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MIL-I-24244(SHIPS)
32 August 1908

MILITARY SPECIFICATION

INSULATION MATERIALS, THERMAL, WITH SPECIAL
CORROSION AND CHLORIDE REQUIREMENTS

1. SCOPE

1.1 Scope. - This specification covers mineral-based thermal insulation, cement, and adhesives with special corrosion and chloride requirements.

1.2 Types. - The insulation material shall be of one of the following types and subtypes as specified (6.2):

- Type 1 - Insulation, pipe, thermal (MIL-I-2781).
 - 1A - Grade I, class b - compounded - temperatures up to 600°F.
 - 1B - Grade II, class c - fibrous - temperatures up to 750°F.
 - 1C - Grade II, class d - compounded - temperatures up to 750°F.
 - 1D - Grade III, class e - compounded - type I - light density - temperatures up to 1200°F.
 - 1E - Grade III, class e - compounded - type II - heavy density - temperatures up to 1200°F.
 - 1F - Grade III, class f - fibrous - temperatures up to 1200°F.
- Type 2 - Insulation blanket, thermal, fibrous mineral (MIL-I-2818).
- Type 3 - Insulation block, thermal (MIL-I-2819).
 - 3A - Class 1 - temperatures up to 600°F.
 - 3B - Class 2 - temperatures up to 1000°F.
 - 3D - Class 3 - temperatures up to 1500°F.
 - 3E - Class 4 - temperatures up to 2000°F.
- Type 4 - Cement, insulation, high temperature (MIL-C-2861).
- Type 5 - Cements, finishing, insulation (MIL-C-2908).
 - 5A - Type I - Asbestos.
 - 5B - Type II - Hydraulic setting mineral wool.
- Type 6 - Adhesives, fire-resistant, thermal insulation. (MIL-A-3316).
 - 6A - Class 1 - For bonding fibrous glass cloth to unfaced fibrous glass insulation. For bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board. For sealing the edges of, and bonding fibrous glass tape to the joints of, fibrous glass board. For bonding lagging cloth to thermal insulation.
 - 6B - Class 2 - For attaching fibrous glass insulation to metal surfaces.
 - 6C - Class 3 - For attaching cork and fibrous glass insulation board to metal surfaces.
- Type 7 - Insulation felt, thermal, asbestos fiber (MIL-I-16091).
 - 7A - Type A - Plain.
 - 7B - Type B - Water repellent.
- Type 8 - Adhesive, asbestos cloth to pipe, insulation (MIL-A-15199).
- Type 9 - Insulation tape, thermal (MIL-I-15349).
 - 9A - Type I - For spiral wrapping.
 - 9B - Type II - For lateral wrapping.
- Type 10 - Insulation felt, thermal, glass fiber (MIL-I-16411).
 - 10A - Type I - Felted rovings.
 - 10B - Type II - Laminated and felted.
- Type 11 - Insulation blanket, thermal, refractory fiber, flexible (MIL-I-23128).
 - 11A - Grade A - Temperatures up to 1200°F.
 - 11B - Grade B - Temperatures up to 2000°F.

Classification (canceled) (changed to
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 NAVSTA
 on 2/5/04 *Ann M. Pope* *Security*
 (Date) (Signature) (Rank) *Spec.*
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Type 12 - Insulation, mineral wool; blanket, felt and industrial batt (for heated surfaces) (HH-I-863).

- 12A - Type I, blanket, class A - for use up to 800°F.
- 12B - Type I, blanket, class B - for use up to 1000°F.
- 12C - Type I, blanket, class C - for use up to 1200°F.
- 12D - Type II, felt, class D - for use up to 800°F.
- 12E - Type III, industrial batt, class E - for use up to 1000°F.
- 12F - Type III, industrial batt, class F - for use up to 1200°F.

Type 13 - Insulation; mineral-wool, block and board (for heated surfaces) (HH-I-864).

- 13A - Form I, block, class A - up to 225°F.
- 13B - Form I, block, class B - up to 800°F.
- 13C - Form I, block, class C - up to 1000°F.
- 13D - Form I, block, class D - up to 1800°F.
- 13E - Form II, board, class A - up to 225°F.
- 13F - Form II, board, class B - up to 800°F.
- 13G - Form II, board, class C - up to 1000°F.
- 13H - Form II, board, class D - up to 1800°F.

Type 14 - Cloth, thread and tape; asbestos. (SS-C-466).

- 14A - Form I, cloth, grade U.G., style 1 - regular weight.
- 14B - Form I, cloth, grade U.G., style 2 - light weight.
- 14C - Form I, cloth, grade U.G., style 3 - No. 1 construction.
- 14D - Form I, cloth, grade U.G., style 4 - No. 2 construction.
- 14E - Form I, cloth, grade U.G., style 5 - glass-asbestos - No. 3 construction.
- 14F - Form I, cloth, grade U.G., style 6 - glass-asbestos - No. 4 construction.
- 14G - Form I, cloth, grade AA, style 1 - regular weight.
- 14H - Form I, cloth, grade AAA, style 1 - regular weight.
- 14I - Form I, cloth, grade AAA, style 2 - light weight.
- 14J - Form I, cloth, grade AAA-M, style 7 - weight per square yard 2.60 (nominal).
- 14K - Form I, cloth, grade AAA-M, style 8 - weight per square yard 2.75 (nominal).
- 14L - Form I, cloth, grade AAA-M, style 9 - weight per square yard 3.50 (nominal).
- 14M - Form II, thread, sewing, reinforced with wire.
- 14N - Form III, thread, sewing, without wire.
- 14P - Form IV, tape, grade U.G., style 1 - plain weave.

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 this specification to the extent specified herein:

SPECIFICATIONS**MILITARY**

- MIL-I-2781 - Insulation, Pipe, Thermal.
- MIL-I-2818 - Insulation Blanket, Thermal, Fibrous Mineral.
- MIL-I-2819 - Insulation Block, Thermal.
- MIL-C-2861 - Cement, Insulation, High Temperature.
- MIL-C-2908 - Cements, Finishing Insulation.
- MIL-A-3316 - Adhesives, Fire-Resistant, Thermal Insulation.
- MIL-I-35091 - Insulation Felt, Thermal, Asbestos Fiber.
- MIL-A-35199 - Adhesive, Asbestos Cloth to Pipe, Insulation.
- MIL-I-35349 - Insulation Tape, Thermal.
- MIL-I-36431 - Insulation Felt, Thermal, Glass Fiber.
- MIL-I-39128 - Insulation Blanket Thermal, Refractory Fiber, Flexible.
- MIL-I-45208 - Inspection System Requirements.

FEDERAL

- HH-I-863 - Insulation, Mineral Wool; Blanket, Felt and Industrial Batt (for Heated Surfaces).
- HH-I-864 - Insulation, Mineral-Wool, Block and Board (for Heated Surfaces).
- SS-C-466 - Cloth, Thread and Tape; Asbestos.
- UU-P-268 - Paper, Kraft, Untreated, Wrapping.

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

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3.2 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

- ASTM D 812 - Methods of Test for Chloride Ion in Industrial Water and Industrial Waste Water.
- ASTM E 60 - Practice for Photometric Methods for Chemical Analysis of Metals.
- ASTM E 62 - Photometric Methods for Chemical Analysis of Copper and Copper Base Alloys.
- ASTM E 120 - Methods for Chemical Analysis of Titanium and Titanium-Base Alloys.
- ASTM E 146 - Methods for Chemical Analysis of Zirconium and Zirconium Base Alloys.
- ASTM Bulletin No. 225 - dated October 1957.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(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 Type. - The type and subtype shall be as required by the ordering data (see 1.2 and 6.2). Types and subtypes other than those listed in 1.2 may be supplied only with written approval of the command or agency concerned.

3.2 Type requirements. - In addition to the requirements of this specification, the material supplied shall conform in all respects to the specification listed in 1.3 for the specific type and subtype material. When types or subtypes other than those covered in specifications listed in 1.2 are required, the type requirement shall be given in the ordering data (see 6.2).

3.3 Chemical requirements. -

3.3.1 Analysis. - The specific material supplied shall be analyzed for leachable chloride, sodium, and silicate, and the "plot point" of these analyses shall fall in the acceptable area of figure 1.

3.3.2 pH. - Leach water from the specific material supplied shall have a pH (Hydrogen ion concentration negative exponent) not greater than 11.2.

3.4 Preproduction requirements. - Prior to supplying any type and subtype of thermal insulation to this specification, a supplier shall comply with the preproduction requirements specified in either 3.4.1 or 3.4.2 for the particular type and subtype supplied.

3.4.1 A supplier who has previously supplied thermal insulation of the specific type and subtype to this specification, or who has and can supply a copy of a certificate of compliance (see 6.3.2) to the requirements of this specification, shall have met the preproduction requirements of this specification when the following requirements have been met:

- (a) The thermal insulation previously produced to this specification, or to the certificate of compliance, shall have met all the requirements of this specification.
- (b) The thermal insulation previously produced was produced to the same formulation, by the same production processes, and using ingredients of the same kind, nature and quality as those which will be employed to produce thermal insulation to this specification. If any such change has been made, the requirements of 3.4.2 shall apply.

3.4.2 A supplier who has not previously produced the required type and subtype of thermal insulation to this specification, or cannot supply an equivalent certification of compliance (see 6.3.2), or when required by 3.4.1(b), shall test a sample from a production lot of the type and subtype required as specified in 6.2.1. The production lot from which the sample is taken shall be of the same formulation, made by the same production processes and from the same kind, nature, and quality of ingredients as those which will

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be employed for production of thermal insulation to this specification. The supplier shall have complied with the preproduction requirements of this specification when the following requirements have been met:

- (a) The production lot from which the sample was taken has met all the requirements of the specification listed in 1.2 for the specific type and subtype, and the sample taken has met the quality conformance test requirements of this specification.
- (b) The sample has been tested as required by the preproduction corrosion test (see 4.3), and not more than one of the four prepared coupons shows a crack when examined as required by 4.3.4(b).
- (c) The actual numerical results of all quality conformance tests and of the preproduction corrosion test shall have been submitted to the command or agency concerned.

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, or for providing certification based on test results that the supplies and services being furnished by the supplier meet the applicable requirements of this specification. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the command or agency concerned. The command or agency concerned reserves the right to perform any of the inspections and tests set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 The performance of the examinations or tests set forth in this specification does not relieve the supplier of his responsibility to provide a product which meets all the requirements of this specification.

4.1.2 The supplier shall provide and maintain an adequate quality assurance plan acceptable under the provisions of MIL-I-45206.

4.1.3 The supplier shall have documented his quality control system procedures, and the documents shall be available for review by the quality control representative of the command or agency concerned.

4.2 Quality conformance inspection.

4.2.1 Lot. - For the purpose of this specification a lot shall consist of one production batch produced at one time, of the same type and subtype as defined by the applicable basic specification (see 1.2), under the same conditions and from ingredients of the same kind, nature, and quality.

4.2.2 Sampling. - A minimum of three samples shall be taken from each lot, as defined in this specification, for the quality conformance tests. Where the type specification (see 1.2) requires a greater number of samples for product quality testing, the number of samples required by the type specification should be used for the quality conformance tests. The sample shall be fully representative of the cross section of the material; that is, it shall include proportionate amounts of facing fabrics or surface finish of insulations; and cements and adhesives shall be thoroughly stirred or mixed prior to sampling. Samples shall be wrapped in clear polyethylene sheets, placed in polyethylene envelopes or in polyethylene bottles as is suitable to protect the sample from contamination. Cleaned rubber or plastic gloves shall be worn while taking and handling the sample to avoid chloride contamination from perspiration or other contamination. The gloves shall be in accordance with 4.3.2(c)(4).

4.2.3 Reports. - Three copies of certified reports shall be furnished by the supplier with the material offered for delivery. They shall include the following:

- (a) The purchaser's order number.
- (b) The type and subtype of the material.
- (c) The supplier's lot (or production batch) number.
- (d) The actual results of chemical analyses and pH determinations.
- (e) The date on which the preproduction corrosion test (see 3.4.2(b)) was performed with accepted results (see 3.4.2(c)).

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4.2.4 Quality conformance tests. -

4.2.4.1 Leaching procedure prior to chemical tests. - Equipment, tools, and reagents used for specimen preparation and leaching shall be clean and sufficiently free of chlorides, silicates, sodium or acidic or alkaline materials which might otherwise affect the chemical tests. Water used in leaching shall be in accordance with 4.3.2(c)(1).

4.2.4.1.1 Specimen preparation. - Two 20 gram specimens shall be taken from each sample. The specimen shall be proportionally representative of the entire cross section of the composition except that metal screen or expanded metal used as a supporting facing shall not be included. Specimen shall be prepared as follows:

- (a) Asbestos-based dry materials, calcium silicate and other hard types shall be pulverized in a Waring Blender, or equal, operated at high speed for 30 to 60 seconds. The sample shall contain no large lumps. Sample portions may be cut or broken into smaller pieces prior to pulverizing.
- (b) Materials having metal wire insertions such as cloths or cloth-faced types shall be cut into pieces having a 1/2 inch maximum dimension.
- (c) Specimens, approximately 20 grams dry basis, of liquid adhesives (or cements) shall be air dried for 24 hours into 2 inch minimum diameter disks in tared metal dishes or pans. Actual dry weight shall be determined after drying. If the disk is dry and hard, it shall be pulverized.

Adhesives which will stick to metal may be painted on both sides of a 4-inch square piece of stainless steel sheet and air dried for 24 hours. As much should be applied as will remain on the sheet and not drip. The dry weight applied shall be determined by the difference in the weight of the sheet before painting and after air drying.

Caution: Protect from contamination during air drying.

4.2.4.1.2 Water leaching. - Place each specimen in an individual 800 milliliter (ml) pyrex beaker and cover the specimen with sufficient water to leach the specimen, 300 to 400 ml should be sufficient. Cover the beaker with a watch glass and heat for 1/2 hour at 95°C. to 100°C, then cool the beaker and its contents to room temperature. Filter the leach solution through a prewashed No. 41 Whatman, or equal, filter paper in a Buchners type funnel, transferring the specimen to the funnel and using light suction as necessary. The beaker and the specimen shall be washed thoroughly using a minimum of ten small washes to make up the filtrate to 800 ml. The filtrate shall be transferred to a polyethylene container and marked as solution A. This solution A shall be the source of aliquots for the chemical tests. Approximately 180 ml of solution A, from which aliquots for the sodium and silicate tests are to be taken, shall be refiltered through a 0.45 millipore filter.

4.2.4.2 Chemical tests. - The chemical tests shall be performed on the duplicate leach solutions A obtained from the duplicate specimens. The chemical analyses for chlorine, sodium, and silicate ions shall be calculated on the basis of the weight of the specimen. The pH shall be reported as the pH of solution A.

4.2.4.2.1 pH. - The pH shall be determined on the aliquot from solution A using a Beckman Zeromatic (or equal) pH meter. Aliquots shall be discarded after the determination.

4.2.4.2.2 Chemical analyses. - The chemical analyses for the chloride, silicate and sodium ion shall be made by the following methods, or equal, as approved in writing by the command or agency concerned. The analyses shall be made on suitable aliquots from solution A.

4.2.4.2.2.1 Colorimetric procedure for chloride. -

- (a) Optical density shall be measured on a prepared solution against a water reference solution in 5 centimeter (cm) cells by a Beckman Model "B" spectrophotometer (or equal) at 470 millimicron (m μ) and the chloride content read from a calibration curve made from aliquots of a standard chloride solution representing 20, 40, 60, 80, and 100 micrograms of chloride ion. Both a sample blank and a reagent blank shall be used and the reading obtained on solution A shall be corrected by subtracting the sum of the blank readings.

Note: Sulphate and phosphate cause positive interference at concentrations exceeding 0.3 weight percent.

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- (b) Add in turn to a 50 ml volumetric flask: an aliquot of solution A which contains 20-60 micrograms of chloride ion, (adjusted to pH 6 to 8 with 6N HNO₃ using indicating paper), 2 ml each of reagents (1) and (2), and water to 50 ml, mixing thoroughly at each addition. Read 15 minutes after preparation, mixing the solutions thoroughly just prior to reading.
- (c) Reagents. - Reagents shall be of suitable analytical grade. Reagent solutions shall have the following composition:
- (1) 99.7 grams of Fe₂(SO₄)₃ · (NH₄)₂SO₄ · 24H₂O per liter dissolved in 6N nitric acid. Store in a brown bottle for at least 24 hours before use. (Stable for several months).
 - (2) 7.5 grams of Hg(SCN)₂ dissolved in methyl alcohol to a final volume of 500 ml after mixing at least 1 hour with a stirrer and filtering through Whatman No. 41 paper.
 - (3) Water shall be distilled water containing less than 0.1 parts per million (ppm) of chloride ion.

Note: For reference see method C of ASTM D 512.

4.2.4.2.2.2 Colorimetric methods for silicate. - An aliquot of millipore filtered solution A shall be analysed photometrically (see ASTM E 60) for silicates by either of the following methods, modified as required to suit the leach water.

- (a) The molybdic acid method given in ASTM E 62
- (b) The molybdenum blue method given in ASTM E 120 or ASTM E 146

4.2.4.2.2.3 Analysis for sodium. - A 100 ml aliquot of millipore filtered solution A shall be analysed by either of the following methods:

- (a) Spectrographic method. - The solution is reduced to dryness under infra-red lamps in a tared platinum dish. The residue is then analysed spectrographically for sodium.
- (b) Flame photometric method. - The millipore filtered solution shall be used for the flame photometric analysis.

Note: Corrections must be made if high concentrations of alkaline or alkaline earth metals such as calcium, potassium or magnesium are present.

4.2.4.2.3 Acceptance. - If the average analysis of the two specimens taken from any sample fails to conform to the requirements of 3.3, the lot represented by that sample shall be rejected.

4.2.4.2.4 Retest. - At the option of the supplier, each individual unit of supply (i.e. carton, bag, roll, sheet, drum, etc.) in rejected lots may be retested at the supplier's expense by testing two samples taken at random from the unit of supply in accordance with 4.2. If the average analysis of the two specimens taken from either sample fails to conform to the requirements of 3.3, the unit of supply represented by that sample shall be rejected.

4.3 Preproduction corrosion test. -

4.3.1 Corrosion test. - The corrosion test shall be performed as a preproduction test by each supplier as required by 3.4.2(b). It need not be repeated for subsequent orders from any source unless required by the ordering data (see 6.3). The supplier shall keep records of the test results available for review by the command or agency concerned.

4.3.1.1 Alternate corrosion test. - The apparatus and corrosion coupon size as described in article "Breast Corrosion Cracking of Insulated Austenitic Stainless Steel" of ASTM Bulletin No. 225 may be used if the following modifications in apparatus, test specimen preparation, and test procedure are made:

- (a) The water container (bath) shall be of suitable corrosion resistant material. Glass, ceramic or chlorided plastic materials shall not be used.
- (b) The water level shall be controlled to assure that the insulation under test is wetted continuously.
- (c) Suitable precautions shall be taken to avoid contamination either by corrosive agents or by significant amounts of corrosion inhibitors, such as silicates, phosphates, sulfates or alkalis.
- (d) The corrosion coupon shall be sensitized and polished as required by 4.3.3(a), and shall be cleaned as required in 4.3.4(a)(1) using reagents defined in 4.3.2(c).

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- (e) The insulation material specimen shall be one inch thick.
 (f) The water evaporation rate for each 2 inch by 7 inch coupon shall be 800 ml per day, minimum.

4.3.2 Test method, apparatus and reagents. -

- (a) Method. - Pure water is transferred by wicking action through the insulation under test to the prepared surface of four heated stainless steel coupons for 4 weeks (28 days). The water, on evaporation on the heated metal, causes a concentration of soluble materials leached from the insulation on the heated surface. At the end of the test the prepared stainless steel coupons are examined for cracks.
- (b) Apparatus. - The arrangement of a test station is shown in figure 2. The parts of the apparatus are described as follows:
- (1) Heat source. - The heat source for the prepared stainless steel surface is shown as a length of 1/2 inch nickel-chromium-iron standard weight pipe, into which steam is admitted through a pressure control valve, adjustable from 5 to 20 pounds per square inch (psi), and a trap to discharge the condensate. Alternately, thermostatically controlled electric heating may be used.
 - (2) Water container. - The water container shown in figure 2 is a light gage one pint stainless steel container which has three overflow holes placed closely under the container rim. A corrosion resistant metal or plastic overflow container shall be placed under the water container to catch water overflow if the level control system should fail.
 - (3) Water makeup and control system. - The water makeup system shall be of polyethylene, polypropylene or other material which will not release chlorides, silicates or sodium to the makeup water. The control system shall maintain the water within the level range shown on figure 2. A simple control system would consist of a closed, elevated (about 3 feet), graduated makeup water container from which a tube having a flow limiting control such as a screw clamp leads to the makeup connection shown on figure 2. A second tubing connection, not shown in figure 2 but similar to the makeup connection, has its lower end set at the minimum water level shown on figure 2 and is connected to the air space in the makeup water container through its stopper or closure. This second connection acts as an overriding control on the makeup water flow limiting device when the water level approaches the minimum level by admitting air to the closed air space in the makeup water container. The increased air pressure in the makeup water container results in an increased flow rate.
 - (4) A ventilated AISI 300 type stainless steel cover, shown in figure 2, is required to protect the test station assembly from contamination while permitting the escape of water vapor.
 - (5) Fine Ni-Cr-Fe alloy 600 screening, detailed on figure 2, held in place with alloy 600 wire ties, holds the insulation under test snugly against the stainless steel coupons.

Note: Ni-Cr-Fe alloy 600 metal is used for portions of the apparatus in contact with the wet insulation because this metal is not subject to chloride stress corrosion cracking and also does not generate undesirable electrolytic effects when in contact with stainless steel.

- (c) Reagents and auxiliary material. - The grades of material specified below shall be used in all cases and for all rinsing, washing, etc.

- (1) Water. - Demineralized water meeting the following specifications:

Chlorides, max. - 0.1 ppm
 Conductivity, max. - 2.5 micro-mho/cm³
 pH, min. - max. - 6.0 - 8.0

(Water shall not be stored in glass, ceramic or any other container in which it could pick up chloride, silicate or sodium ions.)

- (2) Detergent. - The detergent shall be a low chloride alkaline sodium phosphate detergent, such as Pennsalt A-27, or equal. Manufactured by Pennsalt Chemical Company, Three Penn Center, Philadelphia, Pennsylvania.
- (3) Quartz wool. - The quartz wool shall be clear fused quartz fine wool as manufactured by the Amerill Quartz Division of Englehard Industries, 685 Ramsey Avenue, Hillside, New Jersey, or equal. The fine quartz wool shall be rinsed twice in separate lots of boiling water.

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each rinsing shall be followed by thorough draining. The prepared quartz wool shall be air dried and stored in a closed container.

- (4) Rubber (or plastic) gloves. - Rubber (or plastic) gloves shall be gloves made of a material which does not have chlorine containing compounds such as neoprene, saran or metallic chlorides in its formulation. Prior to use, the gloves shall be rinsed, drained, and dried in the same manner as the quartz wool in 4.3.2(c)(3) of this specification.

4.3.3 Test specimens. - Insulation specimens and corrosion coupons after cleaning shall be handled with cleaned rubber or plastic gloves. They shall be prepared as follows:

- (a) Corrosion coupons. - The coupons shall be cut from 16 gage AISI type 304 stainless steel sheet which has been sensitized in argon at 1200°F. for 3 hours. The coupons shall be 1/4 inch wide by 3-1/2 inches long and shall have a 5/32 inch diameter hole centered 7/32 inch from each end. The coupons shall be polished on one side, in the direction parallel to their length, using a dry 80 grit aluminum oxide belt with just sufficient pressure to remove the dull finish and leave the metal bright. The coupons shall be bent to "U" shape to an inside radius approximately 1/64 inch less than the outside radius of the steam pipe, with the polished surface on the outside of the bend. After bending the coupons shall be cleaned by the procedures of 4.3.4(a)1. The coupons shall be examined for cracks under 30X magnification, and any coupon showing evidence of a crack shall be discarded. Stainless steel bolts and nuts No. 6-32 by 1-1/4 inches long shall be used for installation of the coupon.
- (b) Insulation material specimen. - Insulation specimen approximately, but not less than, one inch thick and 2 1/2 inches in axial length, fully representative of the cross section of the material (except metal facings) as required by 4.2.2, shall be prepared in the shape shown in figure 2 as follows:
- (1) Block or rigid insulation shall be cut into fitted strips with the strip length parallel to the pipe (see figure 2) and applied so that the insulation will bear evenly on the surface of the corrosion coupon below the attachment of the bolt.
 - (2) Felt lagging, cloths or other soft materials shall be assembled in blanket form.
 - (3) Cement shall be mixed with water to a stiff paste and built up to a pad of suitable thickness on the 40 mesh Ni-Cr-Fe screen shown in figure 2. The wet cement and screen are then installed as shown on figure 2.
 - (4) Liquid type adhesives shall be applied evenly to the surface of a pad of prepared quartz wool which contacts the coupons. A minimum of 50 grams of the adhesive, dry basis, shall be applied as determined by weighing the pad before application and after the pad has air dried.

4.3.4 Procedure. -

- (a) The water container, corrosion coupons, and corrosion resistant metal overflow containers, shall be cleaned by procedure (1); the outside surface of the steam pipe shall be cleaned by procedure (2), and plastic overflow containers shall be cleaned by procedure (3). Following this cleaning, cleaned rubber gloves shall be worn when working on the test station. The final cleaning procedures are detailed as follows:
- (1) Immerse containers (or coupons) in a water solution containing 50 grams of detergent per liter and hold at 170°F. to 180°F. for 20 to 30 minutes. Remove from the detergent solution, shake well, insert and hold in boiling water for 20 to 30 minutes. Remove from the boiling water and rinse by dipping in a second boiling water solution. Then rinse in cold running water.
 - (2) Scrub the steam pipe with 170°F. to 180°F. detergent solution (50 grams per liter), using a stiff bristle brush. Immediately rinse twice by pouring hot (over 180°F.) water over the pipe.
 - (3) Rinse plastic overflow containers with the following, in turn; water, then acetone, then water, and finally with pure ethyl alcohol.

Note: Items shall be visually clean prior to final cleaning.

- (b) Four corrosion coupons and the insulation material specimens shall be installed as shown in figure 2. The spacing between the coupons shall be approximately one-fourth inch and the coupons shall contact the lower 180 degrees of the pipe surface evenly. The logs of the

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- corrosion coupon are drawn slightly off parallel by tightening the bolt and nut. The supporting screen shall hold the insulation specimen snugly and evenly in contact with the corrosion coupons without reducing the insulation thickness to less than 1 inch over the lower 180 degrees.
- (c) Heat the specimens to 200° to 220° F. by establishing the steam pressure within the pipe to 5 to 10 psig and holding at temperature for 1 hour. Then shut off the steam supply.
 - (d) Add water slowly to the water container to the normal water level. Re-establish the steam pressure at 5 to 10 psig and adjust the water level control system to maintain the levels shown on figure 2 (that is, 3/8 inch to 3/4 inch below the corrosion coupon surface). Keep the cover in place except when working on the station.
 - (e) Check the makeup water flow rate and adjust the steam pressure until the water makeup rate is 200 ml per day. Normal rate should be in the range 200 to 600 ml per day; however, a makeup water rate in excess of 600 ml per day is acceptable.
 - (1) If steam pressure adjustment up to 12 psig does not bring the evaporation rate (water makeup) to 200 ml per day, indicating a poor wicking action, place a layer (about 1/4 inch) of quartz fine wool between the insulation and the supporting screen to improve the wicking action.
 - (2) If any water overflows from the water container, it shall be caught in the overflow container and shall be returned to the water container, as opportunity permits.
 - (f) Continue the test on a 24 hours a day, 7 days a week, basis for four weeks.
 - (g) At the completion of the four-week test, shut off the steam, disassemble the station, remove the coupons and clean the coupons by thoroughly scrubbing in water with a stiff fiber bristle brush.
 - (h) Examine each cleaned coupon under 30X magnification for evidence of cracking.

Note: Areas of attack are frequently identified by reddish corrosion product located around the crack.

4.3.4.1 Acceptance. - If the coupons fail to conform to the requirements of 3.4.2(b), the specific type and subtype tested shall have failed to meet the corrosion test requirements.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing and marking. - Packaging, packing and marking shall be as required by the specification listed in 1.2 for the specific type material and the packaging and packing levels shall be specified in the ordering data (see 6.2), except as follows:

5.1.1 Packaging. - When the level specified in the ordering data does not include a container or a wrap which will completely protect the material from contamination by loose soil, or other outside dirt, the insulation in appropriate bundles shall be completely wrapped in kraft paper, class B, 50-pound weight or heavier, conforming to UU-P-268 (or approved equal material).

5.1.2 Marking.

5.1.2.1 For containers of insulation larger than 5 gallons. - In addition to the marking required in the specification listed in 1.2 for the specific type material, the title and number of this specification shall be labeled in green letters at least 1/2-inch high in a minimum of 3 locations on the container.

5.1.2.2 For 5-gallon containers or smaller. - In addition to the marking required in specification listed in 1.2 for the specific type material, the number and title of this specification shall be labeled in green letters at least 1/4-inch high in a minimum of 2 locations on the container.

6 NOTES

6.1 Intended use. - Mineral type thermal insulation conforming to this specification is intended for use on hot piping, machinery, and equipment having surfaces of AISI 300 type stainless steel. These thermal insulations may also be used on other heated metal surfaces such as iron, Ni-Cu alloy, and Ni-Cr-Fe alloy surfaces.

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6.2 Ordering data. - Procurement documents shall specify the following:

- (a) Title, number, and date of this specification.
- (b) Type and subtype required (see 1.2 and 3.1).
- (c) Applicable ordering data of the specification for specific type material (see 1.2 and 3.1).
- (d) Size, weight or thickness.
- (e) Requirements for other types (Government or industrial) (see 3.2).
- (f) Corrosion test repeated, if required (see 4.3.1).
- (g) Level of packaging and level of packing required (see 5.1).

6.2.1 If an additional preproduction test is required (see 3.4.2), the procurement document shall specify (a), (b), and (c) separately for the preproduction material.

6.3 Definitions. -

6.3.1 Command or agency concerned. - The Government or prime contractor who has design or procurement responsibility acting under contract to the Government.

6.3.2 Certificate of compliance. - An acceptable certificate of compliance for the type and subtype shall include the following:

- (a) The date and source of a laboratory report giving numerical determinations of chemical and corrosion test results performed in accordance with and meeting the requirements of this specification.
- (b) Certification that the material tested had met the requirements of the specification for the specific type material. For those specifications that require qualification (see 1.2), the material must be a product on the applicable qualified products list.

Preparing activity:
Navy - 8H
(Project 5640-N0388h)

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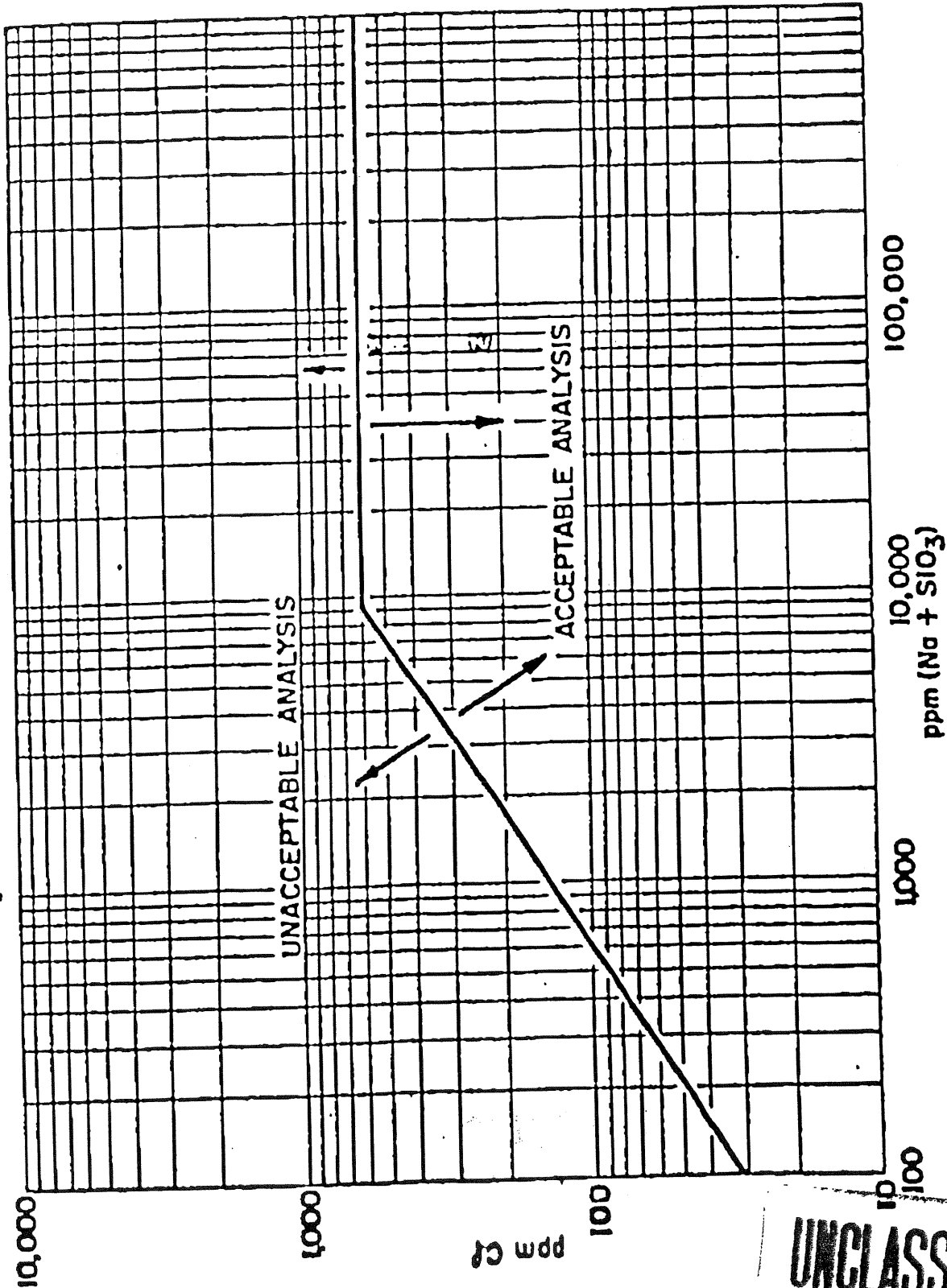


Figure 1 - Acceptability of Insulation material on the basis of the pld points of the Cl and the (Na + SiO₃) analyses.

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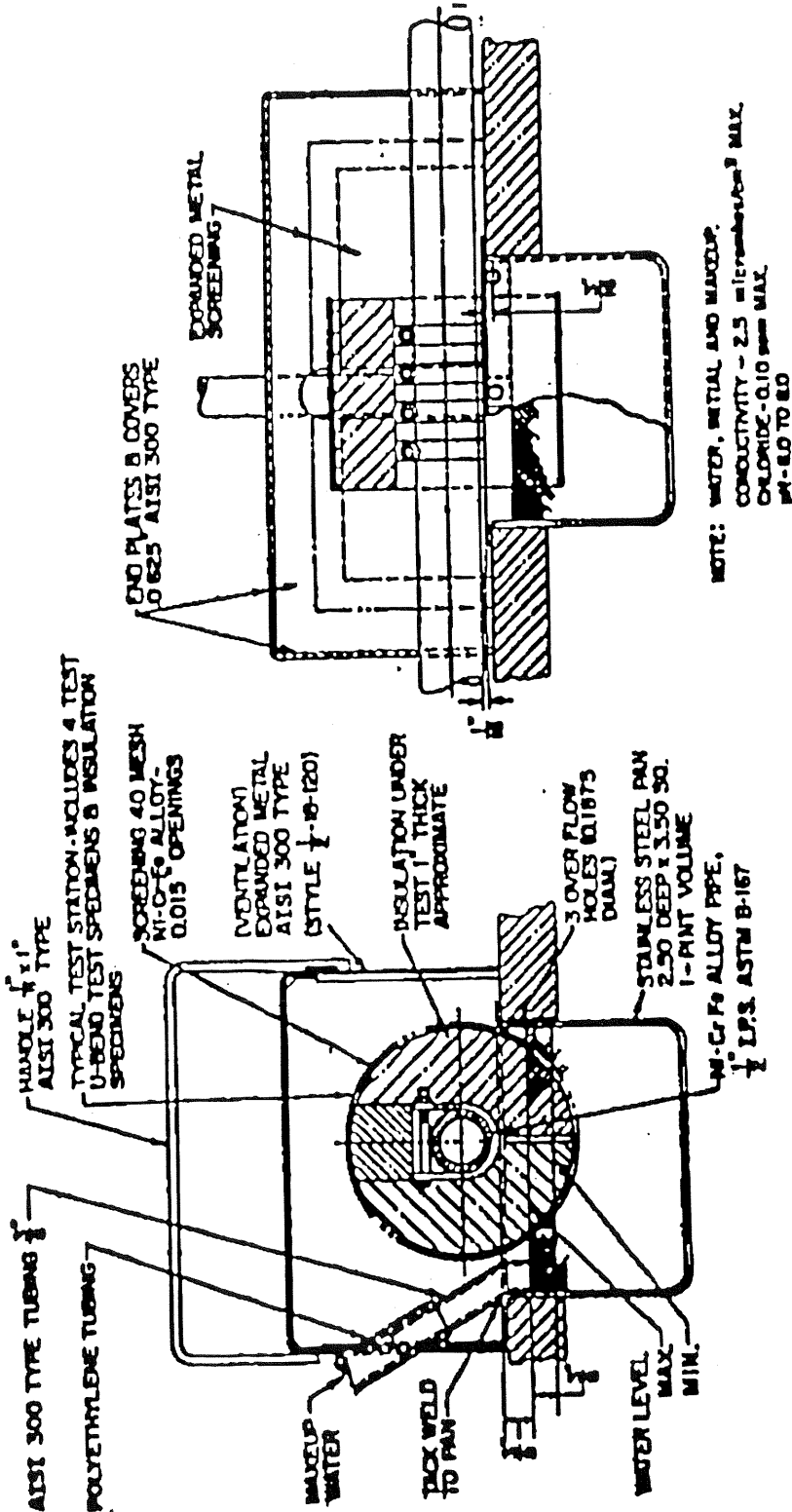
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NOTE: WATER, INITIAL AND MAKEUP,
 CONDUCTIVITY - 2.5 MICROMH-CM² MAX.
 CHLORIDE - 0.10 ppm MAX.
 PH - 8.0 TO 8.0

Figure 2 - Thermal insulation corrosion test station.

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