

BRITISH STANDARD 1142 : Part 1 : 1971

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**SPECIFICATION FOR
FIBRE
BUILDING BOARDS**

Part 1. Methods of test

BRITISH STANDARDS INSTITUTION

SPECIFICATION FOR FIBRE BUILDING BOARDS

Part 1. Methods of test

BS 1142 : Part 1 : 1971

Incorporating amendments issued June, 1972 (AMD 977)
and June, 1985 (AMD 4768)

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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.

A complete list of British Standards, numbering over 9,000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue which may be purchased from BSI Sales Department. The Catalogue may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 874. Methods of determining thermal properties, with definitions of thermal insulating terms.
- BS 1142. Fibre building boards.
Part 2. Medium board and hardboard.
- BS 1494 Fixing accessories for building purposes.
Part 2. Sundry fixings
- BS 3177. Method for determining the permeability to water vapour of flexible sheet materials used for packaging.
- BS 5669. Specification for wood chipboard and methods of test for particle board.

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 that they are in possession of the latest amendments or editions.

The following BSI references relate to the work on this standard:
Committee reference T1B/10. Draft for comment 70/9567

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CO-OPERATING ORGANIZATIONS

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

- British Door Association
- British Plastics Federation
- British Woodwork Manufacturers' Association
- *Department of the Environment—Forest Products Research Laboratory
- *Department of the Environment—Housing and Construction
- *Fibre Building Board Development Organization Limited
- Forestry Commission
- Hardwood Flooring Manufacturers' Association
- Institute of Wood Science
- Institution of Civil Engineers
- *Institution of Municipal Engineers
- Institution of Structural Engineers
- *National Federation of Building Trades Employers
- National Sawmilling Association
- *Royal Institute of British Architects
- *Royal Institute of Chartered Surveyors
- Softwood Agent Brokers' Association
- Timber Container Confederation
- Timber Research and Development Association
- Timber Trade Federation of the UK

The Government departments 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 standard:

- Building Board Manufacturers' Association of Great Britain Ltd.
- Department of the Environment and Fire Offices Committee—Joint Fire Research Organization
- Fibre Building Board Federation
- Incorporated Association of Architects and Surveyors
- Insulation Building and Hardboard Association Limited
- Modular Society
- Society of Motor Manufacturers and Traders Limited

BRITISH STANDARD SPECIFICATION FOR FIBRE BUILDING BOARDS

Part 1. Methods of test

FOREWORD

This British Standard BS 1142 has been revised under the authority of the Timber Industry Standards Committee. It is now being issued in three Parts:

Part 1, Methods of test.

*As amended
June, 1985*

Part 2, Medium board, medium density fibreboard (MDF) and hardboard.

Part 3, Insulating board (softboard).

This Part of the standard incorporates many new tests which either did not figure in the previous standard or which did not form a mandatory part of it. In addition, recommended test methods of the International Organization for Standardization (ISO) have been adopted in accordance with BSI policy and international agreement. The following tests previously used in BS 1142 : 1961 have been redrafted in accordance with this procedure:

Determination of dimensions of test specimens.

Determination of density.

Determination of absorption after water immersion.

Determination of bending strength.

New tests which have been introduced in accordance with ISO recommendations or draft recommendations are:

Determination of thickness swelling after water immersion.

Determination of moisture content.

Measurement of dimensions of boards.

Measurement of surface smoothness.

Two tests have been carried over from the previous standard which have not yet reached a stage of international standardization. These are 'thermal conductivity', and 'dimensional changes associated with changes in relative humidity'. The latter is now introduced for the first time as a mandatory test.

Finally, this Part contains a method of consignment testing which is based on an ISO draft recommendation. This establishes procedures for sampling, cutting and inspection of boards. These may be used to verify compliance with the appropriate requirements specified in Parts 2 and 3 of this standard.

Not all of the tests mentioned have acceptance levels set for them in Parts 2 and 3. The most important case is that of the test for surface smoothness. It has been considered sufficient for the time being to offer a precise method of test

so that purchasers and suppliers can reach agreement on particular cases relative to end use. Test levels will eventually be determined in Part 2 when sufficient experience has been gained with the technique.

It is hoped that this Part of BS 1142 will be subject to addition and amendment, particularly as the work of ISO proceeds.

As part of BSI's programme of metrication, the values in this standard are expressed in metric terms.

Many materials used in the construction and finishes of buildings are known to be capable of emitting small amounts of formaldehyde gas, medium density fibreboard (MDF) being an example. Very low concentrations of this gas, less than 2 parts per million for an average adult, can produce discomfort and irritation in the eyes. Rare cases of discomfort levels have been reported, and in some of these the source was MDF.

*Added
June 1985*

The highest emissions of formaldehyde occur soon after the board is manufactured. The application of paint, lacquer, veneer, or other overlays can reduce the risk of formaldehyde emission; conversely, the risk of discomfort levels arising is increased by poor ventilation, excessive humidity and/or heat. All these factors should, therefore, be noted by designers and specifiers where the application of MDF is being considered. Discomfort caused by the emission of formaldehyde is most unlikely to occur unless large quantities of unfinished MDF are used in unventilated areas.

The method of determining the extractable formaldehyde content is based on work by FESYP (Fédération Européenne des Syndicats des Fabricants de Panneaux de Particules) and is included in 17. Its technical content is identical with that given in BS 5669.

METHODS

1. SCOPE

This British Standard describes methods of test for fibre building board, a sheet material, usually exceeding 1.5 mm in thickness, manufactured from fibres of lignocellulosic material with the primary bond normally derived from the felting of the fibres and their inherent adhesive properties. In medium density fibreboard (MDF) the primary bond is derived from a bonding agent.

*Amended
June 1985*

Bonding, impregnating or other agents may be added during or after manufacture to modify particular properties of the board.

NOTE. The titles of the British Standards referred to in this standard are listed on page 2.

BS 1142 : Part 1 : 1971**2. CLASSIFICATION**

As amended June, 1985 Fibre building boards are broadly classified by international usage into the following basic types:

Type of board	Density (kg/m ³)
Softboard	Equal to or less than 350
Medium board (including panelboard)	Greater than 350 but equal to or less than 800
Medium density fibreboard (MDF)	Greater than 600
Hardboard	Greater than 800

3. CONSIGNMENT TESTING**3.1 Nomenclature**

3.1.1 Boards. Fibre building boards are defined as a sheet material, and 'board' is the general term used for relatively large sheets.

3.1.2 Lot. A number of boards in a consignment, each of the same kind and the same specified characteristics and dimensions, made by the same manufacturer and presented for sampling and testing at the same time.

3.1.3 Lot size. The number of boards in a lot.

3.1.4 Samples. One or more boards drawn at random from the lot for testing.

3.1.5 Test boards. Each of the boards constituting the sample.

3.1.6 Test unit. A test board marked off into test pieces.

3.1.7 Test pieces. Rectangular pieces of material, 100 mm × 300 mm, chosen from the test units by means of sub-division and if convenient the use of random numbers.

3.1.8 Test specimens. Pieces of material cut from a test piece to the required size for a certain test.

3.2 Sampling

3.2.1 The sample size is determined by the lot size according to Table 1.

The sampling shall be done in a random manner, so that each board has an equal chance of being drawn from the lot. A table of random numbers may be used for this purpose.

TABLE 1. SAMPLE SIZE AND LOT SIZE

Lot size		Number of test boards
50 to	110	3
111 to	180	4
181 to	300	5
301 to	500	7
501 to	800	10
801 to	1 300	15
1 301 to	3 200	20
3 201 to	8 000	25
8 001 to	22 000	30
22 001 to	110 000	35
110 001 to	550 000	100

NOTE. Where the lot size is unknown, not less than 5 boards shall be taken.

3.2.2 The whole board shall be used to provide test pieces.

3.2.3 Each of the test units is then marked out into 100 mm × 300 mm test pieces. As the test specimens that are ultimately required are in some cases rectangular and are also needed parallel and perpendicular to the machine direction of the board, half of each test unit should be sub-divided laterally and half sub-divided longitudinally and numbered as indicated in Fig. 1. Any superfluous material is disregarded.

Length or machine direction of board ↑	01	02	03											Length or machine direction of board ↑
	04	05	06	01	02	03	04	05	06	07	08	09		
	07	08	09											
	10	11	12	10	11	12	13	14	15	16	17	18		
	13	14	15											
	16	17	18	19	20	21	22	23	24	25	26	27		
	19	20	21											
	22	23	24											
	25	26	27											

Fig. 1. Sub-divisions of test units

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3.2.4 The required number of test pieces (equal to the number of test specimens) as shown in Table 2, should be selected at random and, if convenient, using a table of random numbers. In some instances the required test piece will be larger than the 100 mm × 300 mm test piece and in this case, the test piece chosen should, before cutting, be enlarged sufficiently in area. The enlargement should be made so that the centre of the enlarged test piece is as near as possible to the centre of the originally chosen test piece. If enlargement is not possible due to proximity of other chosen test pieces, one of the abutting pieces shall be re-allocated at the discretion of the tester.

3.2.5 From each test piece chosen, one test specimen shall be cut and marked with the lot identification number, the board number and the lengthwise or machine direction.

3.2.6 When it is required to test small size sheets, it may be necessary to use a greater number of boards to obtain the required number of test specimens.

Added June 1972 **3.2.7** Not less than six tiles, required for testing in accordance with Part 3, shall be selected at random from the whole consignment. The number of test specimens required is shown in Table 2a.

TABLE 2A. NUMBER OF TEST SPECIMENS REQUIRED WHEN TESTING TILES

Test	Size of test specimen	Number of test specimens per tile
Density	mm 100 × 100	1
Deflection	75 × (20 <i>t</i> + 40) where <i>t</i> = nominal thickness	2
Changes with relative humidity changes	20 × 200	2
Thermal conductivity	300 × 300	1
Vapour permeability	90 mm dia.	1

TABLE 2. NUMBER OF TEST SPECIMENS REQUIRED

Test	Size of test specimen	Number of test specimens per board	
		Parallel to machine direction	Perpendicular to machine direction
Density	mm 100 × 100	3	
Modulus of elasticity and bending strength	75 × (25 <i>t</i> + 50) where <i>t</i> = nominal thickness	6	6
Water absorption and thickness swelling	100 × 100	use density test specimens	
Changes with relative humidity changes	20 × 200	3	3
Thermal conductivity	300 × 300	3	
Surface smoothness	300 × 300	3	
Deflection	mm 75 × (20 <i>t</i> + 40) where <i>t</i> = nominal thickness	6	6
Vapour permeability	90 mm dia.	4	
Transverse internal bond	50 × 50	6	
Screw withdrawal	75 × 75	6	

*As amended
June, 1985**Added
June, 1972**Added
June, 1985*

3.3 Assessment of variability

NOTE. Practical worked examples of the use of this method are to be found in Appendix A.

By international agreement, an acceptable quality level (AQL) of 10% is accepted for fibre building boards. For a material lot where the proportion of defective boards is predicted by the sampling and testing procedure to be no greater than 10% the lot thus complies with the requirements of the standard. A procedure for assessing conformity with this requirement is given below.

3.3.1 Determination of standard deviation. The standard deviation between board means is calculated according to:

$$S_M = \sqrt{\frac{1}{m^2(n-1)} \left(\sum x^2 - \frac{(\sum x)^2}{n} \right)}$$

where S_M = standard deviation between board means

m = number of test specimens for board

n = number of boards

x = single test value.

3.3.2 Determination of lot compliance with specification

3.3.2.1 Single specification limits. Calculate the coefficient k_o according to the following:

$$\text{for an upper specification limit } k_o = \frac{U - X}{S_M}$$

or

$$\text{for a lower specification limit } k_o = \frac{X - L}{S_M}$$

where U = the upper specification

L = the lower specification

X = the test mean

Table 3 gives values for the coefficient K for different numbers of test boards.

If k_o is equal to or greater than K , then less than 10% of the consignment should be defective, and the lot is thus acceptable.

If k_o is less than K , then more than 10% of the consignment is likely to be defective, and the lot shall therefore be deemed not to comply with the requirements of the standard.

TABLE 3. VALUES OF K

Number of test boards	K
3	0.566
4	0.617
5	0.675
7	0.755
10	0.828
15	0.886
20	0.917
25	0.936
30	0.946
35	0.969
100	1.05

3.3.2.2 *Double specification limits.* Calculate

$$Q_U = \frac{U - X}{S_M} \text{ and } Q_L = \frac{X - L}{S_M}$$

From Table 5 find the percentage of a lot falling outside both the lower, (P_L), and upper (P_U) specification limit. The total percentage defective (P_{tot}) is given by

$$P_{tot} = P_L + P_U$$

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In Table 4 are given values for the coefficient M and number of test boards.
If P_{tot} is greater than M , or if either Q_U or Q_L , or both, are negative, the lot shall be deemed not to comply with the requirements of the standard.

TABLE 4. VALUES OF M

Number of test boards	M
3	33.69
4	29.45
5	26.56
7	23.29
10	20.72
15	18.94
20	18.03
25	17.51
30	17.24
35	16.65
100	14.75

**TABLE 5. THE PERCENTAGE OF A LOT FALLING OUTSIDE
THE LOWER (P_L) AND UPPER (P_U) SPECIFICATION LIMIT**

Q_U or Q_L	Sample size										
	3	4	5	7	10	15	20	25	30	35	100
0	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
0.1	47.24	46.67	46.44	46.26	46.16	46.10	46.08	46.06	46.05	46.05	46.03
0.2	44.46	43.33	42.90	42.54	42.35	42.24	42.19	42.16	42.15	42.13	42.09
0.3	41.63	40.00	39.37	38.87	38.60	38.44	38.37	38.33	38.31	38.29	38.24
0.31	41.35	39.67	39.02	38.50	38.23	38.06	37.99	37.95	37.93	37.91	37.86
0.32	41.06	39.33	38.67	38.14	37.86	37.69	37.62	37.58	37.55	37.54	37.48
0.33	40.77	39.00	38.32	37.78	37.49	37.31	37.24	37.20	37.18	37.16	37.10
0.34	40.49	38.67	37.97	37.42	37.12	36.94	36.87	36.83	36.80	36.78	36.72
0.35	40.20	38.33	37.62	37.06	36.75	36.57	36.49	36.45	36.43	36.41	36.35
0.36	39.91	38.00	37.25	36.69	36.38	36.20	36.12	36.08	36.05	36.04	35.97
0.37	39.62	37.67	36.93	36.33	36.02	35.83	35.75	35.71	35.68	35.66	35.60
0.38	39.33	37.33	36.58	35.98	35.65	35.46	35.38	35.34	35.31	35.29	35.23
0.39	39.03	37.00	36.23	35.62	35.29	35.10	35.01	34.97	34.94	34.93	34.86
0.40	36.74	36.67	35.85	35.26	34.93	34.73	34.65	34.60	34.58	34.56	34.49
0.41	38.45	36.33	35.54	34.90	34.57	34.37	34.28	34.24	34.21	34.19	34.12
0.42	36.15	36.00	35.19	34.55	34.21	34.00	33.92	33.87	33.85	33.83	33.76
0.43	37.85	35.67	34.85	34.19	33.85	33.64	33.56	33.51	33.48	33.46	33.39
0.44	37.56	35.33	34.50	33.84	33.49	33.28	33.20	33.15	33.12	33.10	33.03
0.45	37.26	35.00	34.16	33.49	33.13	32.92	32.84	32.79	32.76	32.74	32.67
0.46	36.96	34.67	33.81	33.13	32.78	32.57	32.48	32.43	32.40	32.38	32.31
0.47	36.66	34.33	33.47	32.78	32.42	32.21	32.12	32.07	32.04	32.02	31.95
0.48	36.35	34.00	33.12	32.43	32.07	31.85	31.77	31.72	31.69	31.67	31.60
0.49	36.05	33.67	32.78	32.08	32.72	31.50	31.41	31.36	31.33	31.31	31.24
0.50	35.75	33.33	32.44	31.74	31.37	31.15	31.06	31.01	30.98	30.96	30.89
0.51	33.44	33.00	32.10	31.39	31.02	30.80	30.71	30.66	30.63	30.61	30.54
0.52	35.13	32.67	31.76	31.04	30.67	30.45	30.36	30.31	30.28	30.26	30.19
0.53	34.00	32.33	31.42	30.70	30.32	30.10	30.01	29.96	29.93	29.91	29.84
0.54	34.51	32.00	31.08	30.36	29.98	29.76	29.67	29.62	29.59	29.57	29.49
0.55	34.20	31.67	30.34	30.01	29.64	29.41	29.32	29.27	29.24	29.22	29.15
0.56	33.88	31.33	30.40	29.67	29.29	29.07	28.98	28.93	28.90	28.88	28.81
0.57	33.57	31.00	30.06	29.33	28.95	28.73	28.64	28.59	28.56	28.54	28.47
0.58	33.25	30.67	29.73	28.99	28.61	28.39	28.30	28.25	28.22	28.20	28.13
0.59	32.89	30.33	29.39	28.66	28.28	28.05	27.93	27.92	27.89	27.87	27.79

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Table 5 (continued)

Q_u or Q_L	Sample size										
	3	4	5	7	10	15	20	25	30	35	100
0.60	32.61	30.00	29.05	28.32	27.94	27.72	27.63	27.58	27.55	27.53	27.46
0.61	32.28	29.67	28.72	27.98	27.60	27.39	27.30	27.25	27.22	27.20	27.13
0.62	31.96	29.33	28.39	27.65	27.27	27.05	26.96	26.92	26.89	26.87	26.80
0.63	33.65	29.00	28.03	27.32	27.94	26.72	26.63	26.59	26.56	26.54	26.47
0.64	31.30	28.67	27.72	26.99	26.61	26.39	26.31	26.26	26.23	26.21	26.14
0.65	30.97	28.33	27.30	26.66	26.28	26.07	25.98	25.93	25.90	25.88	25.82
0.66	30.63	28.00	27.06	26.33	25.96	25.74	25.66	25.61	25.58	25.56	25.49
0.67	30.30	27.67	26.73	26.00	25.63	25.42	25.33	25.29	25.26	25.24	25.17
0.68	29.96	27.33	26.40	25.68	25.31	25.10	25.01	24.97	24.94	24.92	24.86
0.69	29.61	27.00	26.07	25.35	24.99	24.78	24.70	24.65	24.62	24.60	24.54
0.70	29.27	26.67	25.74	25.03	24.67	24.46	24.38	24.33	24.31	24.29	24.23
0.71	28.92	26.33	25.43	24.71	24.35	24.15	24.06	24.02	23.99	23.96	23.91
0.72	28.57	26.00	25.09	24.39	24.03	23.83	23.75	23.71	23.68	23.67	23.60
0.73	28.22	25.67	24.76	24.07	23.72	23.52	23.44	23.40	23.37	23.36	23.30
0.74	27.86	25.33	24.44	23.75	23.41	23.21	23.13	23.09	23.07	23.05	22.99
0.75	27.50	25.00	24.11	23.44	23.10	22.90	22.83	22.79	22.76	22.75	22.69
0.76	27.13	24.67	23.79	23.12	22.79	22.60	22.52	22.48	22.46	22.44	22.39
0.77	26.77	24.33	23.47	22.81	22.48	22.30	22.22	22.18	22.16	22.14	22.09
0.78	26.39	24.00	23.15	22.50	22.18	21.99	21.92	21.89	21.86	21.85	21.79
0.79	26.02	23.67	22.83	22.19	21.87	21.70	21.63	21.59	21.57	21.55	21.50
0.80	25.64	23.33	22.51	21.88	21.57	21.40	21.33	21.29	21.27	21.26	21.21
0.81	25.25	23.00	22.19	21.58	21.27	21.10	21.04	21.00	20.98	20.97	20.22
0.82	24.86	22.67	21.87	21.27	20.98	20.81	20.75	20.71	20.69	20.68	20.03
0.83	24.47	22.33	21.56	20.97	20.68	20.52	20.46	20.42	20.40	20.39	20.35
0.84	24.07	22.00	21.34	20.67	20.39	20.23	20.17	20.14	20.12	20.11	20.36
0.85	23.67	21.67	20.93	20.37	20.10	19.94	19.89	19.86	19.84	19.82	19.78
0.86	23.26	21.33	20.62	20.07	19.81	19.66	19.60	19.57	19.56	19.54	19.51
0.87	22.84	21.00	20.31	19.78	19.52	19.38	19.32	19.30	19.28	19.27	19.23
0.88	22.42	20.67	20.00	19.48	19.23	19.10	19.04	19.02	19.00	18.99	18.96
0.89	21.99	20.33	19.69	19.19	18.95	18.82	18.77	18.74	18.73	18.72	18.60