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MIL-I-17433B (SHIPS)
22 May 1969
SUPERSEDING
MIL-I-17433A (SHIPS)
6 March 1959
(See 6.5)

MILITARY SPECIFICATION

INHIBITOR, HYDROCHLORIC ACID

DESCALING AND PICKLING SOLUTIONS

1. SCOPE

1.1 This specification covers inhibitors for hydrochloric (muriatic) acid to minimize attack on metal. The inhibitor must not interfere with the removal of either waterside deposits or corrosion products present on the surfaces. These inhibitors shall be in liquid form.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

MILITARY

MIL-T-16286 - Tubes, Steel, Seamless, Marine Boiler Application.

STANDARDS

MILITARY

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

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

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, D. C. 20402.)

NATIONAL CLASSIFICATION BOARD
National Motor Freight Classification Rules

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., 1616 "P" Street, N. W., Washington, D. C. 20036.)

UNIFORM CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago, Ill., 60606.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

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

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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 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 and must limit metal loss as specified in 3.1.

3.4.1 Compatibility. The inhibitor at concentrations required in 3.4 must be compatible with the acid solution as formulated 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.

3.6 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 supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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.

4.2 Sampling for quality conformance.

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

4.2.2 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.

4.2.3 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.

4.3 Examination of filled containers. Each sample filled container 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 of 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 4.2.2 shall be subjected to the tests 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 (Sp. Gr. 1.19, Assay 37 percent)	120 ml.
Ferric chloride ($FeCl_3 \cdot 6H_2O$)	15 gms.
Cupric chloride ($CuCl_2 \cdot 2H_2O$)	0.31 gms.
1, 3 Diethylthiourea (DETU)	5.2 gms.
Inhibitor, concentration	0.2 percent by weight (of total solution)
Distilled water, sufficient amounts to obtain 500 ml. of solution not to exceed	

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4.5.1.2 Heat solution to 170° ± 2°F., stir and pour 150 ml. into each of 2 tall form beakers (approximately 2-1/8 inch diameter, 3-7/8 inch depth) containing a 1/8 inch 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 diameter), conforming to MIL-T-16286 shall be split, cut and machined into 1 inch 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 125°F. 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. 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 in 4.5.1.1. Acid shall be heated to 170°F. and placed in a thermostatically controlled water bath maintained at 170° ± 2°F. Specimens shall remain in contact with acid for 6 hours, then be removed, rinsed with hot (140° - 150°F.) 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 test shall be repeated.

4.5.3 Arsenic content. This test shall be conducted as follows: Place 10.0 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 108°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 $NaHCO_3$ 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.

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

Where:

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

4.6 Inspection of preparation for delivery. Packaging, packing, and marking shall be inspected to determine conformance with the requirements of Section 5.

5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.4.)

5.1 Domestic shipment and early material use.

5.1.1 Packaging. Material in quantity specified (see 6.2), shall be packaged to afford protection against deterioration and physical damage during shipment from the supply source for early material use at the first receiving activity.

5.1.2 Packing. Packing shall be accomplished in a manner which will insure acceptance by common carrier, at the lowest rate, and will afford protection against physical or mechanical damage during direct shipment from the supply source for early material use at the first receiving activity. The shipping containers or method of packing shall conform to the Uniform Freight or National Motor Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation.

5.1.3 Marking. Shipment marking information, in addition to the labeling required (see 3.5), shall be provided on interior packages and exterior shipping containers in accordance with MIL-STD-129.

5.2 Domestic shipment and storage or overseas shipment. The requirements and levels of packaging, packing and marking for shipment shall be specified by the procuring activity (see 6.2).

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(5.2.1 The following provides various levels for protection during domestic shipment and storage or overseas shipment which may be required when procurement is made.

5.2.1.1 Packaging. Packaging shall be Level A or C, as specified (see 6.2).

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

5.2.1.1.1.1 One and five gallon containers. The 1 and 5 gallon cans shall conform to Type V, class 4, 5, or 6 of PPP-C-96 at the supplier's option. Inner seals are required. Exterior Plan B coating and side seam striping are required. Cans can be provided with wire or bridge type handles. Alternatively, when specified (see 6.2), the one-gallon quantities shall be packaged in plastic bottles conforming to MIL-B-26701 and closure caps shall be provided with liners.

5.2.1.1.1.2 Pails. Ten gallon pails shall conform to PPP-P-704, Type I, class 9, 10, 11, or 12 at the suppliers option. Wire handles and bails shall be protectively coated to resist corrosion.

5.2.1.1.1.3 Five or ten gallon glass carboys. The five or ten gallon glass carboy shall conform to the code of Federal Regulations Title 49 and Department of Transportation Regulations for Explosives and Other Dangerous Articles, Section 178.1-7.

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

5.2.1.2 Packing. Packing shall be Level A or B, as specified (ss 6.2)

5.2.1.2.1 Levels A and B.

5.2.1.2.1.1 Cans. The 1 and 5 gallon cans shall be packed in the arrangement and containers in accordance with the appendix to PPP-C-96.

5.2.1.2.1.2 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.

5.2.1.2.1.3 Glass carboys. The 5 or 10 gallon carboys packed in wood or plywood containers as required by Section 178. 1-7 of the Code of Federal Regulations and Department of Transportation Regulations shall require no additional packing.

5.2.1.3 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. In addition, carboys shall be marked in accordance with Section 178.1-7 of the Code of Federal Regulations and the Department of Transportation Regulations.)

6. NOTES

6.1 Intended use. The inhibitor covered by this specification shall be used to inhibit hydrochloric (muriatic) acid. This descalant is to be employed in a nominal concentration of 10 percent by weight for the removal of mill scale and waterborne deposits from the watersides of specific Government steam generating and other equipment.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number and date of this specification.
(b) Level of packaging and packing required (see 5.2).
(c) Size of container desired (see 5.1.1 and 5.2.1.1.1).
(d) When palletization is required (see 5.2.1.2.1.2).
(e) Special marking, if required (see 5.2.1.3).

6.3 Invitations for bids should specify that bidders shall include in their bids the inhibitor strength that will satisfy the requirements of this specification. The effective concentration of the product will determine the bid price.

6.4 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in Section 2 do not apply when material and parts are procured by the supplier for incorporation into the equipment and lose their separate identity when the equipment is shipped.

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6.5 CHANGES FROM PREVIOUS ISSUE. THE OUTSIDE MARGINS OF THIS DOCUMENT HAVE BEEN MARKED "#" TO INDICATE WHERE CHANGES (DELETIONS, ADDITIONS, ETC.) FROM THE PREVIOUS ISSUE HAVE BEEN MADE. THIS HAS BEEN DONE AS A CONVENIENCE ONLY AND THE GOVERNMENT ASSUMES NO LIABILITY WHATSOEVER FOR ANY INACCURACIES IN THESE NOTATIONS. BIDDERS AND CONTRACTORS ARE CAUTIONED TO EVALUATE THE REQUIREMENTS OF THIS DOCUMENT BASED ON THE ENTIRE CONTENT AS WRITTEN IRRESPECTIVE OF THE MARGINAL NOTATIONS AND RELATIONSHIP TO THE LAST PREVIOUS ISSUE.

Preparing activity:
Navy - SH
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SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity *(as indicated on reverse hereof)*.

SPECIFICATION

ORGANIZATION *(Of submitter)* | CITY AND STATE

CONTRACT NO. | QUANTITY OF ITEMS PROCURED | DOLLAR AMOUNT $

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO IF "YES", IN WHAT WAY?

4. REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity)* | DATE

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