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SPECIFICATION FOR

SPRAYED ASBESTOS INSULATION

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THIS BRITISH STANDARD, having been approved by the Asbestos and Asbestos Cement Building Products Industry Standards Committee and endorsed by the Chairman of the Building Divisional Council, was published under the authority of the General Council on 28th February, 1963.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

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This standard makes reference to the following British Standards:

B.S. 350. Conversion factors and tables.
B.S. 12. Portland cement (ordinary and rapid hardening).
B.S. 410. Test sieves.
B.S. 476, Part 1, Fire tests on building materials and structures.
B.S. 2972. Methods of test for thermal insulating materials.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this standard:
Committee reference ASB 6 Draft for comment AC(ASB)1370

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CO-OPERATING ORGANIZATIONS

The Asbestos and Asbestos-Cement Building Products Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

*Asbestos Cement Manufacturers' Association
Crown Agents for Oversea Governments and Administrations
D.S.I.R.—Building Research Station
Incorporated Association of Architects and Surveyors
*Institution of Civil Engineers
Institution of Municipal Engineers
*Institution of Structural Engineers
Ministry of Housing and Local Government
Ministry of Public Building and Works
National Federation of Builders' and Plumbers' Merchants
National Federation of Building Trades Employers
Royal Institute of British Architects
*The Royal Institution of Chartered Surveyors
Royal Society for the Promotion of Health

The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this British Standard:

D.S.I.R.—Joint Fire Research Organization of the D.S.I.R. and Fire Offices Committee
Fire Protection Association
Manufacturers of asbestos products

BRITISH STANDARD SPECIFICATION FOR

SPRAYED ASBESTOS INSULATION

FOREWORD

This British Standard prepared under the authority of the Asbestos and Asbestos Cement Building Products Industry Standards Committee gives general requirements for asbestos based insulating material which is applied to the surfaces of structures by spraying in order to control condensation, to provide sound absorption, to afford protection from the effects of fire, or to provide insulation against the transmission of heat. Application of sprayed asbestos insulation should be carried out by trained operators.

The material is applied by spraying together with jets of atomised water and pressing back to the thickness required after the surface to be covered has been suitably prepared and if necessary treated with adhesive. Various finishes may be applied by trowelling, spraying or other means. The present standard deals solely with the material as applied and gives tests based on slab specimens as detailed in Clause 6 of this standard.

A stability and cohesion test has been designed to assess the resistance to vibration of sprayed asbestos insulation when subjected to vibration in excess of anything which might be experienced in practice.

This standard does not deal with the adhesives or any change in performance values due to subsequent treatment by way of an applied finish as in both instances there are several variations which appear to be equally satisfactory, according to the purpose for which the insulation is being used.

It is anticipated that a Code of Practice dealing fully with the actual use and application of the material will follow the issue of this standard which is intended to first establish standard characteristics of sprayed asbestos insulation. In the interim some useful information of this nature has been included in Appendix C and Table 1.

NOTE. Metric equivalents are given in Appendix F. The figures in British units are to be regarded as the standard. The metric conversions are approximate. More accurate conversions should be based on the tables in B.S. 350, 'Conversion factors and tables'.

SPECIFICATION

SCOPE

1. This British Standard deals only with requirements for the composition, manufacture, preparation of samples and testing of sprayed asbestos insulation.

DEFINITIONS

2. For the purposes of this British Standard the following definitions apply:
Milled asbestos fibre. Asbestos fibre as normally purchased by the manufacturer.

Prepared asbestos fibre. Asbestos fibre and binder prepared ready for spraying.

COMPOSITION

3. The prepared asbestos fibre for spraying shall be manufactured by intimately mixing milled asbestos fibre and Portland cement complying with B.S. 12*. No other fibrous material shall be used. The minimum asbestos fibre content shall be 55 per cent by weight of the dry coating and the minimum Portland cement content shall be 90 per cent by weight of the remainder.

PREPARATION OF SAMPLES

4. The samples for tests in *a*, *b*, *c*, and *d* of Clause 6 shall be prepared by the manufacturer. At least four sprayed panels shall be provided which shall be prepared by spraying the insulating material on to a scrim cloth evenly spread on a rigid base able to give adequate support to the panels during handling. The scrim cloth enables the panel to be separated easily from the rigid base and shall be removed after conditioning and cutting. The panels shall be approximately 2 ft 6 in × 2 ft 6 in × 1 ± 1/32 in thick.

The panels shall be conditioned to constant weight at 50–70°F and 55–60 per cent relative humidity, before any testing is carried out.

TESTING

5. The manufacturer shall provide the purchaser with information based on the performance of the material when submitted to the tests in Clause 6. When independent testing is required it shall be by arrangement between the purchaser and manufacturer, and this requirement shall be stated in the enquiry and order.

REQUIREMENTS

6. *a. Bulk density.* When tested in accordance with Appendix A the mean bulk density of sprayed asbestos fibre shall be not less than 5 lb cu ft and not more than 15 lb/cu ft.

b. Stability and cohesion. When tested in accordance with Appendix B the weight of fall-out from the specimen and the increase in thickness shall not exceed the figures given below.

Stability. (i) After a test of one hour's duration the average weight of fall-out shall not exceed 0·005 grams per specimen tested.

(ii) After testing for a further three hours the average additional weight of fall-out shall not exceed 0·005 grams.

* B.S. 12, 'Portland cement (ordinary and rapid-hardening)'

Cohesion. After completion of test (ii), the thickness of the specimen shall be measured as specified in Appendix B and the increase in mean thickness shall not exceed 1/8 inch.

c. Thermal conductivity. The test shall be in accordance with that given in B.S. 874, Part 2*. Thermal conductivity shall not exceed the values given below when measured at a hot face temperature in the range 70 ± 10°F and a cold face temperature in the range 40 ± 10°F.

Bulk density of test specimen	Thermal conductivity
lb/cu ft	Btu in/ft² h degF
5	0·30
Over 5 and up to 10	0·35
Over 10 and up to 15	0·40

d. Sound absorption. If the purchaser requires a test for sound absorption this shall be stated with the enquiry and order and the test method agreed. The coefficients obtained from such a test shall be not less than those given in the following table for a 1 inch thickness of sprayed asbestos applied to a plaster-board backing of 3/4 inch thickness and with a 3 inch air space (see Appendix D).

	Sound absorption Sprayed asbestos, 1 in thick					
Frequency cycles/second	125	250	500	1 000	2 000	4 000
Minimum absorption coefficient	0 20	0·30	0·55	0·75	0·70	0·70

e. Fire resistance. When required, fire resistance tests on elements of structure protected with sprayed asbestos shall be made in accordance with the requirements of B.S. 476, Part 1†.

f. Mould growth. If the purchaser requires a test for mould growth this shall be stated in the enquiry and order. Such a test shall be carried out on a specimen taken from the panels specified in Clause 4 and shall be in accordance with the requirements of B.S. 1982, Part 2‡. Under these conditions the material shall be immune from mould growth when evaluated in accordance with Clause 13 of that British Standard.

* B.S. 874 Part 2, 'Definitions of heat insulating terms and methods of determining thermal conductivity'.
† B.S. 476 Part 1, 'Fire tests on building materials and structures'.
‡ B.S. 1982 Part 2, 'Methods of testing fungal resistance of manufactured building materials'.

APPENDIX A

TEST FOR BULK DENSITY

Three specimens each approximately 12 in × 12 in, to an accuracy of $\frac{1}{32}$ in, shall be cut cleanly from three of the four panels specified in Clause 4. The edge of the specimen shall be not less than 2 in from any edge of the panel and the original faces of the panel shall be retained. Specimens shall be dried to constant weight in an oven at a temperature of 105 ± 5°C. The dimensions and weight of each specimen, shall be accurately determined in accordance with B.S. 2972*, paragraph 2.2.1.*a* and *b*, and 2.4 respectively.

The bulk density shall then be calculated and the average density, in lb cu ft, of the three specimens shall be reported.

APPENDIX B

Apparatus. TEST FOR STABILITY AND COHESION

(i) A sieve vibrator shall be used.

(ii) The characteristics of this machine are (see Fig. 1):

Bark cork	$1\frac{5}{8}$ in dia. × $\frac{3}{4}$ in
Gyrations per minute	255 ± 10 per cent
Hammer blows per minute	140 ± 10 per cent
Fall of hammer	$1\frac{5}{8}$ in ± $\frac{1}{8}$ in
Hammer weight (weighed by spring balance while hammer is fixed to the machine)	3 lb

(iii) *Metal specimen holders.* These are shown in Figs. 3 and 4 and provide a means of suspending the sprayed asbestos samples in the machine in a horizontal position.

(iv) *Sieves and receivers.* The sieves are 8 in diameter, flat mesh to B.S. 410† with ¼ in square apertures and are used not as sieves but as a simple means of suspending the samples in their holders.

The combination of 8 in diameter sieves and receivers as shown in Fig. 2 is designed to test three samples simultaneously.

(v) *Adhesives and brushes.* The supplier of the insulation shall specify the type of adhesive to be used when applying the insulation and this adhesive shall be used to attach the test specimens to the steel holders. The adhesive specified is applied to the specimens and the steel holders by means of a 1 in camel hair brush.

* B.S. 2972 : 1961, 'Methods of test for thermal insulating materials'.

† B.S. 410 : 1943, 'Test sieves'.

(vi) *Pressing tool.* As shown in Fig. 5 for pressing the specimen into the specimen holder.

Procedure. Three specimens each 5 in × 5 in shall be cut cleanly from three of the four panels specified in Clause 4. The edges of these specimens shall not be nearer than 2 in from any edge of the panel. The face of the specimen originally covered by the scrim cloth shall be coated thinly with adhesive using the camel hair brush. The cut edges are similarly coated. The inside face and walls of the specimen holder shall also be coated with adhesive and the specimen placed into it so that the uncoated face is exposed. The specimen shall then be gently pressed into position using the pressing tool (Fig. 5), care being taken not to compress the specimen beyond its original thickness. The specimens shall then be conditioned at 50–70 F and 55–60 per cent relative humidity for 24 hours.

The specimens in their holders shall be mounted in the combination of sieves and receivers shown in Fig. 2 and the whole assembly clamped in the machine (see Fig. 1). The machine is run for 1 hour after which the fall-out in the three receivers is brushed out on to a watch-glass and weighed to the same accuracy as in Appendix A. This weight divided by three gives the average figure as required by Clause 6*b*(i).

The sieves and receivers shall be re-assembled, clamped in the machine and run for a further three hours. The assembly is again dismantled and the fall-out in the three receivers brushed out and weighed as before. This weight divided by three gives the average figure required by Clause 6*b*(ii).

The thickness of the specimens shall then be determined at the centre point using the thickness gauge as described in B.S. 2972, sub-clause 2.2.1. *b*(i).

APPENDIX C

NOTES ON SPRAYED ASBESTOS INSULATION AS A FIRE PROTECTION MATERIAL

(see Table 1)

Sprayed asbestos is of value for fire protection of structures from two aspects:

1. It is non-combustible and therefore does not burn or contribute to the fire load of a building;
2. On account of its insulation properties the resistance of structures to fire is increased.

Non-combustibility and fire resistance are defined in B.S. 476, Part 1* The former is a property of a material and the latter of an element of a structure as a whole and not of its components. The effectiveness of the insulation depends

* B.S. 476, Part 1, 'Fire tests on building materials and structures'.

upon its thermal properties, density, and thickness. To obtain the maximum benefit from its use it should remain in position for the duration of fire exposure; in certain cases it may be necessary to employ adhesives or mechanical means for this purpose.

Many tests have been made since 1938 in accordance with B.S. 476, Part 1 on structural elements in which the sprayed asbestos insulation formed a protective coating. The results of tests on some typical forms of construction are shown in Table 1 together with data derived for other periods of fire resistance. The fire resistance of structures not covered by this table can be determined by subjecting them to the standard fire test.

APPENDIX D

SOUND ABSORPTION

Sound absorption is the term used to denote the reduction of sound energy on reflection from a surface.

The acoustic efficiency of a sound absorbent is expressed by a sound absorption coefficient. The coefficient varies with the frequency of the sound and is commonly quoted for frequencies at octave intervals of 125, 250, 500, 1000, 2000, 4000 cycles per second.

The sound absorption coefficient of a surface is the ratio of the energy absorbed to that incident on the surface. The product of the absorption coefficient and the area of the surface is the total absorption of the surface. When the area is expressed in square feet, the unit of absorption is called the 'sabin'.

TABLE 1

FIRE RESISTANCE OF STRUCTURAL ELEMENTS PROTECTED WITH SPRAYED ASBESTOS

Type of construction	Range of density lb/cu ft	*Min. thickness in inches for fire resistance period in hours					
		4	3	2	1½	1	½
1. Timber floor with joists having a minimum width of 2 in and covered with tongue and groove boarding; application to metal lathing fixed direct to joists.	10–15	—	—	1½	1¼	¾	½
2. Solid slab reinforced concrete floor of 3½ in minimum thickness, direct application to soffit.	10–15	1	¾	½	½	½	—
3. Steel cellular flooring with structural concrete topping of 2½ in minimum thickness, direct application to soffit.	10–15	1	¾	½	½	½	½
4. Solid protection to steel columns and beams (shaped to contour).	9–15	1¾	1¼	¾	⅝	⅜	⅜
5. Hollow protection to steel columns and beams; application to metal lathing.	9–15	1¾	1¼	¾	⅝	⅜	⅜
6. External wall of asbestos cement sheeting with application on inside as protection against internal fire only.	10	—	—	2	1½	1	¾
7. Steel bulkhead, ¼ in thick, application both sides.	8–15	—	—	—	—	½	
8. Steel bulkhead, ¼ in thick, application one side only.	8–15	—	—	—	—	1⅜	—
9. Aluminium bulkheads, ¼ in thick, application both sides:							
a. For load bearing structures when the temperature of the aluminium is required not to exceed 200 C.	15	—	—	—		1¾	
b. For non-load bearing structures when the temperature of the aluminium is required not to exceed 300 C.	15	—	—	—	—	1¼	—

* Reduced thicknesses and densities other than those given may be used when shown to be satisfactory by a standard fire test.

APPENDIX E

APPROXIMATE METRIC EQUIVALENTS

in	mm
1/32	0·79
1/8	3·175
1/4	6·35
3/8	9·52
1/2	12·70
5/8	15·87
3/4	19·05
1	25·40
1 1/4	31·75
1 1/2	38·10
1 5/8	41·27
1 3/4	44·45
2	50·8
2 1/2	63·5
2 3/4	69·85
3	76·20
3 1/2	88·90
4	101·60
4 3/4	120·65
5	127·00
8	203·20
12	304·80
13 1/2	342·90
2 ft 6 in	762·00

oz	kg
2 3/4	0·078
5 1/2	0 156
11	0·312
16	0·453

F	C
10	12·2
40	4·4
70	21·1
80	26·7
100	37·0

lb cu ft	kg m³
5	80·09
8	128·15
9	144·17
10	160·18
15	240·28
20	320 37

Btu in/ft² h degF	kcal/m h degC
1·00	0 124 014

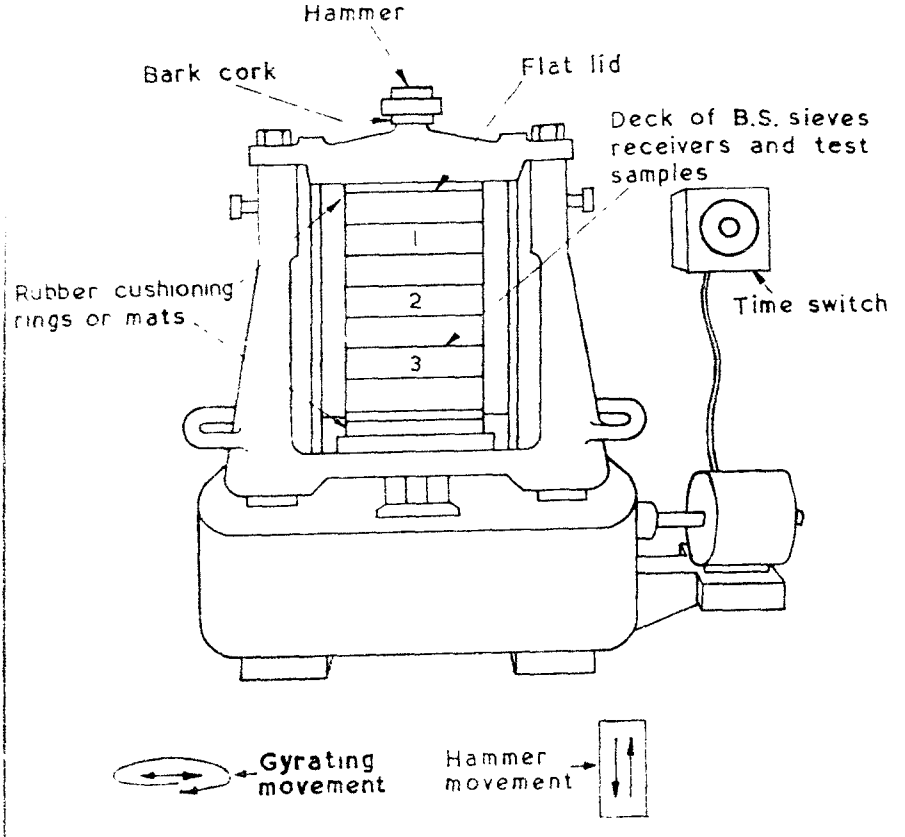


Fig. 1. Sieve vibrator

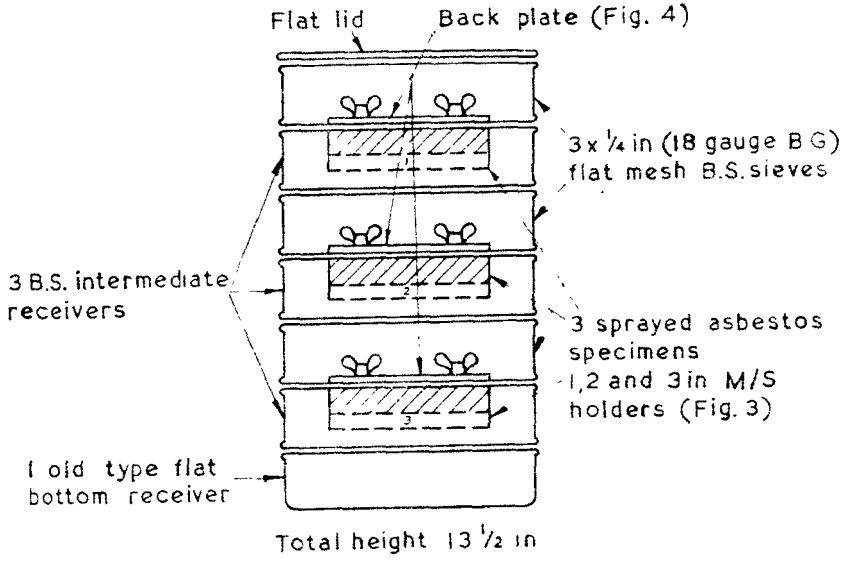
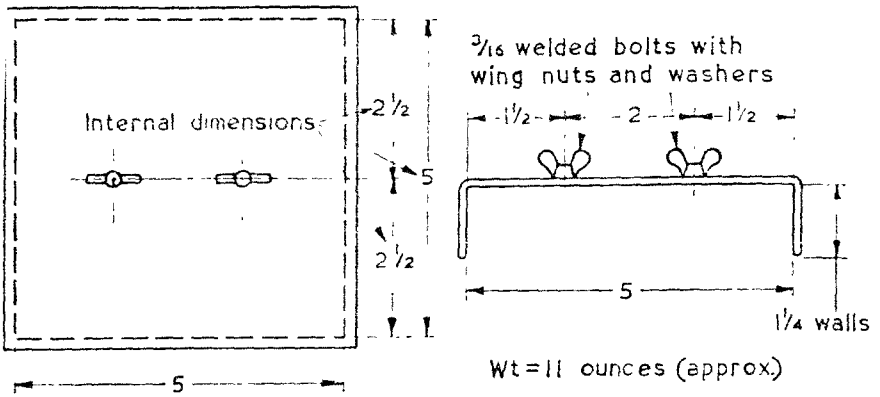


Fig. 2. The assembly of B.S. sieves and receivers with test samples



All dimensions are in inches.

Fig. 3. Mild steel specimen holder (18 gauge m/s)

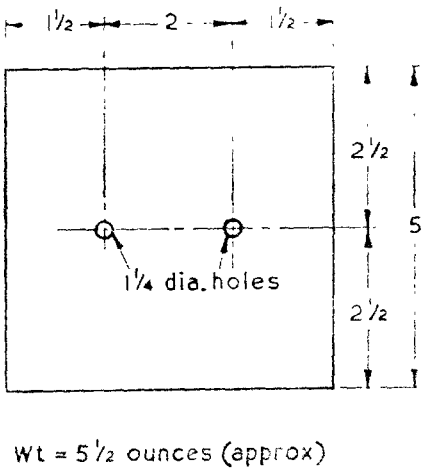


Fig. 4. Back plate (18 gauge m/s)

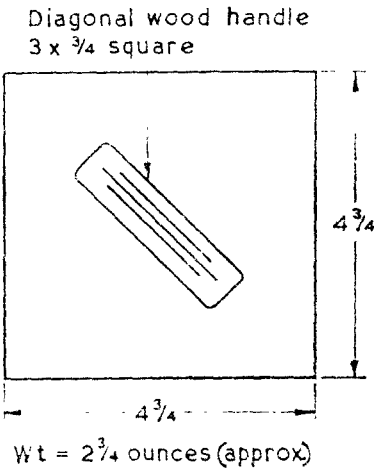


Fig. 5. Pressing tool (1/8 in hardboard)