
Specification for
Unimpregnated asbestos cement boards
for electrical purposes

Spécification des planches en amiante-ciment non-imprégnées
pour usages électriques

Spezifikation für nichtimprägnierte Asbestzementplatten
für elektrische Verwendungszwecke

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Foreword

This standard specification is published under the direction of the General Electrotechnical Engineering Standards Committee as a revision of BS 3497 first published in 1937 and then revised in 1967 under the title of 'Unimpregnated asbestos cement boards (incombustible) for electrical purposes'.

BS 3497 : 1967 included the fuse wire arc test. This has not been retained because experience has indicated that any material made from unimpregnated cement bonded asbestos fibre would pass the test.

In the carbon arc test the cone angle of the carbon rods has been specified because the angle affects the test results. The requirements have also been reassessed to ensure that the values give a requirement that is equally severe for all thicknesses of board.

The requirements of the electrical tests given in the specification should not be used as a guide to the applica-

tion of the material in view of the relatively high water absorption. If boards are used in situations in which they are liable to absorb water, the resulting reduction in electrical insulation, which may be severe, should be recognized.

WARNING NOTE 1. Certain operations entailed in the manufacturing process, notably the handling of raw asbestos and the mechanical sawing of finished sheet, will attract the provisions of the Asbestos Regulation 1969. Guidance on the criteria used by the Health and Safety Executive in assessing observance of the Regulations is to be found in HSE Guidance Note EH/10. Adequate methods exist to control levels of dust during such operations and these are detailed in the Control and Safety Guides issued by the Asbestosis Research Council.

WARNING NOTE 2. Sodium dichromate, required for the conditioning of test pieces in appendix A, is a toxic substance which may only be disposed of under the conditions prescribed by the local authority for dealing with toxic waste.

British Standard Specification for

Unimpregnated asbestos cement boards for electrical purposes

0. Introduction

The boards specified in this standard are intended to withstand repeated exposure to an electric arc in air and to a flame of high intensity. They possess relatively good mechanical and machining properties but, as boards are often used in situations in which they are liable to absorb moisture, it should be recognized that a resulting marked reduction in electrical insulating properties will occur; thus the material can be considered suitable for primary insulation only under dry conditions.

The material is suitable for arc shields on control apparatus and for similar applications.

1. Scope

This British Standard specifies requirements and preferred nominal thicknesses for boards for electrical purposes made from unimpregnated cement-bonded asbestos fibre. For these purposes, when tested in accordance with the requirements of this standard, the boards can be regarded as being non-combustible.

The range of nominal thicknesses covered by this specification is from 3 mm to 50 mm. Boards of greater thicknesses are available but they are not covered by this specification.

2. Definitions

For the purposes of this standard the following definitions apply.

2.1 non-combustible board. A board which, when tested as prescribed in 8.2 and appendix E, neither burns nor gives off flammable vapours.

2.2 central value. The middle value of an odd number of test measurements or the mean of the two middle values of an even number of test measurements when arranged in ascending order.

2.3 flatwise. Perpendicular to the plane of the board.

3. Finish

Boards shall be smooth and uniformly finished.

4. Flatness

When any board is placed without restraint, concave side up, on a flat horizontal surface, the departure at any part of the upper surface of the board from a light straightedge laid in any direction upon it shall not exceed the appropriate values given below.

<i>Length of straightedge</i>	<i>Departure from straightedge</i>
1.0 m	4.0 mm
0.5 m	1.0 mm

In making the measurement the straightedge shall be not longer than the board in the direction in which the straight-edge is laid.

5. Preferred nominal thicknesses and permissible deviations

The preferred nominal thicknesses in millimetres are: 3, 4, 5, 6, 8, 10, 12, 16, 20, 25, 30, 35, 40, 45, 50.

The thickness of the board at any point shall not deviate from the nominal thickness by more than 0.25 mm for boards of thickness up to and including 25 mm or by more than 0.40 mm for boards of thickness greater than 25 mm.

6. Flatwise electric strength at a temperature of 90 °C for boards of nominal thickness up to 25 mm

The flatwise electric strength shall be determined as described in appendix B on boards of nominal thickness up to and including 25 mm. The test result shall be not less than the appropriate value shown in figure 1.

7. Surface electric strength at a temperature of 90 °C

The surface electric strength shall be determined as described in appendix C. The test result shall be not less than 10 kV.

8. Arc resistance and combustibility tests

8.1 Carbon arc test. Boards of nominal thickness up to 12 mm shall be conditioned as described in appendix A and they shall be tested as described in appendix D. Boards of greater thickness may be similarly tested by agreement between the purchaser and the supplier. The test result shall be not less than that given in table 1.

Table 1. Limiting values for carbon arc test

Nominal thickness	Test result
mm	s
3	22
4	39
5	57
6	75
over 6 mm machined to 6 mm for test	75



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8.2 Spirit burner test. The board shall be conditioned as described in appendix A and it shall be tested as described in appendix E. Combustion shall not be established.

NOTE. This test should not be used to assess the potential fire hazard in service. The results obtained relate only to the specified test conditions.

9. Resistance to flatwise compression

The resistance to flatwise compression shall be determined as described in appendix F. The test result shall not exceed 5 % nor shall any part of any test piece either crack or break.

10. Crushing strength

The crushing strength shall be determined as described in appendix G after conditioning as described in appendix A. The test result shall be not less than 100 N/mm².

11. Flatwise shear strength

The flatwise shear strength shall be determined as described in appendix H after conditioning as described in appendix A.

The test result shall be not less than 27.5 N/mm².

12. Flexural strength

The flexural strength shall be determined as described in appendix J after conditioning as described in appendix A. The test result shall be not less than the appropriate value given in table 2.

Table 2. Limiting values for flexural strength

Nominal thickness	Flexural strength
mm	N/mm ²
Up to and including 25	28
over 25	24

13. Machinability

Any board shall be capable of being machined by normal operations such as turning, drilling, milling and shaping without showing signs of splitting, cracking or chipping.

Appendix A

Conditioning of test pieces

Where conditioning is specified in the test method, condition the test pieces for not less than 18 h nor more than 72 h in a controlled atmosphere of $50 \pm 5\%$ r.h. at a temperature of $23 \pm 2^\circ\text{C}$. Commence the relevant test within three minutes of removal of each test piece from this controlled atmosphere.

This atmosphere of 50 % r.h. can be obtained conveniently in an enclosed chamber in which a saturated solution of sodium dichromate is exposed to the atmosphere in the chamber. BS 3718 gives details of a suitable chamber. Prepare the saturated solution from distilled water and sodium dichromate of a recognized analytical reagent quality.

Expose the saturated solution so that the maximum surface is in contact with the air in the chamber, e.g. by covering the floor of the chamber with a tray containing the saturated solution. It is essential to use an ample excess of solid sodium dichromate in contact with the saturated solution. If desired, a mobile slurry of the salt and saturated solution may be used, this being prepared by adding the solid salt, of suitable particle size, to the previously prepared saturated solution of sodium dichromate until the desired fluid consistency is obtained.

Ensure uniform conditions throughout the chamber through the passage of fan-circulated air over the surface of the saturated solution or slurry and around the test pieces. Free access of the conditioning atmosphere to all test pieces is essential. From time to time, check that the relative humidity of the air in the chamber is correct.

The saturated salt solution or slurry will become contaminated in the course of time; the salt tray should, therefore, be emptied, washed all over, carefully dried and refilled with sufficient saturated solution or slurry at intervals of not more than two months. More frequent changes may be necessary if the chamber is used where conditions of severe contamination are experienced.

Appendix B

Flatwise electric strength at a temperature of 90°C for boards of nominal thickness up to 25 mm

B.1 Test pieces. Use at least three test pieces each of the dimensions given in table 3, and of thickness that of the board under test. The thickness shall be determined with an accuracy of 0.03 mm.

B.2 Conditioning. The test pieces shall be dried in an oven at a temperature of $200 \pm 5^\circ\text{C}$ for the appropriate period given in table 3.

Table 3. Dimensions and drying times for test pieces for flatwise electric strength test

Nominal thickness	Minimum dimensions	Drying time at $200 \pm 5^\circ\text{C}$
mm	mm	h
Up to and including 12	150 × 150	18 to 24
over 12 up to and including 25	230 × 230	40 to 48

B.3 Electrodes. The lower electrode shall consist of a solid cylinder of brass or other metal, 75 mm in diameter and approximately 15 mm thick. The upper electrode shall consist of a solid cylinder of brass or other metal 25 mm in diameter and not less than 25 mm thick. The sharp edges shall be removed from the electrodes and the radius at the edges of the faces in contact with the test piece shall be 3 mm.

Arrange the electrodes coaxially with their axes normal to the plane of the board.

B.4 Test voltage. The test shall be made with an alternating voltage in the frequency range of 48 Hz to 62 Hz, of approximately sine wave form and the ratio of the peak value to the r.m.s. value (the peak factor) shall be $\sqrt{2}$ (1 ± 0.05) i.e. 1.34 to 1.48. The test voltage shall be expressed as peak value divided by $\sqrt{2}$ and it shall be determined by means of a peak voltmeter suitably connected across the input or output winding (or a voltmeter winding thereon) and calibrated, up to the maximum voltage that has to be measured, against a sphere gap connected to the output terminal of the transformer. (See BS 358.)

Peak voltmeters, of types other than a sphere gap, may be subject to error if the waveform is re-entrant, if there is a change in mains frequency or if high frequencies are generated by brush discharges. The instrument shall therefore preferably be calibrated against a sphere gap, but calibration of a r.m.s. instrument against a peak voltmeter is permissible if there is adequate evidence, such as a certificate of calibration, that the peak voltmeter is free from error. Both the peak factor of the test voltage and the accuracy of some types of peak voltmeter may be changed by the current taken by the test piece. If this risk is significant the peak factor shall be determined or the voltmeter shall be calibrated against a sphere gap (see BS 358), with the test piece in circuit in oil at $90 \pm 2^\circ\text{C}$. The test equipment shall be capable of maintaining the test voltage up to the instant of breakdown or for the maximum time required.

NOTE. Equipment capable of supplying an output current of not less than 40 mA over the voltage range for which it is intended at all leading power factors between zero and unity usually complies with this requirement.

B.5 Procedure. After the test pieces have been conditioned in accordance with B.2, they shall be cooled to a temperature of $90 \pm 2^\circ\text{C}$ in the same oven or immediately transferred to an oven at a temperature of $90 \pm 2^\circ\text{C}$. The test pieces shall be allowed sufficient time to reach this temperature and shall be tested at this temperature. The electrodes shall be heated to a temperature of $90 \pm 2^\circ\text{C}$ and then placed in position on a test piece. When testing the first test piece, the voltage shall be applied to the electrodes and increased from zero at a uniform rate such that breakdown occurs in 10 s to 20 s. If the time to breakdown of the first (trial) test piece is not within these limits, one or more additional trial pieces shall be tested until a test piece breaks down in 10 s to 20 s or until the average time of breakdown of two or more test pieces (including, if desired, the first) is between 10 s and 20 s.

From the list given below the voltage shall be selected which is nearest to 40 % of the breakdown voltage (or average breakdown voltage) obtained on the trial test piece. This voltage shall be applied in turn to two further test pieces and maintained in each case for 20 s. If a test piece withstands this voltage for 20 s without failure, the next