THERMAL INSULATION OF PIPES AND VESSELS

Part 1: General Principles

Part 2: Insulation of Hot Surfaces (Excluding Refractories)

Part 3 (Insulation of Cold Surfaces) is under preparation

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ducts

Foil	Not recommended	Can be used it ... some lightness is required	Not recommended	Not recommended

Footnotes. (1) As a working guide, rigid materials are not recommended when the circumferential expansion of the vessel is greater than the following limits:—

Vessel Diameter	Allowable Expansion
Up to 5 ft	½ in.
Over 5 ft	1 in.

(2) See Section Four (c)—page 59

(6) *Removal and re-use of insulating materials*

Most insulating materials with the exception of plastic insulation can be readily removed from pipes and vessels. The removal of their protective coverings is usually more difficult except in the case of sheet metal. Rigid materials are most likely to be damaged by removal, and flexible materials least likely. Plastic materials will suffer heavy damage during removal, but may be reconstituted; this however is not recommended.

Reference should be made to Section Four. (See page 56.)

(7) *Cost*

The cost of insulating materials though important should not be considered alone, when estimating the economics to be effected by proper insulation of pipes or vessels. The true cost of an insulation system includes cost of application and protection, as well as the value of heat lost during the period of service. Relevant cost calculations are given in Section Two, which also indicates (graphically) the effects of insulation costs and of thermal conductivity on the total cost.

Material costs alone may perhaps prove a dominating factor in the case of temporary insulation, or where the duration for which the insulation is required is short compared with its useful life. Such cases are rare, and in general it will prove more economical to use the appropriate insulation properly applied than to apply cheap materials.

(8) *Health hazards*

Inhaled dust from certain insulating materials, notably diatomite and asbestos, can cause pneumonoconiosis, though the risk is small if cutting operations are performed out-of-doors. Dust forming operations should not however be carried out in badly ventilated situations.

Some fibrous insulating materials irritate the skin when handled, though individual sensitivity to this varies greatly. Immunity to such irritation may be obtained when these materials are handled regularly, but gloves should be worn if the irritation proves excessive.

Fibrous insulating materials are not acceptable in some branches of the food industry owing to the risk of contamination.

(c) Selection of Protective Coverings and Finish

A protective covering of sheet metal provides an attractive and durable finish, but such a covering is neither appropriate nor economic for all forms of insulation. Table 2/2 also lists the forms of protection that are recommended for individual systems of insulation.

Further details are given in Section Two, which for each material lists the best protective coverings for normal use, and in Section Four, which describes their application.

(E = Excellent; G = Good; F = Fair; P = Poor)

The numbers (1) to (4) in column 8 have the following meanings:

(1) Price per sq ft of an in.-thick slab.
(2) Price per ft of 4½-in. o.d. by 2½-in. i.d. pipe section.
(3) Price per lb of loose-fill and plastic material (dry and in applied condition).
(4) Price per ft of 9-in. wide by 1-in. thick strip.

Notes: The costs in Col. 8 were applicable when this Table was being compiled, and are included for comparison purposes; the latest costs should always be obtained

1	2	3	4	5	6	7	8	9	10	11	12	13
Ref. No.	Physical Form	Maximum Safe Hot-Face Temperature (°F)	Composition or Popular Name	Structure	Approximate Bulk Density in Applied Form (lb/ft³)	Thermal Conductivity (Range at Given Mean Temperature (Btu in/ft² h degF)	Approximate Primary Cost in Shillings and Pence (For (1) (4) see notes above Table)	Heat Insulation	Absorption	Mechanical Damage	Preferred Protective Covering	Remarks
1	Slabs and pipe sections	600–650	Magnesia and asbestos (85% magnesia)	Mixture	12–13·5	0·40–0·42 at 100 0·52–0·55 at 400	3 0–3 6 (1) 1 11–2 10 (2)		F		Wire netting and asbestos cement	—
2	Slabs and pipe sections	650	Corrugated asbestos paper interlined with aluminium foil	Mixture	4	0·40 at 100 0·61 at 400	5 3½ (2)		F		None required	Only suitable for in pes. Gives a decorat light-h
3	Slabs and pipe sections	800	Cellular glass	Cellular	8–10	0·45 at 300	—		G		—	—
4	Slabs and pipe sections	1000	Asbestos	Fibrous	8·5–12	0·31–0·30 at 100 0·56–0·57 at 500	3 0–10 3 6 (1)		G		Wire netting and asbestos cement	Asbestos cement tol appreciably longer t diver asbestos than 85% magnesia.
5	Slabs	1000	Vermiculite and cement	Mixture	20	1·10 at 200 1·51 at 800	4 – (1)		G		Asbestos cement	Cement has high ab content.
6	Slabs and pipe sections	1000–1850	Diatomite and asbestos	Mixture	13–45	0·41–0·60 at 100 0·51–0·78 at 500 0·70–1·36 at 800	3 0–10 6 (1) 2 3 to 3 (2)		G		Usually covered by a hot temperature material	Usually used as a co posite insulation wi magnesia when hot temperature is hig
7	Slabs and pipe sections	1250–1700	Calcium silicate and asbestos	Mixture	11	0·41 at 100 0·51 at 500	2 0 (1)		G		Asbestos cement	Use of calcium silic avoids need for sun insulation for many poses.
8	Slabs	1700	Vermiculite/diatomite/asbestos	Mixture	18–20	0·59 at 100 0·73 at 500	2 6 (1)		G		Asbestos cement	—

RIGID

Contd. on next sheet

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