tolyltriazole concentration. Certification of the test method is required prior to acceptance by the Government. Application for certification should be forwarded to US Army Belvoir Research, Development, and Engineering Center, ATTN: STRBE-VF, Ft. Belvoir, VA 22060-5606. Nonconformance to table I shall constitute failure of this test.

4.7.2.7 pH. The pH of the undiluted antifreeze, and of a 30-percent aqueous solution of the material prepared as specified in 4.7.2.16.1, shall be determined electrometrically, using the apparatus and the procedure specified in ASTM D 1287. Nonconformance to 3.4.1 shall constitute failure of this test.

4.7.2.8 Reserve alkalinity. The reserve alkalinity of the undiluted antifreeze shall be determined electrometrically using the apparatus and procedure specified in ASTM D 1121. Nonconformance to 3.4.2 shall constitute failure of this test.

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4.7.2.9 Ash content. The ash content of the undiluted antifreeze shall be determined in accordance with ASTM D 1119. Nonconformance to 3.4.3 shall constitute failure of this test.

4.7.2.10 Alkaline earths. Place 10 mL of the undiluted antifreeze in a 30-mL test tube. Make alkaline to litmus with ammonium hydroxide solution. Add 5 mL of 95 percent ethyl alcohol, reagent grade. Add 5 mL of 0.5 N ammonium oxalate. No immediate precipitate shall form. Nonconformance to 3.4.4 shall constitute failure of this test.

4.7.2.11 Sulfates and carbonates. Place 10 mL of the undiluted antifreeze in a 30-mL test tube. Add 10 mL of distilled water and mix. Add 2 mL of a 5 percent aqueous solution of barium chloride. A precipitate will form. Add 1 mL glacial acetic acid. There shall be no undissolved precipitate or effervescence. A slight turbidity is allowed. Nonconformance to 3.4.5 shall constitute failure of this test.

4.7.2.12 Chlorides. The chlorides content of the undiluted antifreeze shall be determined in accordance with ASTM D 3634. Nonconformance to 3.4.6 shall constitute failure of this test.

4.7.2.13 Boiling point. The boiling point of the undiluted antifreeze shall be determined in accordance with ASTM D 1120. Nonconformance to 3.5.1 shall constitute failure of this test.

4.7.2.14 Flash point. The flash point of the undiluted antifreeze shall be determined in accordance with ASTM D 92. Nonconformance to 3.5.2 shall constitute failure of this test.

4.7.2.15 Specific gravity. Specific gravity of the undiluted antifreeze shall be determined in accordance with ASTM D 1122. Nonconformance to 3.4.3 shall constitute failure of this test.

4.7.2.16 Freeze point. The freeze point of aqueous solutions of the undiluted antifreeze (see table II) prepared as specified in 4.7.2.16.1, shall be determined in accordance with ASTM D 3321. Nonconformance to 3.5.4 shall constitute failure of this test.

4.7.2.16.1 Preparation of aqueous solutions. Aqueous solutions of the undiluted antifreeze shall be prepared on the basis of percentage by volume of the components in accordance with ASTM D 1176.

4.7.2.17 Foaming test. The undiluted antifreeze shall be tested for foaming tendencies by ASTM D 1881. Nonconformance to 3.5.5. shall constitute failure of this test.

4.8 Inspection of packaging.

4.8.1 Quality conformance inspection of packing.

4.8.1.1 Unit of product. For the purpose of inspection, a completed pack prepared for shipment shall be considered a unit of product.

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4.8.1.2 Examination. Each unit of product shall be examined for the following defects.

103. Preservation not as specified for level A (see 5.1).
104. The net contents of sample unit container is less than the specified unit container volume (see 5.1.1.1 thru 5.1.1.4).
105. The net contents of sample unit container has an overfill volume greater than one percent of the specified unit container volume (see 5.1.1.1 thru 5.1.1.4).
106. Packing not as specified for level A, B, or C (see 5.2).
107. Marking incorrect, illegible or missing (see 5.3).
108. Radiator tags not as specified (see 5.4).
109. Palletization not as specified when required (see 5.5).

5. PACKAGING

5.1 Preservation. Preservation shall be level A.

5.1.1 Level A.

5.1.1.1 One quart quantity. One quart antifreeze shall be unit packed in a container conforming to PPP-C-569, type I, class A, as specified in its appendix thereto or in a one quart capacity polyethylene plastic bottle conforming to MIL-B-26701. A leak-proof inner seal shall be furnished for each container. The filled container shall be tightly closed to prevent leakage of contents.

5.1.1.2 One gallon quantity. One U.S. gallon of antifreeze shall be unit packed as specified for the one quart quantity except the plastic container and box specified in PPP-C-569 shall be type I, class B and the bottle specified in MIL-B-26701 (with the ultraviolet exclusion additive) shall conform to the one-gallon capacity size. A leak-proof inner seal shall be furnished for each container. The filled container shall be tightly closed to prevent leakage of contents.

5.1.1.3 Five gallon quantity. Five U.S. gallons of antifreeze shall be unit packed as specified in PPP-C-1337 in a type II, class 1 metal container fitted with a polyethylene insert, or MIL-D-43703 size I container. A leak-proof, either inner seal or pilfer-proof locking seal shall be furnished with the screw-cap closure of each container. The filled container shall be tightly closed to prevent leakage of contents.

5.1.1.4 Fifty-five gallon quantity. Fifty-five U.S. gallons of antifreeze shall be unit packed as specified in PPP-C-1337 in a type II, class 4 metal container fitted with a polyethylene insert or a nominal 55-gallon capacity polyethylene drum conforming to PPP-D-1860. The PPP-D-1860 polyethylene shall have a specific gravity of 0.941 to 0.965 and a melt index of 0.20 to 1.2 gm per 10 minutes using ASTM D 1238 procedure A, 190/2.16. The filled container shall be tightly closed with rigid plastic fittings to prevent leakage of contents.

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5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

5.2.1 Level A.

5.2.1.1 One quart and one gallon quantities. Twelve one-quart or six one-gallon bottles of antifreeze unit preserved as specified in 5.1.1.1 and 5.1.1.2, respectively, shall be packed within a close fitting box conforming to PPP-B-601, type overseas. Interlocking partitions, fabricated from fiberboard shall be utilized to separate bottles as required.

5.2.1.2 Five gallon and fifty-five gallon quantities. The five and fifty-five gallon quantities shall require no further packing than that specified in 5.1.1.3 and 5.1.1.4, respectively.

5.2.2 Level B.

5.2.2.1 One quart and one gallon quantities. Packing shall be as specified in 5.2.1.1, except exterior box shall conform to PPP-B-636, class weather resistant, variety single wall, grade optional.

5.2.2.2 Five-gallon and fifty-five gallon quantities. The five and fifty-five gallon quantities shall require no further packing than that specified in 5.1.1.3 and 5.1.1.4, respectively.

5.2.3 Level C.

5.2.3.1 One quart and one gallon quantities. Packing shall be as specified in 5.2.1.1, except the exterior box shall be in accordance with PPP-B-636, class domestic, variety single wall, grade optional.

5.2.3.2 Five-gallon and fifty-five gallon quantities. The five and fifty-five gallon quantities shall require no further packing than that specified in 5.1.1.3 and 5.1.1.4, respectively.

5.3 Marking. Marking shall be in accordance with MIL-STD-129. In addition, each container shall be marked with the information as shown in figure 1.

5.4 Protection table and radiator tags. Unless otherwise specified (see 6.2), protection tables and radiator tags for the antifreeze shall be provided on, or with, containers of antifreeze in the following quantities. Not less than 4 tags or labels shall be furnished with each 24 one-quart containers or 6 one-gallon containers, 3 tags or labels with each 5-gallon container, and 20 tags or labels with each 55-gallon container. Pressure sensitive labels may be used in lieu of radiator tags. Radiator tags shall conform to UU-T-81, type B, grade 20R, wire string size 5 and shall be marked on side 1 and 2 as shown in figure 2. Radiator labels shall conform to the labels described in MIL-F-16377 except that the adhesive shall be protected by release paper backing and marking shall be made with waterproof ink. Nonwaterproof ink may be used provided it is protected by the application of a transparent waterproof coating. These labels shall be 6 cm wide and 15 cm long ±2 mm and shall be marked as shown in figure 3. Tags or labels shall be packed together in a bag in accordance with MIL-P-116, method IC-3. The bag shall be placed in the box or on the drum, as applicable. When placed in a box, the bag shall be placed flat on the top of the contents and beneath the box flaps. When placed on the drum, the bag shall be secured to the

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drum with tape conforming to PPP-T-60, type IV, class 1, in an area not normally exposed to abrasion.

5.5 Palletization. When specified (see 6.2), like packs of one-quart, one-gallon, and five-gallon quantities shall be palletized. Level A, B, and C packs shall be palletized in accordance with the applicable requirements including those for opaque stretch wrapped film bonding of MIL-STD-147, using the pallet conforming to NN-P-71, type IV, size 2. The alternate five-gallon polyethylene container conforming to MIL-D-43703 shall be palletized using the vertical frame supports in the form of side frames, storage aid 10, and frame supports, storage aid 13 with the wood cap storage aid 5. A maximum of 36 five-gallon drums shall be placed on a pallet.

6. NOTES

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

6.1 Intended use. Inhibited ethylene glycol (i.e., undiluted antifreeze) is intended for use in the cooling systems of liquid-cooled internal combustion engines, other than aircraft, for protection against freezing in ambient temperatures as low as -51 °C when diluted to 60 percent by volume with water. It may also be used as a coolant in some types of automatic guns such as water-cooled machine guns.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.
b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
c. When first article is required (see 3.1).
d. Unit quantities required (see 5.1.1.1, 5.1.1.2, 5.1.1.3, and 5.1.1.4).
e. Level of preservation and packing required (see 5.1 and 5.2).
f. When protection table and radiator tags are not required (see 5.4).
g. When palletization is required (see 5.5).
h. When a PIN number is required (see 6.9).

6.3 Additive to plastic containers. An additive which is known to be effective in excluding ultraviolet light from the interior of polyethylene containers is phthalocyanine blue.

6.4 International standardization. Certain provisions of this specification (see 1.1) are the subject of International Standardization agreements (NATO STANAG's 1135 and 2845). When amendment, revision, or cancellation of this specification is proposed which would affect or violate the international agreements concerned, the preparing activity will take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

6.5 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in appendix B of FED-STD-313.

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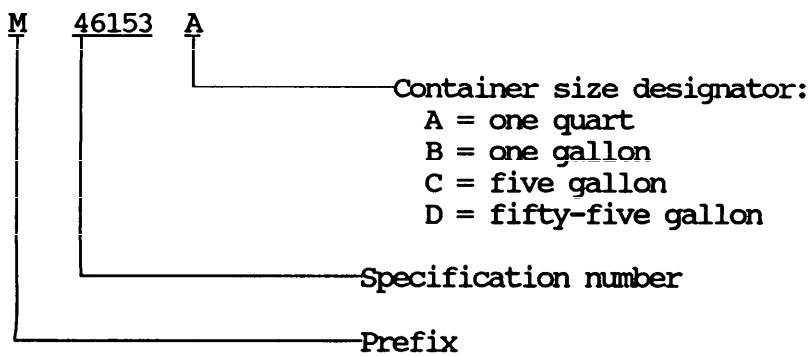
6.6 First article. When a first article inspection is required, the item should be an initial production sample. The first article should consist of four one-quart containers, when quart containers are specified, or not less than one gallon when all other containers are specified. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of the first article test results, and disposition of the first articles. Invitation for bids should provide that the Government reserves the right to waive the requirement 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. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.7 Disposability. Large quantities of antifreeze concentrate may be disposed of by mixing the material with flammable solvents and atomizing the mixture into an incinerator. Contact a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

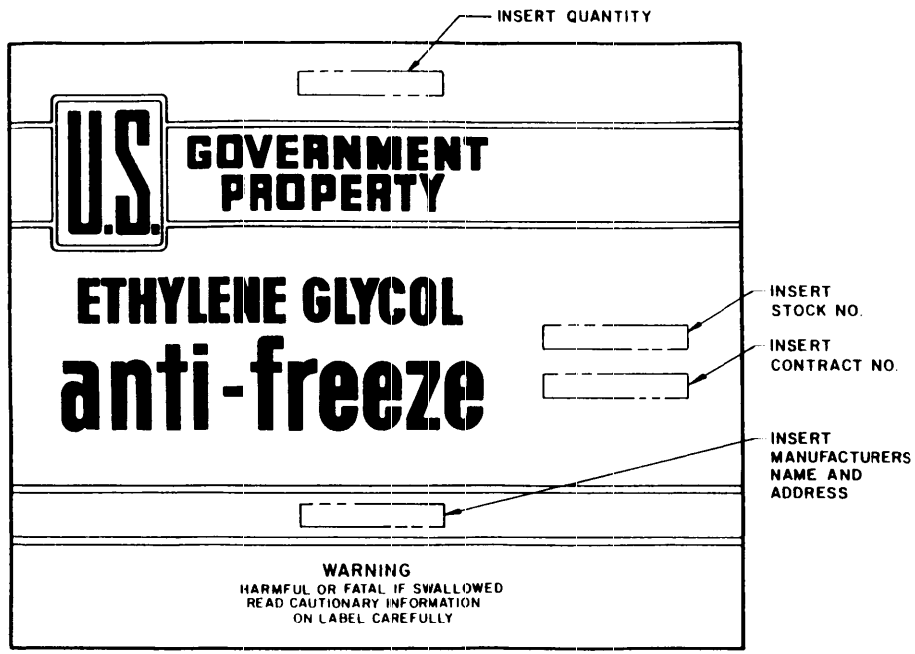
6.8 Subject term (key word) listing.

Coolant
Cooling system
Corrosion inhibitor
Engine, internal combustion
Radiator
Supplemental coolant additive

6.9 Part or identifying number (PIN). The PIN is created as shown below. It serves to identify a product during acquisition and also in the Federal supply system (see 6.2).



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



PROTECTION CHART

COOLING SYSTEM CAPACITY IN QUARTS	ANTI-FREEZE REQUIRED* (IN QUARTS)											
	2	3	4	5	6	7	8	9	10	11	12	13
5	-10	-49										
6	1	-30	-73									
7	9	-15	-46									
8		-5	-30	-61								
9		1	-19	-43	-73							
10		6	-10	-30	-55	-82						
11		10	-4	-20	-41	-64						
12			1	-13	-30	-51	-73					
13			5	-7	-22	-38	-58	-80				
14			9	-2	-15	-30	-47	-67				
15				1	-10	-23	-38	-55	-73			
16				5	-5	-17	-30	-45	-61	-79		
17				7	-1	-12	-24	-37	-52	-67		
18				9	1	-8	-19	-30	-43	-57	-73	
19					4	-4	-14	-24	-36	-49	-63	-78
20					6	-1	-10	-19	-30	-42	-55	-68
21					9	2	-7	-15	-25	-36	-47	-59
22						4	-4	-11	-20	-30	-41	-52
23						6	-1	-8	-16	-25	-35	-46
24						8	1	-6	-13	-21	-30	-40

ANTI-FREEZE 25% 33% 40% 50% 60% 68%
PROTECTS TO +13 +2 -10 -30 -55 -77
NOTE DO NOT USE WITHOUT SOME WATER
68% CONCENTRATION GIVES MAXIMUM FREEZE PROTECTION
* USE AT LEAST 33% CONCENTRATION FOR PROTECTION AGAINST RUST AND CORROSION

TEMPERATURES SHOWN IN DEGREES FAHRENHEIT

LABEL MAY BE BLACK AND WHITE OR CONTRASTING COLORS

FIGURE I. Container marking.

X-4927

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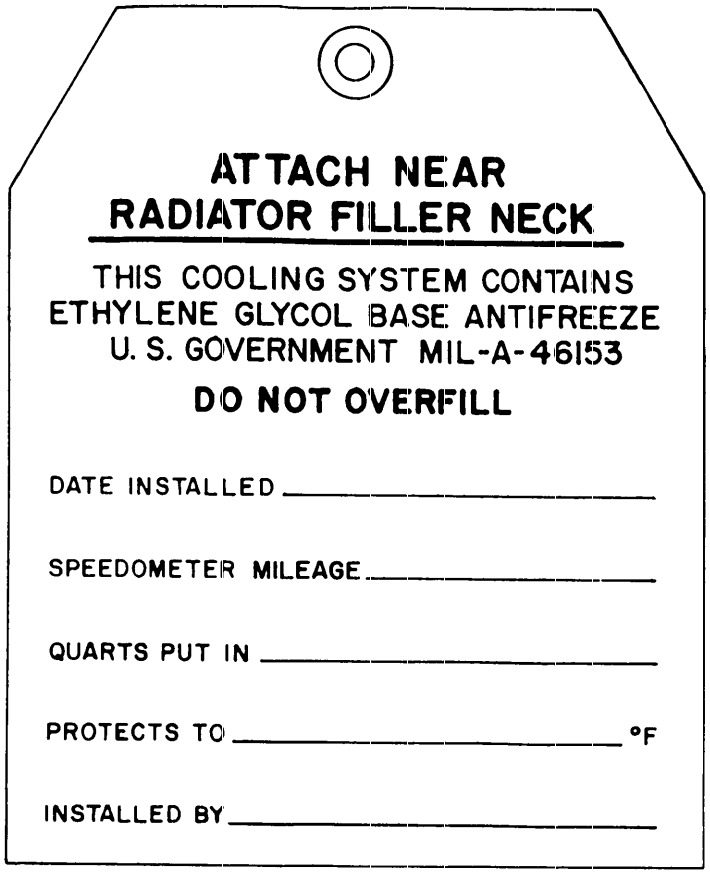
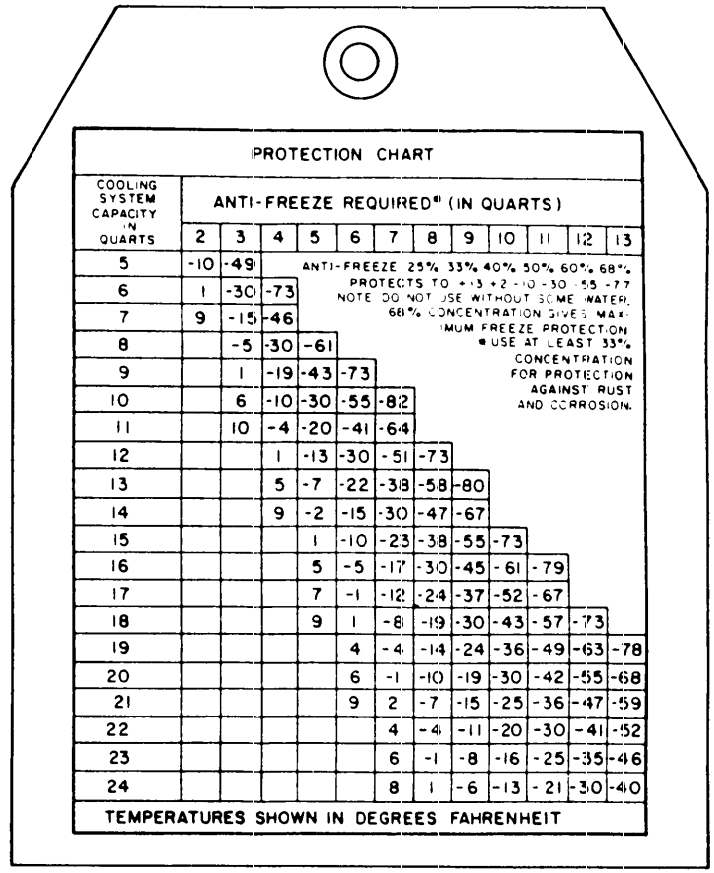


Side 1



PROTECTION CHART

COOLING SYSTEM CAPACITY IN QUARTS	ANTI-FREEZE REQUIRED* (IN QUARTS)											
	2	3	4	5	6	7	8	9	10	11	12	13
5	-10	-49										
6	1	-30	-73									
7	9	-15	-46									
8		-5	-30	-61								
9		1	-19	-43	-73							
10		6	-10	-30	-55	-82						
11		10	-4	-20	-41	-64						
12			1	-13	-30	-51	-73					
13			5	-7	-22	-38	-58	-80				
14			9	-2	-15	-30	-47	-67				
15				1	-10	-23	-38	-55	-73			
16				5	-5	-17	-30	-45	-61	-79		
17				7	-1	-12	-24	-37	-52	-67		
18				9	1	-8	-19	-30	-43	-57	-73	
19					4	-4	-14	-24	-36	-49	-63	-78
20					6	-1	-10	-19	-30	-42	-55	-68
21					9	2	-7	-15	-25	-36	-47	-59
22						4	-4	-11	-20	-30	-41	-52
23						6	-1	-8	-16	-25	-35	-46
24						8	1	-6	-13	-21	-30	-40

ANTI-FREEZE 25% 33% 40% 50% 60% 68%
PROTECTS TO +13 +2 -10 -30 -55 -77
NOTE DO NOT USE WITHOUT SOME WATER.
68% CONCENTRATION GIVES MAXIMUM FREEZE PROTECTION
* USE AT LEAST 33% CONCENTRATION FOR PROTECTION AGAINST RUST AND CORROSION.

TEMPERATURES SHOWN IN DEGREES FAHRENHEIT

Side 2

FIGURE 2. Tag.

X-4928

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ATTACH NEAR
RADIATOR FILLER NECK

THIS COOLING SYSTEM CONTAINS
ETHYLENE GLYCOL BASE ANTIFREEZE
U. S. GOVERNMENT MIL-A-46153

DO NOT OVERFILL

DATE INSTALLED _____

SPEEDOMETER MILEAGE _____

QUARTS PUT IN _____

PROTECTS TO _____ °F

INSTALLED BY _____

PROTECTION CHART

COOLING SYSTEM CAPACITY IN QUARTS	ANTI-FREEZE REQUIRED* (IN QUARTS)											
	2	3	4	5	6	7	8	9	10	11	12	13
5	-10	-49										
6	1	-30	-73									
7	9	-15	-46									
8		-5	-30	-61								
9		1	-19	-43	-73							
10		6	-10	-30	-55	-82						
11		10	-4	-20	-41	-64						
12			1	-13	-30	-51	-73					
13			5	-7	-22	-38	-58	-80				
14			9	-2	-15	-30	-47	-67				
15				1	-10	-23	-38	-55	-73			
16				5	-5	-17	-30	-45	-61	-79		
17				7	-1	-12	-24	-37	-52	-67		
18				9	1	-8	-19	-30	-43	-57	-73	
19					4	-4	-14	-24	-36	-49	-63	-78
20					6	-1	-10	-19	-30	-42	-55	-68
21					9	2	-7	-15	-25	-36	-47	-59
22						4	-4	-11	-20	-30	-41	-52
23						6	-1	-8	-16	-25	-35	-46
24						8	1	-6	-13	-21	-30	-40

ANTI-FREEZE 25% 33% 40% 50% 60% 68%
PROTECTS TO +13 +2 -10 -30 -55 -77
NOTE. DO NOT USE WITHOUT SOME WATER.
66% CONCENTRATION GIVES MAXIMUM FREEZE PROTECTION
*USE AT LEAST 33% CONCENTRATION FOR PROTECTION AGAINST RUST AND CORROSION

TEMPERATURES SHOWN IN DEGREES FAHRENHEIT

FIGURE 3. Label.

X-4929

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Custodians:
Army - ME
Navy - SH
Air Force - 68

Review activities:
Army - AT, MI, SM
Navy - YD
DLA - GS
Misc - DS

User activity:
Navy - MC

Preparing activity:
Army - ME

Project 6850-1047

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3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-A-46153C	910805

3. DOCUMENT TITLE

Antifreeze, Ethylene Glycol, Inhibited, Heavy Duty, Single Package

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
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c. ADDRESS (Include Zip Code) US Army Belvoir RDE Center ATTN: STRBE-TSE Ft. Belvoir, VA 22060-5606	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	