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REVIEW OF MILITARY SPECIFICATIONS

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Many of the military and federal specifications for thermal insulations were specifically written for asbestos and, therefore, no substitution within these specifications is possible. Examples of these types of specifications are:

MIL-I-0015091B(SHIPS)	Insulation felt, thermal, asbestos fiber
MIL-P-52350	Paper, asbestos
SS-C-466c	Cloth, thread, and tape; asbestos
HH-I-561c	Insulation, thermal, asbestos, block and pipe-covering (for temperatures up to 750°F)
HH-M-351b	Millboard, asbestos
MIL-G-15342A	Gaskets (metallic, asbestos, spiral wound, symbol 2410, for boilers)
HH-G-76c	Gaskets; asbestos metallic cloth
HH-P-46c	Packing; asbestos, sheet, compressed

HH-P-41c	Packing; asbestos, rope and wick
HH-P-34b	Packing; asbestos, rod, braided
HH-P-31d	Packing material, asbestos, metallic cloth and tape

Some specifications do not specify a particular material for the insulation, only that the material meet certain tests and requirements. For example, MIL-I-2781D (13 June 1963), the military specification entitled Insulation, Pipe, Thermal states (3.2) "The thermal pipe insulation shall be composed of heat-resisting compounds suitable for the temperature conditions and the purpose intended." Thus, it would seem that any compound meeting this requirement would have been acceptable.

MIL-STD-769A(SHIPS) (23 April 1963) entitled "Military Standard Thermal Insulation Requirements for Machinery and Piping" seems to suggest that either asbestos-containing or asbestos-free materials can be used for certain applications. On page 3, (4.2(e)) a choice is given between calcium silicate or cellular glass insulation on hot piping exposed to the weather. Also on page 3, (4.3) the type of lagging specified is either asbestos or fibrous glass. On page 7, (Table V) insulating materials for hot surfaces of machinery and equipment up to 850°F could have been asbestos felt, insulation block,

mineral fiber blanket, or pipe covering. On page 10, (6.1.4) boiler uptakes can be insulated with either mineral wool felt or fibrous glass sheet. On page 11, (6.4.1) there is also mention of calcium silicate or cellular glass insulation for piping exposed to the weather.

The Bureau of Ships Technical Manual, Chapter 9390 Thermal Insulation (11/1/65), on page 2, (9390.11) lists the insulating materials available. These include:

2.a. preformed sectional pipe covering:

thermal insulation pipe covering (MIL-I-2781)

thermal cellular glass block and pipe covering (HH-I-551)*

plastic foam unicellular, sheet and tubular form, elastomeric (MIL-P-15280)*

insulation, pipe, thermal, fibrous glass (MIL-I-22344)*

2.b block:

thermal insulation block (MIL-I-2819)

2.c batts, blankets, and felts:

roll asbestos felt (MIL-F-20077)*

asbestos insulating felt (MIL-F-15091)*

fibrous glass batt insulation (MIL-I-15475)*

mineral wool blanket insulation (MIL-I-2818)*

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* I do not have copies of these specifications.

thermal glass fiber insulation felt (MIL-I-16411)*

thermal fibrous glass insulation felt (flexible) (MIL-I-16023)*

thermal insulating tape (MIL-T-15349)*

plastic foam, unicellular, sheet and tubular form, elastomeric (MIL-P-15280)*

insulation blanket, thermal refractory, fiber flexible (MIL-I-23128)*

2.d. plastic:

high temperature insulation (MIL-C-2861)

finishing cement (MIL-C-2908)*

The technical manual then discusses each type of insulating material, which kind is commonly used to meet the specification, and their limitations, such as temperature range.

3. Thermal insulation pipe covering (MIL-I-2781), grade I, is usually 85% magnesia good up to 600°F. Grade II is usually bonded amosite asbestos good to 750°F.

9. Molded cellular glass thermal insulation (HH-I-551) is good up to 400°F but is not recommended for vibrating machinery.

11. Preformed fibrous glass pipe covering (MIL-I-22344) is bonded glass fibers good up to 370°F and used for antisweat and hot pipe insulation.

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* I do not have copies of these specifications.

12. Thermal insulation block (MIL-I-2819) is furnished in four classes according to the temperature range. Materials are not specified except that for the range of 1001°F to 1500°F diatomaceous earth is used. The specification MIL-I-2819E (Interim Amendment) dated 9 January 1973 states "The insulation block shall be composed of asbestos-free and silica free heat-resisting compounds suitable for the temperature conditions and the purpose intended."

15. Roll asbestos felt (MIL-I-15091) is composed of long asbestos fibers and organic sizing and is suitable for up to 900°F.

16. Asbestos insulating felt (MIL-I-15901) is good up to 900°F. Thermal fibrous glass insulation felt (MIL-I-16023) is incombustible and fire retardant. Thermal glass fiber insulation felt (MIL-I-16411) is good up to 1200°F.

17. Fibrous glass felt insulation (MIL-I-15475) is composed of glass fibers bonded to form a semirigid batt. It can be used to 450°F without a sheet steel enclosure, or to 900°F with an enclosure. It is suitable for insulating boiler uptakes.

18. Mineral wool blanket insulation (MIL-I-2818) consists of felted mineral wool and is good up to 900°F.

19. Thermal insulating tape (MIL-I-15349) is composed of a woven asbestos jacket enclosing either asbestos or glass fibers. It is suitable for up to 750°F.

21. High temperature insulation cement (MIL-C-2861), as specified here, will contain asbestos. MIL-C-2861D (4 December 1967) also includes asbestos in the cement mixture. However, MIL-C-2861D (Interim Amendment-1) (20 June 1974) prohibits the use of asbestos in the cement. The memorandum of May 1, 1981 by Lewis Clapp referred to the Hass deposition, in which Hass stated that asbestos was not a requirement in thermal insulating cements until MIL-C-2861C was issued on 17 September 1963.

Lagging materials are described in the Bureau of Ships Technical Manual under 9390.12. The purposes of lagging are to protect the relatively soft insulating material from mechanical abuse, to support the insulating material which is subjected to continual vibration, and to provide a smooth finish to be painted.

The following are listed in the technical manual:

2.a. cloth:

asbestos cloth, thread and tape (SS-C-466)

fibrous glass cloth, tape and thread (MIL-C-20079)*

2.b. brattice cloth (MIL-C-788)*

2.c. paper:

flameproof and water-repellent sheathing paper (MIL-P-15006)*

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* I do not have copies of these specifications.

equivalency between glass fiber felt and refractory fiber blanket, and between asbestos felt, insulation block, mineral fiber blanket, and glass fiber felt.

The General Stores Navy Stock List of September 1955 lists several asbestos-free insulations. On page 31, felted mineral wool (MIL-I-2818) was used for insulating boilers, breechings, and ovens. On page 37, insulation cloth, thermal, fibrous glass (MIL-C-20079) was used for lagging material or jacket over thermal insulation. On page 38, fibrous glass gasket (N: 32-T-2, Type A) was used as a gasket material for heat insulation.. On pages 40-42, insulation pipe covering, thermal (MIL-I-2781) is described without reference to the specific materials which comprise the insulation.

The report by Allen Winer, et al. entitled "Asbestos - A Case Study of the U.S. Navy's Response to Upgraded Safety and Health Requirements" (March 1976) states "In general, the basic material substituted for asbestos thus far in thermal insulation systems are fibrous glass cloth and felt, refractory felt, and calcium silicate with a non-asbestos filler." (page 7). These insulations, except perhaps for the asbestos-free calcium silicate, were available commercially for quite a few years.

Besides the specifications and other material you sent me, I am enclosing some additional material which might be useful.

From certain minutes of the Asbestos Textile Institute:

(1) General Meeting of April 7, 1949 - on page 2, it states that the asbestos textiles used for protective clothing for firefighting purposes are being completely disregarded in preference for glass cloth, laminated with aluminum or silver foil.

(2) Board of Governor's Meeting of October 6, 1971 - on page 4, it states that certain Insulation Tape, Thermal specifications were being revised to delete asbestos and include glass stuffer.

(3) Board of Governor's Meeting (date unknown, but probably early 1971) - on page 4, it states that the Navy leaves the use of either fiber glass fabrics or asbestos fabrics to the discretion of the shipyard.

The Building Products Register of the American Institute of Architects from 1964 describes several specifications for various asbestos-free thermal insulations.

A thick book entitled Specifications for Construction of a Twin Screw Passenger and Cargo Vessel, Design P2-SE2-R3, by the U.S. Maritime Commission (January 1945), states on page 75-1 that "The insulating materials for temperatures below 600°F shall be 85% magnesia, fibrous asbestos, rock wool or fibrous glass; except that for temperatures below 200°F, 85% magnesia or asbestos shall not be used." This shows the equivalency between these four types of insulations and that

any one of them could have been used. On page 75-2, it states that glass cloth or tape could have been used in most situations, instead of asbestos, to cover pipe insulation. The designation P2-SE2-R3 means a combination passenger and cargo vessel for American Export Lines.

A similar book entitled Specifications for Construction of a Single Screw Cargo Vessel, Design C4-S-1-a, for the Maritime Administration (November 1950) states on page 75-2 and page 75-3 that the insulating materials (among others mentioned) for piping systems and machinery shall comply with the specifications for either 85% magnesia (HH-M-61b), amosite asbestos insulation, fibrous glass pipe insulation for use up to 600°F, fibrous glass sheet insulation for use up to 1000°F, calcium silicate for use up to 1200°F, or diatomaceous silica for use up to 1000°F. On page 75-3, the high temperature insulating cement is composed predominately of mineral wool, without mentioning asbestos. On page 75-4, fibrous glass cloth and tape are listed as choices of lagging materials. The C4-S-1-a designation is for a mariner type high speed cargo vessel.

In conclusion, it is clear that asbestos insulation was not a requirement for many applications aboard ships and other applications, especially those below 600°F, where fibrous glass insulation could have been used. Other effective kinds of

insulations, such as mineral wool types or refractory fiber blankets, were also mentioned in specifications. Insulating cements did not seem to require asbestos. Fibrous glass cloth and tape were alternative lagging materials.