

MATERIAL STANDARD

FOR

INHIBITOR FOR HYDROCHLORIC ACID

AS

DESCALING AND PICKLING SOLUTION

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1. SCOPE

This Standard 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. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

ANSI 129.1 "Precautionary Labeling of Hazardous Industrial Chemicals"

IPS (IRANIAN PETROLEUM STANDARDS)

E-TP-780 "Chemical Control of Corrosive Environments"(Not applicable for procurement)

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

ISO 9000-3 "Quality Management and Quality Assurance Standard"

MIL (MILITARY SPECIFICATION)

Mil-T-16286 "Tubes, Steel, Seamless, Marine Boiler Application"
 Mil-I-17433B "Inhibitor, Hydrochloric Acid Descaling and Pickling Solutions"

MIL-STD (MILITARY STANDARD)

Mil-STD 105 "Sampling Procedure and Table for Inspection by Attributes"
 Mil-STD 129 "Marking for Shipment and Storage"

3. UNITS

This Standard is based on International System of Units, (SI) except where otherwise specified.

4. REQUIREMENTS

The inhibitor shall meet the requirements of 4.1 and 4.6.

4.1 Weight Loss

When tested as specified in 5.2, the weight loss shall not exceed 5.440 g per square meter per hour.

4.2 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 5.6.2.

4.3 Arsenic

The inhibitor shall contain not more than 0.01 percent of arsenic when tested as specified in 5.7.

4.4 Inhibitor Strength

Inhibitor use concentrations (dosage) shall not exceed 0.2 percent and must limit metal loss as specified in 4.1.

4.5 Compatibility

The inhibitor at concentrations required in 4.4 must be compatible with the acid solution as formulated in 5.5.1. No adherent deposits shall form on the metal specimen surfaces and copper plating shall not occur.

4.6 Miscibility

The product shall be completely miscible in hydrochloric acid in order to provide maximum metal protection.

5. TEST PROCEDURES

5.1 Preparation of Inhibited Acid Solution

5.1.1 The inhibited acid solution shall be formulated as follows:

Hydrochloric acid, 23 Baume (Sp. 1.19, Assay 37 percent)	120 ml
Ferric chloride hydrated ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$)	25 g
Cupric chloride hydrated ($\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$)	0.31 g
1, 3 Diethylthiourea (DETU)	5.2 g
Inhibitor, concentration	0.2 percent by weight (of total solution)
Distilled water	sufficient to obtain 500 ml of solution not to exceed.

5.1.2 Heat the above solution to $77 \pm 1^\circ\text{C}$, stir and pour 150 ml into each of 2 tall form beakers (approximately 28.5 mm diameter, 100 mm depth) containing a 3 mm glass rod bent into a V shape to support test specimens during evaluations.

5.2 Weight Loss Determination

5.2.1 Specimen preparation

A boiler tube (50 mm diameter), conforming to Mil-T-16286 shall be split, cut and machined into 25 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 (52°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 0.4 mm^2 . 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.

5.2.2 Test specimens shall be placed in beakers containing the descalant solution described in 5.1.1. Acid shall be heated to 77°C and placed in a thermostatically controlled water bath maintained at 77±1°C. Specimens shall remain in contact with inhibited solution acid for 6 hours, then be removed, rinsed with hot (60-66°C) water, dipped in acetone, air dried and weighed. Weight loss in grams per 6 hours shall be converted to grams per square meter per hour. Determination shall be run in duplicate and averaged. Results shall agree within 10 percent of the mean or test shall be repeated.

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 a 400 ml. beaker containing 150 ml of cold water placed in an ice or cold-water bath. (The condenser tip shall dip below the surface of the water in the beaker. The distillation shall 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 weight percent NaOH solution, then add 1:1 HCl until just acid with the aid of PH indicator add 15 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 0.01 N 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.

6. STORAGE LIFE AND PREPARATION FOR DELIVERY

6.1 Storage Life

The product shall meet the requirements of clause 4 after storage for 24 months from the date of delivery in a tightly covered container at temperatures between -20 to +60°C.

6.2 Preparation for Delivery

6.2.1 Packaging

The material purchased according to this standard specification shall be packaged in suitable new steel drums containing not more than 210 liters of materials.

6.2.2 Packing

Packing shall be accomplished in a manner which will insure acceptance by common carrier, at lowest rate, and will afford protection against physical or mechanical damage during shipment.

6.2.3 Marking

Shipment marking information, in addition to the labeling required (see 8) shall be provided on each package.

7. INSPECTION AND TESTING

7.1 All materials supplied under this standard specification shall be subject to timely inspection by the purchaser or his authorized representative. the purchaser shall have the right to reject any material(s) supplied which is (are) found to be defective under this standard specification. In case of dispute, the arbitration or settlement procedure, established in the procurement documents shall be followed.

7.2 The supplier shall be responsible for the performance and costs for all laboratory test requirements as specified in this Standard Specification.

7.3 Samples submitted to the purchaser will be tested in the purchaser's laboratory or in a responsible commercial laboratory designed by the purchaser.

7.4 The supplier shall place free of charge at the disposal of the purchaser's inspector(s) all means necessary for carrying out his (their) inspection, specification results of tests, checking of conformity of materials with this Standard specification, checking of marking and packing and temporary acceptance of materials.

7.5 The supplier shall furnish the purchaser with a certified copy of results of tests made by the manufacturer covering physical and performance characteristics of each batch (see 7.8) of product to be supplied under this standard specification. The supplier shall furnish, or allow the purchaser to collect samples of the material representative of each batch of product. Certified test reports and samples (see 7.7) furnished by the supplier or collected by the purchaser and/or his authorized representative shall be properly identified with each lot (see 7.8) of product.

7.6 Prior to acceptance of the supplier's material, samples of material submitted by the supplier or collected by the purchaser and/or nominated inspector will be tested by the purchaser. If any sample is found not to conform to this standard specification, material represented by such sample will be rejected.

7.7 The number of samples for testing shall consist of 10 percent of the lot or batch (see 7.8), but in no case shall be less than one or more than 10 drums.

7.8 A lot or batch shall consist of an indefinite number of drums, offered for acceptance and filled with a homogeneous mixture of material from one isolated container, or filled with a homogeneous mixture of material manufactured by a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

8. LABELING

Refer to ANSI Standard Z 129.1 "Precautionary Labeling of Hazardous Industrial Chemicals".

MARKING OF CONTAINERS

Each drum shall be legibly marked with the following information:

- Product Name:
 - MESC No.:
 - Order No.:
 - Flash Point°C:
 - Lot (Batch) No.:
 - Stock Number:
 - Date of Manufacture:
 - Quantity of Inhibitor in drum (net weight):
 - Information and Warnings (if needed):
 - Manufacture's Name and Address:
- Design guide: For the guidance on the usage of this inhibitor reference shall be made to IPS-E-TP-780.

9. DIRECTIONS FOR USE

The manufacturer shall supply detailed directions for use including application procedures, technical and safety data sheet with each drum.