

CONFIRMED
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Specification for

Thermal insulation for marine piping systems

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Foreword

This British Standard has been prepared under the direction of the Shipbuilding and Marine Standards Committee and is based on a proposal of the British Ship Research Association.

Thermal insulation is an important prerequisite for the control of heat transfer, prevention of fire hazards and to ensure that ambient temperatures are maintained in machinery and similar compartments conducive to the comfort of operating personnel.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 13 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the Shipbuilding and Marine Standards Committee, was published under the authority of the Executive Board and comes into effect on 31 December 1981

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The following BSI references relate to the work on this standard:
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NOTE Users of this British Standard Marine Series should note that while observing the requirements of this standard, they should at the same time ensure compliance with such statutory requirements, rules and regulations as may be applicable to the individual ship concerned.

1 Scope

This British Standard specifies requirements for the thermal insulation of marine piping systems operating in the temperature range $-40\text{ }^{\circ}\text{C}$ to $+565\text{ }^{\circ}\text{C}$ ¹⁾ including diesel exhaust gas piping systems.

Excluded from this standard are:

- a) boiler safety valve exhaust pipes and other hot pipes in ships' funnels excepting where such pipes are hazardous to personnel;
- b) direct insulation on boilers, main and auxiliary machinery.

Typical methods of applying insulation are shown in Figure 1 to Figure 4.

2 References

This standard makes reference to the following standards publications.

BS MA 51, *Summary and application of pipework flanges for marine use — Part 1: Carbon steel flanges — Part 2: Cast iron flanges — Part 3: Copper alloy flanges — Part 4: Alloy steel flanges — Part 5: Bolting.*

BS 476, *Fire tests on building materials and structures — Part 4: Non-combustibility test for materials — Part 5: Method of test for ignitability — Part 7: Surface spread of flame tests for materials.*

BS 1449, *Steel plate, sheet and strip — Part 1: Carbon steel plate, sheet and strip.*

BS 1710, *Identification of pipelines.*

BS 2989, *Hot-dip zinc coated steel sheet and coil.*

BS 3927, *Phenolic foam materials for thermal insulations and building applications.*

BS 3958, *Thermal insulating materials — Part 1: 85 per cent magnesia preformed insulation — Part 2: Calcium silicate preformed insulation — Part 3: Metal mesh faced mineral wool mats and mattresses — Part 4: Bonded preformed mineral wool pipe sections — Part 5: Bonded mineral wool slabs (for use at temperatures above $50\text{ }^{\circ}\text{C}$) — Part 6: Finishing materials; hard setting composition, self-setting cement and gypsum plaster.*

BS 3974, *Pipe supports — Part 1: Pipe hangers, slider and roller type supports — Part 3: Large bore, high temperature, marine and other applications.*

BS 4391, *Recommendations for metric basic sizes for metal wire.*

BS 5608, *Specification for preformed rigid urethane and isocyanurate foams for thermal insulation of pipework and equipment.*

BS 5970, *Code of practice for thermal insulation of pipework and equipment (in the temperature range of $-100\text{ }^{\circ}\text{C}$ to $+870\text{ }^{\circ}\text{C}$).*

3 Definitions

For the purposes of this British Standard the following definitions apply.

3.1

bulk density

the mass per unit volume of dry insulating material (kg/m^3)

3.2

thermal conductivity

the thermal transmission through unit area of a slab of a uniform material of unit thickness when unit difference of temperature is established between its faces [$\text{W}/(\text{m K})$]

3.3

preformed insulating material

material fabricated in such a manner that at least one surface conforms to the shape of the surface to be covered, and which when handled will maintain its shape without cracking, breaking, crumbling or permanent deformation

3.4

radiused and bevelled lags

preformed rigid insulation for longitudinal application to cylinders larger than those for which pipe sections are available, and having one or more edges bevelled with faces curved to fit the surface

3.5

mattress

a flexible construction comprising insulating material faced on both sides or totally enclosed with fabric, wire netting, expanded metal or similar covering

3.6

removable type flange cover

sheet metal or fabric flange cover manufactured in halves and lined with insulating material

3.7

loose-fill insulating material

insulating material in the form of powder, granules, loose or pelleted fibres, which is used in the dry state as a filling in cavities, casings or jackets

¹⁾ Temperature range covered by BS MA 51-1 to BS MA 51-5.

3.8**plastic composition insulating material**

insulating material in loose dry form which is prepared for application as a paste or dough, and which when dry forms a continuous hard insulating layer

3.9**multilayer insulation**

insulation comprising two or more contiguous layers of insulating material

3.10**protective finish coating**

the final and outer layer of material used to protect the insulation from oil or grease and water vapour impregnation, mechanical damage or exposure to weather as may be appropriate

3.11**design temperature**

the temperature of the internal fluid (°C)

4 Design temperatures and applicability of insulation

4.1 Temperature range classification. The design temperature classification and range, together with the typical piping systems corresponding to these classifications, are specified in Table 1.

4.2 Temperature limits of accessible surfaces. The temperature of insulated surfaces that might be touched accidentally shall be within the following ranges, at an ambient air temperature of 32 °C:

- a) Fabric surfaces, 65 °C to – 10 °C;
- b) Metal surfaces, 55 °C to 0 °C.

Table 1 — Design temperature classification

Design temperature classification	Temperature range, °C		Typical corresponding piping system	Insulation thickness, table number
	Min.	Max.		
Low	– 40	32	Refrigeration (cargo and domestic) cold domestic water	3
Medium	65	260	Steam, hot water, heated oil	4 and 5
High	260	565	Steam	4 and 5
			Exhaust gas	6 and 7

4.3 Applicability of insulation

4.3.1 Thermal efficiency purposes. Insulation for thermal efficiency purposes shall be applied on all pipes conveying fluids whose design temperatures fall within the ranges specified in Table 1. The thickness of insulation specified in Table 3, Table 4, Table 5, Table 6 and Table 7 ensures that the surface temperature of the insulated pipes will not exceed the limiting temperatures of 4.2, provided that the quality of material, workmanship and installation procedures comply with the requirements of this standard.

4.3.2 Safety of personnel. Insulation for safety purposes need not be used for accessible or inaccessible metallic pipes conveying fluids, provided that the surface temperature of the piping is within the safety ranges given in 4.2.

4.3.3 Surface condensation. Insulation shall be applied locally to any metallic pipe conveying fluids, which due to its surface temperature in an ambient air temperature of 32 °C creates condensation that could be detrimental to the operation of machinery, or causes discomfort to personnel.

5 Insulating materials

5.1 Suitability. The materials shall be selected from those given in Table 2 for suitability to the design temperatures and purpose of the piping system.

Where the piping system and components comprise austenitic steel materials, attention shall be given to the possibility of stress-corrosion attack (see BS 5970).

5.2 Form. The forms of insulation used shall be of the types defined in 3.3 to 3.10.

5.3 Exhaust systems. Insulating materials for diesel exhaust gas piping systems shall be capable of withstanding temperatures of up to 500 °C without deterioration, and shall be able to withstand severe vibration without crumbling or cracking.

5.4 Fire hazard

NOTE 1 The performance of specimens in laboratory fire tests may bear little correlation to the behaviour of products made from the same material in an actual fire situation.

A fire test is a procedure designed to measure or assess the response of a material, product, structure or system to one or more aspects of fire.

It is emphasized that fire tests cannot normally measure fire hazard, nor can the results of fire tests alone guarantee safety. Such results merely provide information to assist the assessment and control of fire hazards and they form only one of a number of factors which need to be taken into account.

NOTE 2 In addition, it is necessary for the fire performance of the finished construction to comply with the appropriate regulations.