

MIL-I-17433C(SH)
4 June 1986
SUPERSEDING
MIL-I-17433B(SHIPS)
22 May 1969
(See 6.5)

MILITARY SPECIFICATION

INHIBITOR, HYDROCHLORIC ACID DESCALING AND PICKLING SOLUTIONS

This specification is approved for use within the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers liquid inhibitors for minimizing the deleterious effects of hydrochloric (muriatic) acid on metal, while not interfering with the removal of either waterside deposits or corrosion products present on the surface.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

- PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
- PPP-P-704 - Pails, Metal: (Shipping, Steel, 1 through 12 Gallons).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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- MIL-T-16286 - Tubes, Steel, Seamless, Marine Boiler Application.
- MIL-B-26701 - Bottles, Screw Cap and Carboys Polyethylene Plastic.

STANDARDS

FEDERAL

- FED-STD-313 - Material Safety Data Sheets Preparation and the Submission of.

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- 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.

2.1.2 Other Government document. The following other Government document forms a part of this specification to the extent specified herein. Unless otherwise specified, the issue shall be that in effect on the date of the solicitation.

DEPARTMENT OF TRANSPORTATION

Code of Federal Regulations, Title 49

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

(Copies of specifications, standards and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT

National Motor Freight Classification

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., ATA TRAFFIC Dept., 2200 Mill Road, Alexandria, VA 22314.)

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UNIFORM CLASSIFICATION COMMITTEE AGENT

Uniform Freight Classification Ratings, Rules and Regulations

(Application for copies should be addressed to the Uniform Classification Committee Agent, Tariff Publication Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which 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 specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Weight loss. When tested as specified in 4.5.2, the weight loss shall not exceed 0.0020 pound per square foot per hour.

3.2 Staining and filming of metal. The inhibited hydrochloric acid solution shall not cause filming, staining, or deposit on metal surfaces. These effects will be ascertained from visual observation of specimens following the test as specified in 4.5.2.2.

3.3 Arsenic. The inhibitor shall contain not more than 0.01 percent of arsenic when tested as specified in 4.5.3.

3.4 Inhibitor strength. Inhibitor use concentrations shall not exceed 0.2 percent by weight (see 4.5.1.1) and must limit metal loss as specified in 3.1.

3.4.1 Compatibility. The inhibitor at concentrations required as specified in 3.4 must be compatible with the acid solution as formulated and as specified in 4.5.1.1. No adherent deposits shall form on the metal surfaces and copper plating shall not occur.

3.5 Precautionary labeling. Complete, concise instructions for use of the inhibitor, as well as safety precautions, shall be legibly labeled in a durable manner on the container (see 5.3).

3.6 Material safety data sheet. The contracting activity shall be provided a material safety data sheet (MSDS) at the time of contract award. The MSDS form and requirements for its preparation are found in FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification. The MSDS shall provide available pertinent toxicity information, and delineate acceptable personal protective measures for use when applying the product (see 6.3).

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3.7 The material shall have no adverse effect on the health of personnel when used for its intended purpose and when handled as recommended. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency.

3.8 Workmanship. The product shall be manufactured in a manner to produce an inhibitor that is completely miscible in hydrochloric acid to provide maximum metal protection.

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 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 assure 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 assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 The contractor shall have the toxicological formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use.

4.2 Quality conformance inspection.

4.2.1 Sampling for quality conformance.

4.2.1.1 Lot. For purposes of sampling, a lot shall consist of all material manufactured as one batch and offered for delivery at one time.

4.2.1.2 Sampling for tests. From each inspection lot, the inspector shall select two containers at random. From each of the two containers, 1-pint samples shall be taken and placed in separate clean, dry, metal or glass containers, sealed and marked.

4.2.1.3 Sampling for examination of filled containers. A random sample of filled containers shall be selected from each lot in accordance with MIL-STD-105, at inspection level I, with an acceptable quality level (AQL) of 2.5 percent defective to verify compliance with this specification regarding fill, closure, marking and other requirements not involving tests.

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4.3 Examination of filled containers. Each sample filled containers shall be examined for defects of construction of the container and the closure, for evidence of leakage, and for unsatisfactory markings; each filled container shall also be weighed to determine the amount of contents. 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 in accordance with MIL-STD-105, the lot represented by the sample shall be rejected. Rejected lots may be resubmitted for acceptance tests, provided the manufacturer has removed or repaired all nonconforming containers.

4.4 Quality conformance testing. Each of the samples selected as specified in 4.2.1.2 shall be subjected to the tests as specified in 4.5.1, 4.5.2, and 4.5.3. If a sample fails to comply in any respect to this specification, the lot which it represents shall be rejected. Rejected lots may be resubmitted for acceptance tests, provided the manufacturer has removed or reworked all nonconforming products.

4.5 Test procedures.

4.5.1 Preparation of inhibited acid solution.

4.5.1.1 The inhibited acid solution shall be formulated as follows:

Hydrochloric acid, 23° Baume (specific gravity (sp. gr.) 1.19, assay 37 percent)	120 milliliters (mL)
Ferric chloride ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$)	15 grams
Cupric chloride ($\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$)	0.31 grams
1, 3 Diethylthiourea (DETU)	5.2 grams
Inhibitor, concentration	final concentration not to exceed 0.2 percent by weight
Distilled water	sufficient amounts to obtain 500 mL of inhibited acid solution

4.5.1.2 Heat solution to 170 ± 2 degrees Fahrenheit ($^{\circ}\text{F}$); (76.6 ± 1 degrees Celsius ($^{\circ}\text{C}$)) stir and pour 150 mL into each of two tall form beakers (approximately 2-1/8 inch (54 millimeters (mm)) diameter, 3-7/8 inch (98 mm) depth) containing a 1/8 inch (3 mm) glass rod bent into a V shape to support test specimens during evaluations.

4.5.2 Weight loss.

4.5.2.1 Specimen preparation. A class G boiler tube (2-inch (51 mm) diameter) in accordance with MIL-T-16286 shall be split, cut and machined into 1-inch (26-mm) lengths of half-tubes. Before testing, the specimens shall be degreased in acetone and wiped dry. Corrosion products shall be removed by placing the specimen in concentrated hydrochloric acid heated to approximately

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125°F (51.6°C) until removal is accomplished (usually about 5 minutes). Specimens shall then be rinsed with water, dipped in acetone, and wiped dry. Total surface area shall be measured to the nearest 1/64 inch (0.4 mm). Wire brushing is then applied, followed by a momentary exposure to the acid and a water rinse. The specimens are then dipped in acetone, air dried and placed in a desiccator prior to weighing. The weight of each specimen shall be determined to the nearest milligram. Stress relieving shall not be applied to the boiler tube specimens.

4.5.2.2 Test specimens shall be placed in beakers containing the descalant solution described and as specified in 4.5.1.1. Acid shall be heated to 170°F (76.6°C) and placed in a thermostatically controlled water bath maintained at $170 \pm 2^\circ\text{F}$ ($76.6 \pm 1^\circ\text{C}$). Specimens shall remain in contact with acid for 6 hours, then removed, rinsed with hot (140 to 150°F) (60 to 65.5°C) water, dipped in acetone, air dried and weighed. Weight loss in grams per 6 hours shall be converted to pounds per square foot per hour. Determinations shall be run in duplicate and averaged. Results shall agree within 10 percent of the mean or the test shall be repeated.

4.5.3 Arsenic content. This test shall be conducted as follows: Place 10 grams of the sample in a 200 mL flask. Add 5 grams cuprous chloride and 75 mL HCl (sp. gr. 1.09). Mix well, insert a thermometer and arrange the flask and condenser for downward distillation. Distill approximately 35 mL of the solution into 150 mL of cold water contained in a 400 mL beaker cooled in an ice or cold-water bath. (The condenser tip should dip below the surface of the water in the beaker. The distillation should be watched carefully to avoid suck-back.) The temperature of the vapors during distillation, shall remain below 223°F (106°C); otherwise halt the distillation, cool the flask, and add 34 mL of concentrated HCl before continuing the distillation. Neutralize the distillate carefully with 25 percent NaOH solution, then add 1:1 HCl until just acid. Add 15 mL to 20 mL of cold-saturated NaHCO₃ solution. Add 1 gram of KI crystals and 5 mL of 1 percent starch solution. Stir until the KI is dissolved and titrate with 0.01N iodine solution.

$$\text{Percent arsenic} = \frac{3.75 \text{ AN}}{W}$$

Where:

A = mL of iodine solution used.
N = normality of iodine solution.
W = weight of sample.

4.6 Inspection of packaging. Sample packages and packs, and the inspection of the preservation-packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

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5.1 Preservation. Preservation shall be level A or C, as specified (see 6.2).

5.1.1 Level A. The inhibitor shall be furnished in 1-, 5-, or 10-gallon containers as specified (see 6.2).

5.1.1.1 One- and 5-gallon containers. The 1- and 5-gallon cans shall be in accordance with type V, class 4, 5, or 6 of PPP-C-96 at the contractor's option. Inner seals are required. Exterior plan B coating and side seam stripping shall be required. Cans shall be provided with wire or bridge type handles. Alternatively, as specified (see 6.2), the 1-gallon quantities shall be preserved-packaged in plastic bottles in accordance with MIL-B-26701 and closure caps shall be provided with liners.

5.1.1.2 Pails. Ten-gallon pails shall be in accordance with PPP-B-704, type I, class 6. Wire handles and bails shall be protectively coated to resist corrosion.

5.1.1.3 Five- or 10-gallon glass carboys. The 5- or 10-gallon glass carboy shall be in accordance with the Code of Federal Regulations Title 49 and Department of Transportation Regulations for Explosives and Other Dangerous Articles, Section 178.1-7.

5.1.2 Level C. The material, in quantity specified (see 6.2), shall be preserved-packaged to afford protection against deterioration and physical damage during shipment from the supply source for early material use at the first receiving activity.

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

5.2.1 Levels A and B.

5.2.1.1 Cans. The 1- and 5-gallon cans shall be packed in the containers and arranged for packing in accordance with the appendix to PPP-C-96.

5.2.1.2 Pails. The 10-gallon pails shall require no additional packing. When specified (see 6.2), pails shall be palletized for shipment in accordance with MIL-STD-147.

5.2.1.3 Glass carboys. The 5- or 10-gallon carboys packed in wood or plywood containers in accordance with Section 178.1-7 of the Code of Federal Regulations and Department of Transportation Regulations shall require no additional packing.

5.3 Marking. Shipment marking information, in addition to the labeling required (see 3.5 and 6.2), shall be provided on interior packages and exterior shipping containers and palletized loads in accordance with MIL-STD-129 and shall include hazardous material markings as applicable.

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6. NOTES

6.1 Intended use. The inhibitor covered by this specification is intended to be used to control the effects of hydrochloric (muriatic) acid working on the metal of Government steam-generating equipment.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Size of container desired (see 5.1.1 and 5.2.1.1.1).
- (c) Level of preservation-packaging and packing required (see 5.1).
- (d) When palletization is required (see 5.2.1.2).
- (e) Special marking, if required (see 5.3).

6.3 Subject term (key word) listing.

Corrosion inhibitor, hydrochloric acid
Descaling
Hydrochloric acid inhibitor
Inhibitor, concentrated
Muriatic acid inhibitor
Pickling

6.4 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.

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

Preparing activity:
Navy - SH
(Project 6850-N798)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL*(See Instructions - Reverse Side)*

1. DOCUMENT NUMBER MIL-I-17433C(SH)		2. DOCUMENT TITLE INHIBITOR, HYDROCHLORIC ACID DESCALING AND PICKLING SOLUTIONS	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION <i>(Mark one)</i> <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER <i>(Specify):</i> _____	
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>			
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER <i>(Last, First, MI) - Optional</i>		b. WORK TELEPHONE NUMBER <i>(Include Area Code) - Optional</i>	
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code) - Optional</i>		8. DATE OF SUBMISSION (YYMMDD)	