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Specification

Materials for thermal insulation of buildings

Part 6: Cellulose loose fill thermal insulation material

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SOUTH AFRICAN BUREAU OF STANDARDS

SPECIFICATION

MATERIALS FOR THERMAL INSULATION OF BUILDINGS

PART 6: CELLULOSE LOOSE FILL THERMAL INSULATION MATERIAL

Obtainable from the

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Notice

This part of SABS 1381 was approved in accordance with SABS procedures on 10 January 1994.

Manufacturers producing cellulose loose fill thermal insulation material to this part of SABS 1381 may, under a mark permit issued by the SABS, apply the certification mark as illustrated above to the commodity as evidence to the purchaser that the commodity is being made in accordance with this part of SABS 1381 and that compliance with its requirements is ensured by tests and inspections carried out by the SABS.

NOTE 1 In terms of the Standards Act, 1993 (Act 29 of 1993), it is a punishable offence for any person other than a mark permit holder to apply a certification mark to a commodity or to refer to the SABS or any of its standards in a manner likely to create the impression that the commodity has been approved by the SABS. Furthermore, no person shall claim or declare that he or any other person complied with a standard unless

a) such claim or declaration is true and accurate in all material respects, and

b) the identity of the person on whose authority such claim or declaration is made, is clear.

NOTE 2 It is recommended that authorities who wish to incorporate any part of this standard into any legislation in the manner intended by section 31 of the Act consult the SABS regarding the implications.

This part of SABS 1381 will be revised when necessary in order to keep abreast of progress. Comment will be welcome and will be considered when this part of SABS 1381 is revised.

Foreword

Annexes A and B are for information only.

Attention is drawn to the normative references given in clause 2 of this standard. These references are indispensable for the application of this standard.

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Materials for thermal insulation of buildings

Part 6:
Cellulose loose fill thermal insulation material

1 Scope

1.1 This part of SABS 1381 specifies the characteristics of cellulose loose fill thermal insulation material that is intended for installation in ventilated roof spaces of buildings by blowing or by manual pouring.

1.2 This part of SABS 1381 does not address the method of installation of the insulation. Should the purchaser require guidance on the installation of the material, BS 5803-5 can be referred to.

NOTES

1 The requirements of BS 5803-5 should be complied with in the installation of any type of insulation, inclusive of cellulose and man-made mineral insulation.

2 Installation criteria may affect the satisfactory use of the insulation described in this part of SABS 1381. These criteria can be obtained from the manufacturer.

3 Materials that comply with this part of SABS 1381 are not necessarily suitable for applications other than those given in the scope.

4 This part of SABS 1381 does not address material that can be used at high humidity without special precautions being taken.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of SABS 1381. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this part of SABS 1381 are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards may be obtained from the South African Bureau of Standards.

ASTM B 152, *Specification for copper sheet, strip, plate and rolled bar.*

BS 5803-4, *Thermal insulation for use in pitched roof spaces in dwellings - Part 4: Methods for determining flammability and resistance to smouldering.*

BS 5803-5, *Thermal insulation for use in pitched roof spaces in dwellings – Part 5: Specification for installation of man-made mineral fibre and cellulose fibre insulation.*

ISO 8301, *Thermal insulation – determination of steady state specific thermal resistance and related properties – Heat flow meter method.*

ISO 8302, *Thermal insulation – determination of steady state areal thermal resistance and related properties – Guarded hot plate apparatus.*

3 Definitions

For the purposes of this part of SABS 1381, the following definitions apply:

3.1 acceptable: Acceptable to the parties concluding the purchase contract, but in relation to the certification mark and to inspections carried out by the SABS, acceptable to the South African Bureau of Standards.

3.2 cellulose loose fill thermal insulation (material): A wool-like matrix of cellulose fibres made from processed paper or wood stock treated with chemical additives to provide the required properties. The additives may or may not include binders that are applied or activated at the time of application.

3.3 coverage: The maximum area over which the contents of a bag of material can be applied and still achieve the declared thermal resistance.

3.4 minimum thickness: The minimum thickness at which the material should be applied to provide a declared thermal resistance.

NOTE – This thickness should allow for any settlement after installation.

3.5 pneumatic application: A method that uses air to apply the material mechanically.

3.6 poured application: A manual method of applying the material.

3.7 settled density: The density of the product after settlement, as established by the test for settled thickness (see 6.10).

3.8 settled thickness: The thickness of the material after settling and declared by the manufacturer as that which will provide the declared thermal properties.

3.9 thermal conductivity λ, W(m.K): The thermal transmission through a unit area of a layer of uniform material of unit thickness when a unit difference of temperature is established between the faces of the layer.

3.10 thermal resistance *R*, m^2.K/W: The quotient of actual thickness and thermal conductivity.

3.11 thermal transmission *q*, W: The quantity of heat flowing in unit time.

4 Requirements

4.1 Material

4.1.1 Type

The material shall be of one of the following types:

a) type I : for pneumatic application; and

b) type II : for poured application.

NOTE - This part of SABS 1381 does not address the machinery used for pneumatic applications. The machinery has to be capable of being operated with safety from the domestic power supply, or the installation contractor has to supply the source of power. All the requirements of South African legislation with respect to machinery have to be complied with.

4.1.2 Composition

The material shall be composed of cellulose (wood-based) fibres treated with fire retardant and biocidal additives.

The material shall not contain extraneous foreign materials such as glass or metal. The material may contain a thermosetting polymer binder.

4.2 Thermal resistance

When determined in accordance with 6.3, the average value of thermal resistance for each of the declared minimum thicknesses (see 5.2(e)) shall be at least 95 % of the appropriate declared thermal resistance value for that minimum thickness, and the thermal resistance value of any single specimen of the same thickness shall be at least 90 % of the appropriate declared value.

4.3 Mass of contents

The actual mass of the material in each bag or package, determined using a scale that has an accuracy of ± 0,5 %, shall be at least equal to the declared value (see 5.2(d)).

4.4 Coverage

The declared coverage per bag of material for each of the declared minimum thicknesses (see 5.2(e)) shall not exceed that determined in accordance with 6.4.

4.5 Flammability

When the materials are tested in accordance with 6.5, the combustion zone shall not extend to within 25 mm of any part of the timber surround.

4.6 Resistance to smouldering

When material that is declared as being resistant to smouldering (see 5.2(g)) is tested in accordance with 6.6 after combustion has ceased, smouldering or flaming combustion shall not have extended more than 150 mm from the centre-line of the cylindrical ignition source.

4.7 Moisture absorption

When tested in accordance with 6.7, the material shall not absorb more than 15 % moisture.

4.8 Resistance to fungal attack

When material that is declared as not supporting the growth of fungi (see 5.3(g)) is tested in accordance with 6.8, the growth observed on each of the test specimens shall not exceed the growth on the comparative item.

NOTE The aim of the above requirement is to ensure that the materials do not support a greater growth of fungi than the surrounding materials of the structure being insulated.

4.9 Corrosion resistance

When the material is tested in accordance with 6.9, only one type of test coupon may be perforated but there shall be no perforation of the copper test coupon.

NOTES

1 Ignore notches that extend less than 3 mm from the edge of the coupon.

2 If metals other than those tested are found in the intended place of application of the insulation material, consult the manufacturer for specific information on compatibility.

4.10 Settled thickness and settled density

When determined in accordance with 6.10, the settled thickness and settled density shall be at least as declared (5.3(e)).

NOTE - The installed thickness of the insulation is the minimum thickness as defined in 3.4.

4.11 Freedom from objectionable odours

When the material is in normal use or when it is wetted with clean water, any odour emitted shall be such as to be acceptable.

5 Packing, marking and data sheet

5.1 Packing

The material shall be so packed in bags or in other packages that it is protected from damage during normal handling, transportation and storage.

5.2 Marking

The following information shall be given in legible and indelible marking on the bag/package or on a label inside, or securely attached to, the bag/package, as applicable:

a) the manufacturer's name or trade name or trade mark;

b) the product identification;

c) the batch identification or date of manufacture;

d) the mass of the contents of the bag/package;

e) a table, set out as table 1, giving the minimum thickness and the coverage for all of the standard thermal resistance values. Two separate tables shall be given if the material is recommended for both blown and poured applications;

f) a warning on the possibility of any health hazards and a recommendation that the installer or person working in or near the material wear eye protection and a respiratory mask. The following note on the bag/packaging or contained in a sheet that accompanies each bag/package shall be clearly visible to the purchaser:

NOTE - When installing **ANY** insulation, the installer should take note of the following:

a) all loose electrical wires should be lifted and relaid over the surface of the insulation where at all possible and where there is sufficient slack in the cabling, to allow the cables to be raised; and

b) all insulation should be kept back at least 75 mm from all electrical apparatus that penetrates the ceiling.

g) whether or not the insulation is resistant to smouldering; and

h) instructions for installation or reference to an installation manual which is readily available.

Table 1 — Declared properties

1	2		3	4	5
Thermal resistance *R* $m^2.K/W$	**Minimum thickness needed** mm		**Minimum mass per unit area** kg/m^2	**Maximum coverage** m^2 per package	**Minimum bag/package usage rate** bags/packages/ 100 m^2
	Installed blown thickness	**Settled thickness**			
1,25					
1,75					
2,00					
2,25					
2,75					
3,00					
3,50					

5.3 Data sheet

The following data given on a data sheet shall be available from the manufacturer:

a) the manufacturer's name or trade name or trade mark;

b) the product identification;

c) the batch identification or date of manufacture;

d) the mass of the contents of the bag/package;

e) the settled density and the settled thickness, in millimetres;

f) the percentage moisture absorption;

g) whether or not the material supports the growth of fungi; and

h) any recommendations that may be necessary for the transportation and storage of the material.

6 Inspection and methods of test

6.1 Inspection

Examine each unit in the sample for compliance with all the relevant requirements of this part of SABS 1381 for which tests to assess compliance are not given in 6.3 to 6.10 (inclusive).

6.2 Number and conditioning of test specimens

6.2.1 Table 2 indicates the number of test specimens that are required for each test method.

Table 2 — Minimum number of test specimens required for each test method

1	2	3
Test method subsection	**Test**	**Minimum number of test specimens required for each test method**
6.3	Thermal resistance	1 for at least three of the declared minimum thicknesses
6.4	Coverage	1 for each declared minimum thickness
6.5	Flammability	1
6.6	Resistance to smouldering	1
6.7	Moisture absorption	1
6.8	Resistance to fungal attack	1
6.9	Corrosion resistance	At least 2
6.10	Settled thickness and settled density	1

6.2.2 Unless otherwise stated, condition all test specimens at a temperature of 23 °C ± 2 °C and a relative humidity of (50 ± 20) % for a period of at least 24 h immediately before tests are carried out, and carry out all tests under these conditions.

6.3 Thermal resistance

6.3.1 Use the method and apparatus described in ISO 8301 or ISO 8302.

6.3.2 Use the specimens prepared for the test of 6.10 and adjust the frames to the settled thickness. Determine the thermal resistance for at least three of the declared minimum thicknesses, using a hot face temperature of 36 °C ± 2 °C and a cold face temperature of 10 °C ± 2 °C (to ensure that a mean temperature of 23 °C ± 2 °C is obtained).

6.3.3 If a single-specimen apparatus is used to determine the thermal resistance, it is necessary to determine the thermal conductivity for heat flow upwards and downwards. The reported value for thermal resistance will be the average of the values for thermal resistance for heat flow upwards and for heat flow downwards.

6.3.4 If the reported values of thermal resistance for the tests conducted on the selected minimum thickness comply with 4.2, deem the material to comply with 4.2.

6.4 Coverage

6.4.1 Calculate the maximum coverage A, in square metres, corresponding to each of the stated minimum thicknesses as follows:

$$A = \frac{1\,000 \times m_1}{d \times p}$$

where

m_1 is the mass of the contents of the bag or package, in kilograms;

d is the settled thickness, in millimetres; and

p is the settled density, in kilograms per cubic metre.

6.4.2 Check for compliance with 4.4.

6.5 Flammability

6.5.1 Use section 2 of BS 5803-4.

6.5.2 Check for compliance with 4.5.

6.6 Resistance to smouldering

6.6.1 Use section 3 of BS 5803-4.

6.6.2 Check for compliance with 4.6.

6.7 Moisture absorption

6.7.1 Apparatus

6.7.1.1 Ventilated drying oven, maintained at a temperature of 50 °C ± 5 °C.

6.7.1.2 Humidity cabinet, maintained at a temperature of 23 °C ± 2 °C and at a relative humidity of (90 ± 5) %.

6.3.2 Use the specimens prepared for the test of 6.10 and adjust the frames to the settled thickness. Determine the thermal resistance for at least three of the declared minimum thicknesses, using a hot face temperature of 36 °C ± 2 °C and a cold face temperature of 10 °C ± 2 °C (to ensure that a mean temperature of 23 °C ± 2 °C is obtained).

6.3.3 If a single-specimen apparatus is used to determine the thermal resistance, it is necessary to determine the thermal conductivity for heat flow upwards and downwards. The reported value for thermal resistance will be the average of the values for thermal resistance for heat flow upwards and for heat flow downwards.

6.3.4 If the reported values of thermal resistance for the tests conducted on the selected minimum thickness comply with 4.2, deem the material to comply with 4.2.

6.4 Coverage

6.4.1 Calculate the maximum coverage A, in square metres, corresponding to each of the stated minimum thicknesses as follows:

$$A = \frac{1\,000 \times m_1}{d \times p}$$

where

m_1 is the mass of the contents of the bag or package, in kilograms;

d is the settled thickness, in millimetres; and

p is the settled density, in kilograms per cubic metre.

6.4.2 Check for compliance with 4.4.

6.5 Flammability

6.5.1 Use section 2 of BS 5803-4.

6.5.2 Check for compliance with 4.5.

6.6 Resistance to smouldering

6.6.1 Use section 3 of BS 5803-4.

6.6.2 Check for compliance with 4.6.

6.7 Moisture absorption

6.7.1 Apparatus

6.7.1.1 Ventilated drying oven, maintained at a temperature of 50 °C ± 5 °C.

6.7.1.2 Humidity cabinet, maintained at a temperature of 23 °C ± 2 °C and at a relative humidity of (90 ± 5) %.

6.7.1.3 Scale, of sufficient capacity and sensitivity to determine the mass of the test specimen to an accuracy of within 0,1 %.

6.7.1.4 Wire frame, that is of approximate size 300 mm x 300 mm and of depth 50 mm, made of non-corrodible wire of appropriate thickness, and that has apertures of size approximately 1 mm and a removable cover of the same construction.

6.7.2 Preparation of material

Determine the mass of the wire frame and the cover. Fill the wire frame with material at a density that corresponds to the settled density determined in accordance with 6.10, and fit the cover to the frame.

6.7.3 Procedure

6.7.3.1 Dry the material (in the frame) to constant mass in the drying oven, removing the frame and the material from the oven and allowing them to cool between weighings. Record the mass of the dried material (m_3).

6.7.3.2 Condition the frame and the dried material in the humidity cabinet. During conditioning, ensure free air movement around the wire frame and also that no drops of condensed water fall on the material in the frame.

6.7.3.3 Condition the material for 72 h ± 1 h, remove the frame and material from the humidity cabinet and determine the mass of the conditioned material (m_4) in the frame.

6.7.4 Calculation

Calculate the moisture absorbed m as a percentage of the mass of the dried material as follows:

$$m = \frac{m_4 - m_3}{m_3} \times 100$$

where

m_3 is the mass of dried material, in grams; and

m_4 is the mass of conditioned material, in grams.

Check for compliance with 4.7.

6.8 Resistance to fungal attack

6.8.1 Apparatus

6.8.1.1 Autoclave, or oven, capable of maintaining a temperature of 120 °C.

6.8.1.2 Inoculating wire, of platinum or nichrome, sterilized.

6.8.1.3 Erlenmeyer flask, of capacity 125 mL and provided with a glass stopper.

6.8.1.4 Solid glass beads, of diameter 5 mm, and approximately 50 to 70 in number.

6.8.1.5 Glass wool.

6.8.1.6 Glass funnel and sterile flask.

6.8.1.7 Filter paper, sterilized.

6.8.1.8 Atomizer, sterilized.

6.8.1.9 South African pine wood, three pieces, of dimension approximately 50 mm x 50 mm x 10 mm each.

6.8.1.10 Test chamber, capable of maintaining a temperature of 30 °C and a relative humidity of 95 %.

6.8.2 Preparation

6.8.2.1 Prepare mineral-salts agar in accordance with table 3.

Table 3 — Basic ingredients of mineral-salts agar

1	2
Chemical	**Amount**
Sodium nitrate ($NaNO_3$)	2,0 g
Magnesium sulfate ($MgSO_4$)	0,5 g
Potassium chloride (KCl)	0,5 g
Ferric sulfate ($Fe_2(SO_4)_3.9H_2O$	0,01 g
Potassium dihydrogen orthophosphate (KH_2PO_4)	1,2 g
Agar	15,0 g
Distilled water	1,0 L
Yeast extract	0,02 g

6.8.2.2 Autoclave the mineral-salts agar at 120 °C for 20 min.

6.8.2.3 So add 0,01 mol/L solution of sodium hydroxide (NaOH) that the pH value is between 6,0 and 6,5.

NOTES

1 Reagent grade chemicals are used unless otherwise stated.

2 Any reference to water indicates distilled or deionized water.

6.8.3 Preparation of mixed spore suspension

6.8.3.1 Use the test fungi described in table 4.

6.8.3.2 Maintain separate cultures of these fungi on appropriate mediums (for example, potato dextrose sugar).

6.8.3.3 Maintain the culture of *chaetomium globosum* on strips of filter paper placed on the surface of the mineral-salts agar as prepared in 6.8.2.

Table 4 — Test fungi

1	2	3
Fungi	**ATCC**	**NLABS10**
Aspergillus niger	9 642	386
Aspergillus versicolor	11 730	432
Penicillium funiculosum	11 797	474
Chaetomium globosum	6 205	459

6.8.3.4 The stock culture shall not be kept for a period of longer than 4 months when stored at a temperature of 6 °C ± 4 °C, at which time subcultures shall be made and new stocks shall be selected from the subcultures. If genetic or physiological changes occur, obtain new cultures as described above.

6.8.3.5 Incubate subcultures that are used for preparing new stock for 9 d or longer at 30 °C.

6.8.3.6 Pour 10 mL of a sterile solution containing 0,05 g/L of a non-toxic wetting agent (for example, sodium dioctyl sulfosuccinate or sodium lauryl sulfate) onto each culture.

6.8.3.7 Using the sterile inoculating wire, gently scrape the surface growth from the culture of the test organism.

6.8.3.8 Pour the spore charge into the sterile 125 mm glass-stoppered Erlenmeyer flask containing 45 mL of sterile distilled water and the glass beads.

6.8.3.9 Shake the flask vigorously to liberate the spores from the fruiting bodies and to break the spore clumps.

6.8.3.10 Place a 6 mm layer of glass wool into the glass funnel and filter the dispersed fungal spore suspension through this into the sterile flask. This is intended to remove large mycelial fragments and clumps of agar that could interfere with the spraying process.

6.8.3.11 Centrifuge the filtered spore suspension aseptically, and discard the supernatant liquid.

6.8.3.12 Resuspend the residue in 50 mL of sterile distilled water, and centrifuge.

6.8.3.13 Wash the spores obtained from the fungi in this way three times.

NOTE - It is important to ensure that the liquid media is completely removed during each wash, to ensure complete removal of nutrient contamination from the spore samples.

6.8.3.14 So dilute the final washed residue with sterile distilled water that the resulting spore suspension contains $1 \times 10^6 \pm 2 \times 10^5$ spores per millilitre, as determined with a counting chamber.

6.8.3.15 Repeat the above for each organism used in the test and blend equal volumes of the resultant spore suspensions to obtain the final mixed spore suspension.

6.8.3.16 The spore suspension may be prepared fresh each day, or, alternatively, it may be stored at 6 °C ± 4 °C for no longer than 7 d.

6.8.4 Viability of inoculum control

6.8.4.1 For each of the daily groups of tests, place one each of three pieces of sterilized filter paper on hardened mineral-salts agar in separate covered petri dishes.

6.8.4.2 Inoculate the petri dishes with the spore suspension by spraying approximately 0,5 mL of the suspension from a sterilized atomizer. (The atomizer should be capable of providing $15 \times 10^3 \pm 3 \times 10^3$ spores per square centimetre.)

6.8.4.3 Incubate the petri dishes and the contents in the test chamber at 30 °C and at a relative humidity of 95 %, together with samples.

6.8.4.4 Examine the controls after 7 d of incubation. There should be copious growth on all three of the filter paper control specimens. Absence of such growth requires that the test be repeated.

6.8.5 Comparative items

6.8.5.1 Ensure that the upper surface of the South African pine is commercially finished.

6.8.5.2 Precondition the pine at 30 °C and at a relative humidity of 95 % for at least 4 h.

6.8.6 Procedure

6.8.6.1 Place each piece of pine in a sterile petri dish and moisten with 3 mL of sterile water.

6.8.6.2 Moisten a 10 g specimen of the cellulose loose fill insulation material with sterile distilled water. Determine the quantity of distilled water V (in millilitres) to be used for the specimen in accordance with the following:

$$V \quad \frac{46}{d} \times 37{,}5$$

where d is the settled density of the insulation material (see 4.10), in kilograms per cubic metre.

6.8.6.3 Aseptically transfer one-third of the 10 g specimen to each of three sterile petri dishes and gently tamp down to a relatively smooth surface, to facilitate microscopic examination.

6.8.6.4 Inoculate the test specimens and comparative items by using the sterilized atomizer to spray 0,5 mL of the spore suspension onto the contents of each petri dish.

6.8.6.5 Immediately cover each petri dish. Start the incubation period as soon as the inoculation has taken place.

6.8.7 Incubation

Allow incubation to take place for a period of 28 d at a temperature of 30 °C and at a relative humidity of 95 %. Ensure that the test chamber remains closed during incubation except when, for inspection purposes, this is not possible.

6.8.8 Inspection

At the end of 28 d, remove the test specimens and the comparative items from the test chamber and compare them under 40 x magnification.

6.8.9 Check for compliance with 4.8.

6.9 Corrosion resistance

6.9.1 Apparatus

6.9.1.1 Air circulating oven, capable of maintaining a temperature of 50 °C ± 2 °C.

6.9.1.2 Six crystallizing dishes, of diameter 80 mm and height 40 mm.

6.9.1.3 Six outer containers, made of

a) glass, or

b) polyethylene, or

c) polypropylene,

and of diameter 117 mm and height 117 mm and with close fitting covers.

6.9.1.4 Gloves.

6.9.1.5 Six test coupons, two of bare aluminium alloy of zero temper, two of soft copper type ETP, Cabra No. 110 (see ASTM B 152), two of low-carbon commercial quality, cold-rolled to less than 0,30 % carbon shim steel. Each test coupon is of dimensions 50 mm x 50 mm x 0,10 mm and is free from tears, punctures and crimps.

NOTES

1 Coupons of a different composition from that described above may be used, provided that they do not in any way detrimentally affect the final result of the test and also provided that the final result, using the coupons of a different composition, is the same as that which would have been achieved had the original coupons been used.

2 All chemicals that are used are to be reagent grade chemicals.

6.9.2 Procedure

6.9.2.1 Precleaning the coupons

CAUTION: Never touch the coupons with ungloved hands. Cleaned coupons are to be handled with clean forceps only.

6.9.2.1.1 Clean the coupons by vapour degreasing with 1-1-1 trichloroethane for 10 min in a fume hood.

6.9.2.1.2 Subject the coupons to caustic or detergent washing, and rinse the coupons in flowing water to remove all residues.

6.9.2.1.3 Inspect the coupons for a water-break free surface. Hot air dry the coupons at 105 °C.

6.9.2.2 Preparation of test specimens

6.9.2.2.1 The test is to be done at the settled density of the loose fill insulation.

6.9.2.2.2 For each of the six coupons, subdivide 20 g of the insulation material into two 10 g portions. Determine the quantity of distilled water V (in millilitres) to be used for each 10 g portion of insulation material in accordance with the following:

$$V = \frac{46}{d} \times 75$$

where d is the settled density of the insulation material (see 4.10), in kilograms per cubic metre.

6.9.2.2.3 Pre-saturate each 10 g portion of the insulation material with the determined amount of water. Place a 10 g pre-saturated portion in each crystallizing dish. Tamp the portion level, using a suitable clean instrument.

6.9.2.2.4 Place a metal coupon onto the pre-saturated portion in each dish and centre the coupon in a horizontal plane.

6.9.2.2.5 Place another pre-saturated 10 g portion of the insulation material on top of each metal coupon and tamp the composite specimen to ensure an even distribution of the material and to ensure good contact between the material and the metal coupon.

6.9.2.2.6 Ensure that there are no air pockets near or on the coupon.

6.9.2.2.7 Do not cover the crystallizing dish but take care to avoid evaporation during preparation of the composite specimen.

6.9.2.3 Test method

6.9.2.3.1 Preheat the oven to 50 °C ± 2 °C for at least 2 h before the test.

6.9.2.3.2 Place the crystallizing dishes containing the composite specimen into suitable separate outer containers.

6.9.2.3.3 Add a solution of 70 mL of distilled water and 25 g of potassium sulfate to the annular space between the crystallizing dish and the outer container. Take extreme caution to ensure that none of the solution contaminates the composite specimen. If contamination occurs, discard the specimen and prepare a new composite specimen.

6.9.2.3.4 Loosely place the covers on the outer containers and pre-heat the containers in the oven for 1 h at 50 °C ± 2 °C.

6.9.2.3.5 Seal the containers by tightening the covers.

6.9.2.3.6 Leave the containers in the oven for 336 h ± 4 h. During this period, periodically monitor the oven temperature. Do not open the oven during the test period unless it can be shown that this will not adversely affect the results of the test.

6.9.2.4 Cleaning of the metal coupons after the test

6.9.2.4.1 Disassemble the composite specimens.

6.9.2.4.2 Thoroughly wash the metal coupons, using running water. Lightly brush the coupons with a nylon brush to remove any loose corrosion products.

6.9.2.4.3 Electrolyse the coupons by making up a solution of 28 mL of sulfuric acid (sp gr 1,84), 2 mL of organic inhibitor (for example 0,5 g/L of diorthotolyl thiourea/quinoline ethiodide/betanaphthol quinoline) and 970 mL of water.

6.9.2.4.4 Maintain the solution at 75 °C. Use carbon or lead for the anode.

6.9.2.4.5 Electrolyse for 3 min at a current density of 20 A/cm.

NOTE ┘ If lead anodes are used, lead could deposit on the coupon. If the coupon is resistant to nitric acid, then the lead can be removed by a flash dip of the coupon in a solution of equal parts of nitric acid and water.

CAUTION: To avoid injury when mixing acid and water for electrolytic cleaning, gradually pour the acid into the water with continuous stirring and cooling if considered necessary.

6.9.3 Evaluation

Inspect the coupons, using a 40 W light source, and check for compliance with 4.9.

6.10 Settled thickness and settled density

6.10.1 Apparatus

Vibration apparatus, capable of vibrating at a frequency of 24 Hz. The amplitude of vibration is 1,5 mm ± 0,5 mm about the mean position.

6.10.2 Procedure

Determine the mass of a thin-walled frame of low conductivity (e.g. cardboard) that fits into the thermal conductivity apparatus and that has the same depth as one of the stated minimum thicknesses in table 1. Fill the frame with sample material, using the manufacturer's recommended method. Cover the faces of the frame with thin sheets of plastics material, blotting paper or other suitable uniform sheet material that will confine the material under test. Fasten the frame onto the vibrator. Start the vibrator and vibrate the frame for 1 h. Remove the frame and determine its mass and the settled thickness. Calculate the settled density as follows:

$$p = \frac{(m_2 - m_1).1\ 000}{d \times A}$$

where

p is the settled density, in kilograms per cubic metre;

m_2 is the mass of the filled frame, in kilograms;

m_1 is the mass of the frame, in kilograms;

d is the settled thickness, in millimetres; and

A is the area of the bottom of the frame, in square metres.

6.10.3 Check for compliance with 4.10.

Annex A
(informative)

Safety related issues regarding the application of cellulose loose fill insulation

A.1 This annex is intended as a guide to precautions that should be taken when loose fill insulation is being installed.

A.2 All loose electrical cables should be lifted and relaid over the surface of the insulation where at all possible and where there is sufficient slack to allow the cables to be raised.

A.3 An alternative to **A.2** is to box the cables in such a way that there is an air gap of at least 25 mm around each cable, along its entire length.

A.4 All insulation material should be kept at least 75 mm from all electrical apparatus that penetrates the ceiling.

NOTE - If there is any doubt as to the safety of the installation, a qualified electrician or electrical engineer should be consulted.

Annex B
(informative)

Quality verification of cellulose loose fill thermal insulation material

When a purchaser requires ongoing verification of the quality of loose fill thermal insulation material, it is suggested that, instead of concentrating solely on evaluation of the final product, he also direct his attention to the manufacturer's quality system. In this connection it should be noted that SABS ISO 9001, SABS ISO 9002 and SABS ISO 9003 cover the provision of an integrated quality system.

Annex C
(informative)

Bibliography

BS 5803-3:1985, *Thermal insulation for use in pitched roof spaces in dwellings ⌟ Part 3: Specification for cellulose fibre thermal insulation for application by blowing.*

SABS ISO 9001, *Quality systems ⌟ Model for quality assurance in design/development, production, installation and servicing.*

SABS ISO 9002, *Quality systems ⌟ Model for quality assurance in production and installation.*

SABS ISO 9003, *Quality systems ⌟ Model for quality assurance in final inspection and test.*

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