

MIL-STD-769D(SHIPS)
NOTICE-1
27 October 1972

MILITARY STANDARD
THERMAL INSULATION REQUIREMENTS
FOR
MACHINERY AND PIPING

TO ALL HOLDERS OF MIL-STD-769D(SHIPS).

1. THE FOLLOWING PAGES OF MIL-STD-769D(SHIPS) HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

<u>NEW PAGE</u>	<u>DATE</u>	<u>SUPERSEDED PAGE</u>	<u>DATE</u>
3	27 October 1972	3	1 April 1971
4	27 October 1972	4	1 April 1971
9	27 October 1972	9	1 April 1971
10	1 April 1971		Reprinted without change

2. RETAIN THIS NOTICE PAGE AND INSERT BEFORE THE TABLE OF CONTENTS.

3. Holders of MIL-STD-769D(SHIPS) will verify that page changes indicated above have been entered. The notice page will be retained as a check sheet. This insurance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the Military standard is completely revised or canceled.

Preparing activity:
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glass felt, MIL-I-16411, mineral wool felt, MIL-I-2818, or insulation block, MIL-I-2319 to the required thickness and shape; the insulation is then lagged with asbestos cloth. This cloth shall be carried over the outer edge of the permanent insulation and secured with adhesive. The semi-removable cover shall then be sealed and painted.

6. INSTALLATION

6.1 Hot surface insulation.

6.1.1 Pipe and tubing. Each layer of molded insulation shall be installed with joints butted together. Where two layers are used, all joints shall be staggered. Not less than three fastenings shall be used for securing each 3-foot section of insulation. Fastening shall be number 18 gage minimum (0.049-inch diameter) annealed black or hot-dipped galvanized iron wire or flat steel bands. Except as otherwise specified, lagging shall be installed over the insulation.

6.1.1.1 The installation of soot blower piping insulation shall be in accordance with drawing 5000-S5103-841336.

6.1.2 Piping components. For valves, fittings, and accessories, welded and brazed fittings including unions may be insulated and lagged similarly to adjacent piping.

6.1.2.1 Block, felt, blanket insulating materials, or molded pipe insulation secured with hot-dipped galvanized iron wire, may be used. When insulating felts are used above 850°F., the inner layer shall be fibrous glass felt conforming to MIL-I-16411 or refractory fiber felt, MIL-I-23128. Galvanized iron wire netting, number 18 gage minimum (0.049-inch diameter), shall be spread over the insulating material and secured with wire. Insulating cement shall be used to fill all crevices, smooth all surfaces, and completely cover the wire netting. A 1/2-inch thickness of finishing cement shall then be applied. Insulating material shall be the same thickness as that on adjacent piping.

6.1.2.2 For components 3-1/2 inch i.p.s. and smaller, insulating cement only conforming to MIL-C-2861, may be applied to a thickness 1/2-inch less than the adjacent pipe insulation. A 1/2-inch thickness of finishing cement shall be applied over the insulating cement.

6.1.2.3 Re-usable covers shall be fitted where required.

6.1.3 Machinery and equipment. For machinery and equipment, block, felt, or blanket insulating materials of the required thickness shall be secured with hot-dipped galvanized iron wire. Galvanized iron wire netting 1-inch mesh and number 18 gage minimum (0.049-inch diameter) shall be spread over the surface and secured by wire. Insulating cement shall be used to fill all crevices, smooth all surfaces, and completely cover the wire netting.

6.1.3.1 When no insulating cement has been specified, a 1/2-inch thickness of finishing cement shall be applied.

6.1.3.2 When an insulating cement has been specified it shall be applied in successive layers, 1/2-inch to 1-inch in thickness, until the total thickness specified has been reached. Wire netting, similar to that used for covering the insulating materials shall be installed between layers. A 1/2-inch thickness of finishing cement shall be applied over the last layer of insulating cement.

6.1.3.3 Lagging shall be installed over finishing cement. Re-usable covers shall be installed where required.

6.1.3.4 Clips, hooks, or other fastenings for securing insulation or lagging shall not be brazed or welded to nonferrous parts of distilling plants or deaerating feed tanks.

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6.1.4 Boiler uptakes. For boiler uptakes, the thermal insulation shall be 2-inches thick. Either mineral wool felt, MIL-I-2818, or fibrous glass sheet, MIL-I-15475, may be used. If acoustic absorptive treatment is found to be necessary to decrease the noise level the insulation thickness shall be increased accordingly.

6.1.4.1 Metal lagging for uptakes shall be galvanized sheet steel conforming to QQ-S-775, not less than 1/32-inch thick.

6.1.4.2 Insulation and lagging is not required on uptakes above the weather deck, except where the transfer of heat, to spaces adjacent to the uptake area, would be objectionable.

6.1.5 Unfired pressure vessels. Unfired pressure vessels including catapult wet accumulators shall be covered with block insulation MIL-I-2819 in accordance with table V. Block insulation shall be covered with 1/2-inch cement, MIL-C-2861, lagged with asbestos cloth, grade U.G. of SS-C-466, and painted in accordance with 6.6. Insulation in the way of vessel supports shall be metal faced to prevent insulation from wedging between the vessel and its support.

6.1.5.1 Removable and re-usable covers shall be installed over butt welded shell inserts for which periodic radiographic inspection of the joint is required. These covers shall extend 4 inches beyond the welded joint.

6.2 Antisweat insulation (cold and chilled water service).

6.2.1 Preformed pipe covering shall be secured to the pipe in the manner prescribed in 6.1.1. Fibrous glass felt insulation shall be secured with number 18 gage minimum (0.049-inch diameter) hot-dipped galvanized iron wire, soft annealed copper wire, QQ-W-343, wire inserted asbestos yarn, or glass thread, MIL-C-20079, spirally wound on 1-inch centers. One layer of water repellent and fire resistant paper, UU-B-790, shall be wrapped tightly around the insulation and secured with cotton twine, T-T-931, glass thread, MIL-C-20079, or 1-inch wide tape, UU-T-106. All joints of the paper shall be lapped and sealed with adhesive cement, MIL-A-3316, class 1. The compatible lagging shall then be installed and completely covered with vapor barrier compound, MIL-C-19565, type II. The water repellent paper may be omitted on cellular glass where the insulation surface is suitable for the effective application of vapor barrier compound MIL-C-19565.

6.2.2 Application of a vapor barrier is not required on elastomeric foamed plastic insulation, MIL-P-15280. Lagging shall be applied to protect insulation from damage, and to delay smoke generation in the event of fire.

6.3 Refrigerant insulation.

6.3.1 Cellular glass insulation shall be coated on all surfaces with vapor barrier compound, MIL-C-19565, type II at the time of installation. Insulation shall be installed with staggered end joints. On horizontal pipes the longitudinal joints shall be at the top and bottom. Insulation shall be secured with number 18 gage minimum (0.049-inch diameter) copper-covered steel wire or 1-inch wide tape, UU-T-106, on 9-inch centers. The compatible lagging shall then be installed and completely covered with vapor barrier compound, MIL-C-19565, type II.

6.3.2 Elastomeric foamed plastic, MIL-P-15280, may be applied in 1/4-inch minimum thickness layers as necessary to build up the required thickness (type II, form 1 or 2). All longitudinal and butt joints shall be staggered. All joints and lagging, if required (see 6.2.2), shall be secured with adhesive cement in accordance with paragraph 3.7 of MIL-P-15280.

6.4 Weather deck hot piping insulation.

6.4.1 Calcium silicate or cellular glass insulation for piping exposed to the weather shall be installed as follows:

- (a) Preliminary preparation of piping.
 - (1) All surfaces to be clean, dry, and free of scale and grease.
 - (2) Fittings, valves, flanges, pipe supporting clamp, and at least 3 inches of adjacent pipe shall be painted as follows: Apply one coat pretreatment formula 117, MIL-C-15328. After this coat dries, apply two coats of aluminum paint made by mixing two pounds of aluminum paste, TT-P-320, type II, class B, with each gallon of phenolic varnish.

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- (2) Prevent the transfer of heat to surrounding areas which would be objectionable to personnel or adversely affect other components.
- (3) Prevent transfer of heat which would otherwise reduce the efficiency or effectiveness of the system or component.
- (g) Where operating temperatures are normally between 125°F. and 150°F. and the omission of insulation will not adversely affect operating efficiency, non-metallic lagging only may be applied where necessary, to protect personnel from contact with hot metal surfaces.
- (h) Insulation on austenitic stainless steel components and piping except for antisweat and refrigeration types shall meet the requirements of MIL-I-24244.
- (i) Adhesives containing halogenated solvents shall not be used for submarine applications.
- (j) Two feet of pipe immediately upstream of thermostatic steam traps shall be insulated with 1/4 inch of insulation cement, SS-C-160, type III, grade F, and covered with approved lagging cloth. A removable cover made of two thicknesses of cloth (see 5.3) shall be installed over the trap.

4.3 Adhesives. The following adhesives shall be used for fastening cloth and tape lagging. Lagging pretreated with compatible adhesive is acceptable providing the end result is equal to one of these combinations:

<u>Type of lagging</u>	<u>Specification</u>
Asbestos	
Fibrous glass	MIL-A-3316, class 1

4.4 Finishing cements. Where finishing cement is specified, any of the following materials are acceptable subject to any material limitations for the proposed application:

- (a) Finishing cement, SS-C-160, type III, grade F.
- (b) High-temperature insulating cement, MIL-C-2861, when used under asbestos cloth.
- (c) A mixture of 80 percent high-temperature insulating cement, MIL-C-2861, and 20 percent Portland cement, SS-C-192.

4.5 Metal lagging. Where metal lagging is required, any of the following materials are acceptable, except for uptake applications (see 6.1.4):

<u>Sheet material</u>	<u>Specification</u>	<u>Nominal thickness</u> Inch
Hot-dipped galvanized steel	QQ-S-775	0.014
Aluminum	ASTM A209, 6061	.030
Corrosion-resistant steel (CRES)	ASTM A167, AISI type 304	.014

4.6 Fasteners. Insulation shall be held in place by suitable wire or flat metal bands. The welding of fasteners to machinery, piping, pressure vessels or other related equipment is prohibited. Where fasteners are necessary they shall be attached during manufacture (prior to heat treatment, stress relief and testing) by a Naval Ship Engineering Center approved procedure.

5. RE-USABLE COVERS

5.1 Hot-surface insulation covers. In order to insure that the pipe covering will not interfere with the servicing of a takedown joint where a re-usable cover is installed, the permanent insulation shall stop short of the takedown joint and a short removable and re-usable section of insulation shall be installed between the permanent insulation and the takedown joint. The insulation joint formed by the permanent and re-usable sections may be square, or at an angle of 45 degrees; the joint, however, shall be tight, without any gaps between the two sections and shall incorporate means to prevent dislodging the insulation sections. Re-usable covers are not required on systems insulated with elastomeric foamed plastic insulation (MIL-P-15280).

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5.2 Construction. For sizes larger than 2 inches i.p.s., valve bonnets and valves having takedown joints at the ends shall be fitted with re-usable covers such that the bonnet joint may be removed independently of the valve covering. Valves 2 inches i.p.s. and under shall be fitted with separate covers as indicated above, or covers of a one-piece design such that they may be wrapped around the entire valve body and clipped or otherwise secured just below the handwheel.

5.3 Fabrication, piping components. For piping components except as otherwise specified, any one of the following methods of fabrication is acceptable:

5.3.1 Covers may be made in two halves of thermal insulating felt enclosed in asbestos cloth. Each half cover shall be sewn and quilted with wire-inserted asbestos yarn conforming to SS-C-466, form II, (for machine sewing, if desired, this yarn may be constructed with the three monel wires twisted together first, and the three asbestos threads twisted around the outside of the wire) or fastened with mechanical stapling in a manner to provide a uniform thickness, strength and rigidity.

5.3.1.1 Covers for use at temperatures of 850°F. and below shall be filled with insulation felt (see table I). Wire-inserted asbestos cloth, SS-C-466, grade AAA-M, shall be used on the inside surface of covers for valves larger than 2 inches i.p.s. For valves 2 inches i.p.s. and smaller, grade AAA shall be used on inside surface of covers. For all covers, asbestos cloth, SS-C-466, grade U.G., having a minimum average breaking strength of 90 pounds in warp and 40 pounds in fill shall be used on outside surfaces.

5.3.1.2 Covers for use at temperatures above 850°F. shall have filling consisting of layers of fibrous glass felt, MIL-I-16411, or refractory fiber felt, MIL-I-23128, and shall be covered on the inside surface and on the ends with nickel-chromium alloy wire mesh, QQ-W-390 (or wire-inserted asbestos cloth, SS-C-466, grade AAA-M, for services up to 950°F.) and on the outside surface with grade U.G. asbestos cloth (as described in 5.3.1.1). Asbestos paper MIL-P-52350, class 2, thickness 1/8 inch may be inserted between the insulation felt and the asbestos cloth if considered necessary to retain the cylindrical shape of the cover.

5.3.1.3 Hard asbestos millboard, 1/4 inch thick, enclosed in asbestos cloth of the type used on the outside cover, shall be sewn on ends of covers for strength and rigidity. When a more flexible cover is desired, such as when space limitation would not permit installation of the more rigid type, the millboard will not be required. When the flange diameter is larger than the outside diameter of the adjacent pipe covering, build-up pieces made of insulation felt encased in asbestos cloth, SS-C-466, grade AAA shall be stitched to inside of cover. Halves of covers shall be fastened together by 1/16-inch diameter galvanized, or other corrosion resistant wire rope laced through brass or galvanized steel hooks or rings, or fastened by brass snap fasteners. Fastenings shall be securely attached to cloth lagging.

5.3.1.4 Preformed fibrous glass valve or fitting covers may be used when temperatures are in the 125°-370°F. range. These shall be of the same thickness as the adjacent pipe covering. Such covers, when used, shall be lagged independently of the pipe covering and in a manner which will facilitate removal and replacement.