NOT MEASUREMENT SENSITIVE

MIL-A-53009A
2 July 1991
SUPERSEDING
MIL-A-53009
6 August 1982

MILITARY SPECIFICATION

ADDITIVE, ANTIFREEZE EXTENDER, LIQUID COOLING SYSTEMS

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 and one grade of additive intended for inhibiting water or reinhibiting used MIL-A-46153 antifreeze (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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 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).

SPECIFICATION

FEDERAL

NN-P-71	- Pallet, Material Handling, Wood, Stringer Construction, 2 Way and 4 Way (Partial).
PPP-B-601	- Boxes, Wood, Cleated Plywood.
PPP-B-621	- Boxes, Wood, Nailed and Lock Corner.
PPP-B-636	- Box, Shipping, Fiberboard.
PPP-C-569	- Container, Plastic, Molded (for Liquids, Pastes and Powders), Overpacked.

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

MILITARY

MIL-B-26701 - Bottles, Screw Cap and Carboys, Polyethylene Plastic.

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.)

2.2 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) STANDARDS

D 1121 - Reserve Alkalinity of Engine Antifreeze, Antirusts, and Coolants.
D 1122 - Specific Gravity of Engine Coolants by the Hydrometer.
D 1287 - pH of Engine Antifreezes, Antirusts and Coolants.
D 3634 - Trace Chloride Ion in Engine Coolants.
D 4727 - Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes.
E 29 - Using Significant Digits in Test Data to Determine Conformance with Specifications.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania (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 6.3) in accordance with 4.5.

3.2 Materials Materials shall be as specified herein.

3.3 Composition. The additive shall consist of an aqueous solution of sodium metaborate octahydrate, sodium mercaptobenzothiazole, and potassium silicate in the proportions specified in table 1.

TABLE I. Chemical composition.

Components	Weight Percent
Distilled or deionized water (total added)	63.4 ±0.6
Sodium metaborate octahydrate ($Na_2B_2O_4 \cdot 8H_2O$)	29.0 ±0.3
Potassium silicate solution	4.6 ±0.2
Sodium mercaptobenzothiazole, 50% aqueous solution, by weight	3.0 ±0.1

3.3.1. Sodium metaborate octahydrate. The sodium metaborate octahydrate shall be technical grade with a minimum purity of 98 percent, which will meet all requirements of this specification. When tested as specified in 4.7.2.1, the sodium metaborate octahydrate concentration shall be within the limits specified in table I.

3.3.2 Potassium silicate. The potassium silicate shall be an aqueous solution containing 38.80 weight percent potassium silicate. The weight ratio of SiO_2 to K_2O shall be 2.1 to 1.10 (see 6.7). When tested as specified in 4.7.2.1, the potassium silicate concentration shall be within the limits specified in table I.

3.3.3 Sodium mercaptobenzothiazole. The sodium salt of mercaptobenzothiazole shall be a technical grade, 50 percent aqueous solution by weight, which will meet all requirements of this specification. When tested as specified in 4.7.2.1, the sodium mercaptobenzothiazole concentration shall be within the limits specified in table I

3.4 Chemical properties.

3.4.1 pH value. When tested as specified in 4.7.2.2, the undiluted additive shall have a pH of 12.5 ±0.5.

3.4.2 Reserve alkalinity. When tested as specified in 4.7.2.3, a three percent by volume solution of additive in distilled water shall have a reserve alkalinity of 8.0 or greater.

3.4.3 Chlorides. When tested as specified in 4.7.2.4, the chloride content of the undiluted additive shall be not more than 300 ppm.

3.4.4 Insoluble matter. When tested as specified in 4.7.2.5, the insoluble matter content shall be not greater than 0.02 percent by weight or less.

3.5 Physical requirements.

3.5.1 Specific gravity. When tested as specified in 4.7.2.6, the specific gravity of the undiluted material shall be no less than 1.185 and no greater than 1.200 at 15.5/15.5 °C.

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 effect 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 6.6).

3.7 Limiting values. The following applies to all specified limits in this specification: For purposes of determining conformance with these specifications, an observed value or 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.

3.8 Workmanship. The additive shall be manufactured in a manner to produce a clear, single-phase solution, which contains no particulate matter and complies with all the requirements of this specification.

4. QUALITY ASSURANCE PROVISION.

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 material 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 6.6).

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 4.7.2.6. Failure of any test shall be cause for rejection.

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 IIa. A lot shall be accepted when zero defects are found and rejected when one or more are found.

4.6.2 Examination. Samples selected as specified in 4.6.1 shall be examined as specified in 4.7.1. Presence of 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 4.7.2.6. Failure of any test shall be cause for rejection.

4.7 Inspection procedure.

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

101. Material not as specified (see 3.2).
102. The net contents of sample unit container is less than one quart (0.95 liters).
103. The net contents of sample unit container has an overfill volume greater than one percent of the specified unit container volume.

4.7.2 Tests.

4.7.2.1 Chemical composition. For the chemical composition tests, any quantitative spectrographic or wet chemical method that can be shown to produce the accuracy necessary to assure conformance of the material to the requirements in table I may be used. A chemical composition found to be outside the limits specified in table I constitutes failure of this test. Certification of the test

method is required prior to acceptance by the Government. Application for certification should be forwarded to U.S. Army Belvoir Research, Development, and Engineering Center, ATTN: STRBE-VF, Ft. Belvoir, Va. 22060-5606.

4.7.2.2. pH value. The pH shall be determined in accordance with ASTM D 1287. In addition to the requirements of ASTM D 1287, the temperature of the test solution during the test shall be 25 ±2 °C. A pH outside the range specified in 3.4.1 constitutes failure of this test.

4.7.2.3 Reserve alkalinity. The reserve alkalinity shall be determined in accordance with ASTM D 1121. A reserve alkalinity less than that specified in 3.4.2 constitutes failure of this test.

4.7.2.4 Chlorides. The chloride content shall be determined in accordance with ASTM D 3634. In addition to the requirements of ASTM D 3634, the additive shall be diluted to one part additive and nine parts distilled or deionized water prior to conducting the test. The dilution shall be considered in the calculation for conformance to 3.4.3. A chloride content greater than that specified in 3.4.3 constitutes failure of this test.

4.7.2.5 Insoluble matter. Weigh 500.0 ±0.1 grams of the additive from a well agitated container into a 600-mL beaker. Filter additive through a medium porosity tared Gooch filtering crucible. After emptying the beaker, rinse the it thoroughly with distilled water, to completely transfer all insoluble matter to the crucible. Then wash the crucible contents five times with 15-mL portions of distilled water and dry to constant weight using an oven set at 105 ±1 °C. The gain in weight of the crucible is insoluble matter. Insoluble matter found greater than that specified in 3.4.4 constitutes failure of this test.

4.7.2.6 Specific gravity. The specific gravity shall be determined in accordance with ASTM D 1122. A specific gravity outside the range specified in 3.5.1 constitutes failure of this test.

4.8 Inspection of packaging.

4.8.1 Quality conformance inspection of pack.

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

4.8.1.2 Sampling. Sampling for examination shall be in accordance with MIL-STD-105.

4.8.1.3 Examination. Samples selected in accordance with 4.7.1.2 shall be examined for the following defects.

104.	Preservation not as specified for level A (see 5.1.1).
105.	Quantities packed together not as specified for level A, B, or C (see 5.2.1, 5.2.2, and 5.2.3).
106.	Box not provided with a liner, pads and partitions as specified level A, B, or C (see 5.2.1, 5.2.2, and 5.2.3).
107.	Shipping containers not in accordance with the referenced document as specified for level A, B, or C (see 5.2.1, 5.2.2, and 5.2.3).

108. Marking missing, illegible, incorrect, or incomplete for level A, B, or C (see 5.3).

5. PACKAGING

5.1 Preservation. Preservation shall be level A (see 6.8).

5.1.1 Level A. The additive shall be unit packed in a one-quart capacity container. The container shall conform to PPP-C-569, type 1, class A or MIL-B-26701. When a bottle conforming to MIL-B-26701 is used, the bottle shall be manufactured using an additive in the polyethylene resin which will yield a bottle that no portion will transmit more than one percent of ultraviolet light at any wavelength in the range of 310 to 325 nanometers when tested using a calibrated spectrophotometer with air as a reference (see 6.4).

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

5.2.1 Level A. Twelve one-quart bottles of additive shall be packed together, in a single layer, using a close fitting box conforming to PPP-B-601, overseas type, style optional or PPP-B-621, class 2, style optional. The box shall be provided with a full liner, top and bottom pads, and interlocking partitions to separate the bottles; fabricated from fiberboard conforming to ASTM D 4727, type CF, Class weather-resistant, variety SW, grade W5c. Box closure and strapping shall be in accordance with the appendix to the applicable box specification.

5.2.2 Level B. Packing shall be as specified in 5.2.1 for level A except the box shall conform to PPP-B-636, class weather resistant, grade V3c.

5.2.3 Level C. Packing shall be as specified in 5.2.2 except the boxes shall be domestic class.

5.3 Storage marking. In addition to any special marking specified in the contract or purchase order (see 6.2), marking shall be in accordance with MIL-STD-129.

5.3.1 Warning. Each container shall be marked with the following warning:

"Store at temperature above 10 °C (50 °F). Separation may occur at lower temperatures and can only be redissolved at elevated temperatures with agitation."

5.3.2 Metric equivalent. Each container shall be marked to include the metric equivalent of the unit container quantity as: "1 quart (0.95 liters)" or "1 qt. (0.95L)".

5.4 Palletization. When specified in the contract or order (see 6.2) the packed additive for level A, B or C shall be palletized in accordance with MIL-STD-147, load type as applicable, using pallets conforming to NN-P-71, type IV.

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 additive is intended for use in used MIL-A-46153 antifreeze and in water at a concentration of three percent (one-half quart additive per seventeen quarts antifreeze or water). The antifreeze is defined as antifreeze that tests green to yellow when tested as specified in TB 750-651, Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems, using A-A-51461, Test Kit, Antifreeze, Freeze Point and Corrosion.

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 2.1.1 and 2.2).
c. When a first article is required for inspection and approval, and the number of units required (see 3.1).
d. Level of packing required (see 5.2).
e. Any special marking (see 5.3).
f. When palletization is required (see 5.4).

6.3 First article. When a first article inspection is required, the item(s) should be an initial production sample. The first article should consist of one filled quart unit. 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.

6.4 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.

6.5 Preparation of additive

6.5.1 Mixing sequence. In order to obtain a clear solution the following mixing sequence should be followed:

a. Weigh distilled water.
b. Heat at 38 °C (100 °F) and stir in weighed sodium metaborate octahydrate until solution is clear.
c. Cool to room temperature (25 °C).
d. Add weighed potassium silicate to the water/borate solution.
e. Add weighed sodium mercaptobenzothiazole and stir until all components have dissolved. After all components are in solution, stir an additional 30 minutes.

6.6 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 addressed for submission of data are listed in FED-STD-313, appendix B.

6.7 Potassium silicate. KASIL #6, manufactured by the Philadelphia Quartz Company, P.O. Box 840, Valley Forge, PA 19482, has a weight ratio of SiO_2 to K_2O of 2.1 to 1.0.

6.8 Levels of preservation. Levels of preservation have not been included as the preservation specified is the minimum acceptable for protection.

6.9 Disposability. If this product becomes a waste, it does not meet the criteria of a hazardous waste as defined by the Environmental Protection Agency (EPA). As a nonhazardous liquid waste, it should be solidified with stabilizing agents (such as sand or cement) so that no free liquid remains before disposal to an industrial waste landfill. A non-hazardous liquid waste can also be deep-well injected in accordance with local, state, and federal regulations.

6.10 Subject term (key word) listing.

Antifreeze
Antifreeze corrosion test kit
Corrosion inhibitor
Engine coolant system
Supplemental coolant additive
Water inhibitor

6.11 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.

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

Review activities:
Army - AT, SM
DLA - GS

Preparing activity:
Army - ME

Project 6850-1063

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-A-53009A	910702

3. DOCUMENT TITLE

Additive, Antifreeze Extender, Liquid Cooling Systems

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
	(703) 664-5717	354-5717
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	