BRITISH STANDARD

Rigid polyisocyanurate (PIR) and polyurethane (PUR) products for building end-use applications –

Part 2: Specification for laminated boards with auto-adhesively bonded facings for use as thermal insulation for internal wall linings and ceilings

ICS 91.100.60

Confirmed
December 2011

BSI
British Standards

Publishing and copyright information

ISBN 0 580 48190 5

The following BSI references relate to the work on this standard:
Committee reference PRI/72/4
Draft for comment 05/30121972 DC

Publication history

First published, July 1975
Second edition, July 2006

Amendments issued since publication

Amd. no.	Date	Text affected

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard was published by BSI and came into effect on 20 July 2006. It was prepared by Subcommittee PRI/72/4, *Polyurethane*, under the authority of Technical Committee PRI/72, *Rigid cellular materials*.

Supersession

This part of BS 4841 supersedes BS 4841-2:1975, which is withdrawn.

Information about this document

This British Standard has been introduced to specify the requirements needed to ensure fitness for purpose of those rigid polyurethane and polyisocyanurate cored laminated insulation boards with auto-adhesively or separately bonded flexible and/or rigid facings used in the insulation of internal walls and ceilings of buildings in the United Kingdom. The requirements have been written so that products conforming to BS 4841-2 also conform to BS EN 13165:2001 (including amendments 1 and 2) whilst satisfying the specified minimum performance levels of the properties included in the current standard.

Additional information for the guidance of users, installers and designers is given in informative Annexes A, B, C and D to this standard.

The other parts of BS 4841 have also been revised to reflect recent technical advances and to take into account the European Standard BS EN 13165:2001 (including amendments 1 and 2).

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are presented in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal obligations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

0 Introduction

For more than 30 years the types of wall and ceiling products described in this standard have been safely used in the UK as non-loadbearing insulated internal wall linings and ceiling products which are usually fixed to a masonry supporting structure. Because of their high thermal efficiency these products provide the necessary insulation requirement at minimum thickness. In this way the loss of usable internal space in the room is minimized.

These composite products have either two flexible faces bonded to the core or more frequently one substantial rigid facing (usually plasterboard) and a flexible face so that the product is installed with the plasterboard facing the interior of the room.

1 Scope

This British Standard specifies requirements for rigid polyisocyanurate (PIR) and polyurethane (PUR) cored laminated insulation boards with auto-adhesively or separately bonded flexible or substantial rigid facings, for use as thermal insulation for internal wall linings and ceilings. The standard also applies to products with one flexible and one substantial rigid facing.

NOTE 1 Because of the changes introduced into this standard, products conforming to this standard also conform to BS EN 13165:2001 (including amendments 1 and 2).

NOTE 2 Additional information for the guidance of users, installers and designers is given in informative Annexes A, B, C, and D to this standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 822:1995, *Thermal insulating products for building applications – Determination of length and width*

BS EN 823, *Thermal insulating products for building applications – Determination of thickness*

BS EN 825:1995, *Thermal insulating products for building applications – Determination of flatness*

BS EN 826:1996, *Thermal insulating products for building applications – Determination of compression behaviour*

BS EN 1607:1997, *Thermal insulating products for building applications – Determination of tensile strength perpendicular to faces*

BS EN 13165:2001 (including amendments 1 and 2), *Thermal insulation products for buildings – Factory made rigid polyurethane foam (PUR) products – Specification*

BS EN 13501-1:2002, *Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests*

3 Terms, symbols and definitions

3.1 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1.1 auto-adhesively bonded facing

facing that becomes bonded onto the PIR or PUR core during the process of creating it

NOTE These facings can be flexible or rigid.

3.1.2 separately bonded facing

facing that is bonded onto the PIR or PUR core in a separate manufacturing process

NOTE These facings can be flexible or rigid.

3.1.3 polyisocyanurate product

rigid cellular plastics insulation product with a substantially closed cell structure mainly based on polymers of the isocyanurate type

3.1.4 polyurethane product

rigid cellular plastics insulation product with a substantially closed cell structure mainly based on polymers of the polyurethane type

3.2 Symbols

d_N	nominal thickness of the product in mm
λ_D	declared thermal conductivity in mW/(m·K)
S_b	deviation from squareness in mm/m
S_{max}	maximum deviation from flatness in mm/m

4 Construction and composition

4.1 General

The insulation boards shall consist of an insulating core (**4.2**) with either two bonded flexible facings (**4.3**) or two rigid facings (**4.4**), or one flexible facing (**4.3**) and one substantial rigid facing (**4.4**).

4.2 Flexible facings

The flexible facings of the insulation boards shall be either functional or decorative, e.g. paper, metal foil, glass tissue or mineralized glass with a minimum weight of 100 g/m^2 or polyethylene coated glass fibre.

NOTE The two facings need not be identical.

4.3 Substantial rigid facings

4.3.1 General

Substantial rigid facings shall consist of either calcium silicate in accordance with **4.3.2** or plasterboard in accordance with **4.3.3**.

4.3.2 Calcium silicate

When tested in accordance with BS EN 13501-1:2002 calcium silicate boards shall have a reaction to fire classification of Euroclass A1 or A2.

4.3.3 Plasterboard

When tested in accordance with BS EN 13501-1:2002 plasterboard facings shall have a reaction to fire classification of Euroclass A1 or A2.

NOTE The type of facings and the degree of their bonding are crucial to ensure good service performance for the laminated insulation boards. The degree of bonding, if required, should conform to the recommendations given in Annex E when evaluated according to the procedure given in Annex A.

5 Requirements

5.1 Thermal resistance and thermal conductivity

The declared thermal conductivity λ_D of the flexible faced insulation boards or core product shall be determined in accordance with BS EN 13165:2001 (including amendments 1 and 2). The declared values shall not exceed 29 mW/m·K at 10 °C, i.e. the value shall be determined without any substantial rigid facings.

*NOTE See also **B.3** for information on insulation board design U values.*

5.2 Dimensions

5.2.1 Length and width

The length and width of boards shall be as specified in Table 1 when measured in accordance with BS EN 822:1995.

Table 1 **Tolerances for lengths and widths**

Dimensions mm	**Tolerances** mm
< 1000	± 5
1000 to 2000	± 7.5
2001 to 4000	± 10
> 4000	± 15

NOTE UK manufacturers usually quote for their products' lengths and widths with a maximum deviation of ± 3 mm for those dimensions up to and including 1200 mm. Those with dimensions greater than 1200 mm may have lower tolerances than are quoted in Table 1.

5.2.2 Thickness

Thickness, d, shall be determined in accordance with BS EN 823. No test result shall deviate from the nominal thickness, d_N, by more than the tolerances given in Table 2 for the declared class.

Table 2 **Classes for thickness tolerances**
Dimensions in millimetres

Class	Nominal thicknesses		
	< 50	**50 to 75**	**> 75**
	Tolerances		
T1	± 3	± 4	+6, –3
T2	± 2	± 3	+5, –2
T3	± 1.5	± 1.5	± 1.5

5.2.3 Squareness

Squareness shall be determined in accordance with BS EN 824. The deviation from squareness on length and width, S_b, shall not exceed 6 mm/m.

5.2.4 Flatness

Flatness shall be determined in accordance with BS EN 825:1995. The maximum deviation from flatness, S_{max}, shall not exceed the values given in Table 3.

Table 3 **Deviation from flatness**

Full size product length	Full size product area	Deviation from flatness S_{max}
m	m^2	mm
$\leqslant$ 2.50	$\leqslant$ 0.75	$\leqslant$ 5
	> 0.75	$\leqslant$10

5.3 Compressive strength

5.3.1 Normal to the major plane of the board

When tested in accordance with BS EN 826:1996 the compressive strength of the board shall be not less than 120 kPa, which corresponds to the designation CS (10\Y) 120 given in BS EN 13165:2001 (including amendments 1 and 2).

NOTE 1 See Figure 1.

NOTE 2 The designer's attention is drawn to the need for the insulation board to possess sufficient robustness to withstand the handling procedures concerned with its delivery and installation.

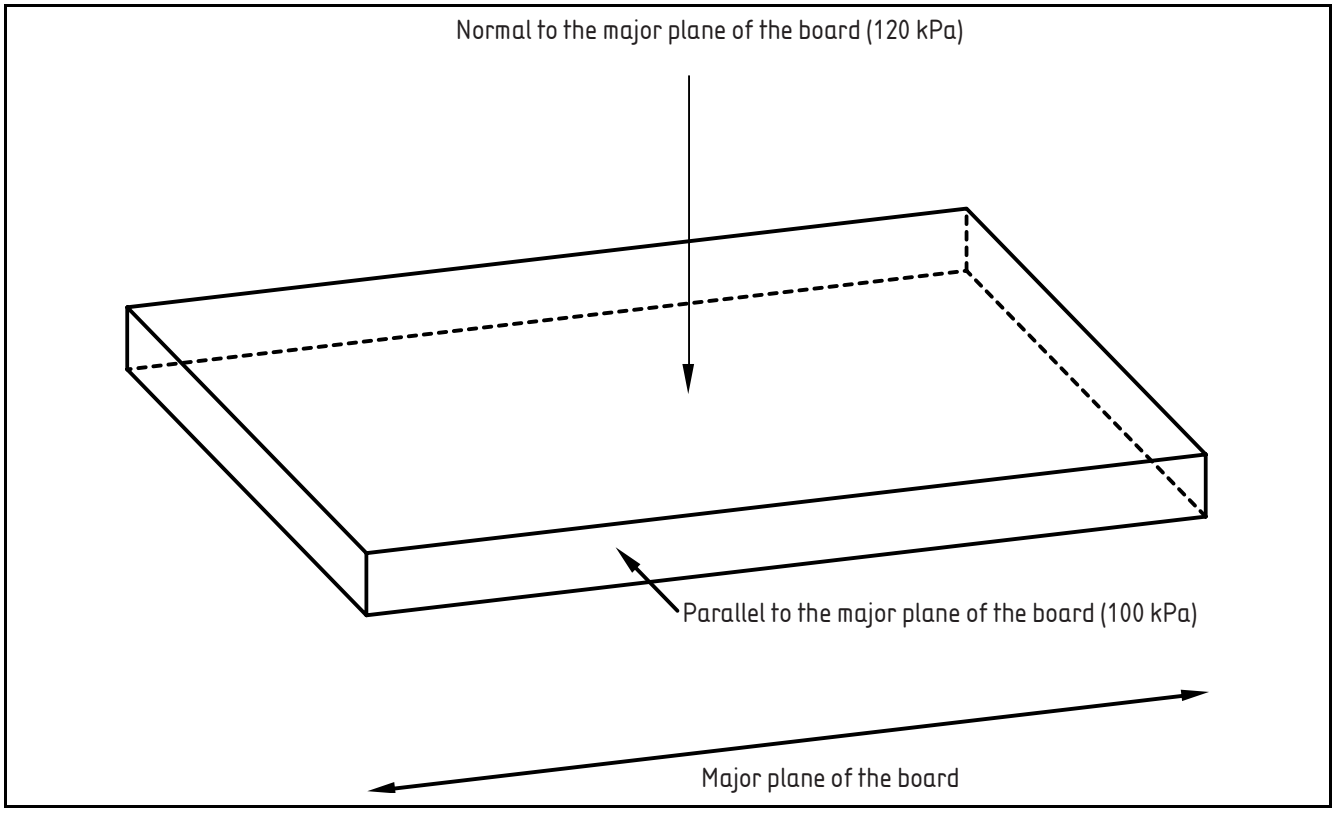
5.3.2 Parallel to the major plane of the board

When tested in accordance with BS EN 826:1996 the compressive strength of the core shall be not less than 100 kPa, which corresponds

to the designation CS (10\Y) 100 given in BS EN 13165:2001 (including amendments 1 and 2).

NOTE See Figure 1.

Figure A.1 **Diagram to explain orientations for compressive strength measurements**



5.4 Dimensional stability under specified temperature and humidity conditions

When tested in accordance with the procedure in BS EN 13165:2001, **4.2.6** (including amendments 1 and 2) insulation boards shall have a performance of at least DS(TH)5.

5.5 Tensile strength normal to the major plane of the board

When tested in accordance with BS EN 1607:1997 the insulation boards shall have a tensile strength of not less than 60 kPa which corresponds to the designation TR60 given in BS EN 13165:2001 (including amendments 1 and 2).

5.6 Reaction to fire

When classified by the procedure given in BS EN 13501-1 the products shall have a classification of either class B or C for substantial rigid faced board products or class F for flexible faced board products.

NOTE 1 Class F is "No performance determined".

NOTE 2 The fire performance of insulation boards in isolation is not significant since the UK Building Regulations Approved Document B [1] requires testing of the complete composite lining board or the flexible faced board behind plasterboard in this end-use application. These composites are

*subject to the requirements of the UK Building Regulations Approved Document B [1] for internal wall lining fire performance requirements (Class 0 when tested according to BS 476-6 and BS 476-7:2004 or Euroclass B when classified according to **5.6**).*

NOTE 3 For further information on the reaction to fire performance of PIR or PUR insulating products see Annex C.

6 Designation

NOTE The use of BS EN 13165 in this designation should be interpreted as including amendments 1 and 2.

The boards shall be given the following designation:

"BS 4841-2:2006/BS EN 13165: XX: Y: W"

where:

- XX is the thermal conductivity, λ_D, in mW/m·K (see **5.1**);
- Y is the reaction to fire classification (see **5.6**);
- W is the core type, either PIR or PUR (see **4.2**).

7 Marking

The product, packages or invoices shall be marked with at least the following information:

a) manufacturer's name or trademark;

b) product designation as given in Clause **6**[1)];

c) manufacturer's description and/or product reference.

[1)] Marking BS 4841-2:2006/BS EN 13165 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of this specification and BS EN 13165. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third party certification of conformity.

Annex A (informative) Method for the determination of areas of unbonded facings

A.1 Principle

The unbonded area is established by removing loose facing material after cutting up the specimen.

A.2 Apparatus

A.2.1 *Bandsaw or similar fine toothed saw.*

A.2.2 *Means for measuring the dimensions of unbonded area with an accuracy of 0.5 mm, e.g. a rule.*

A.3 Test specimen

The test specimen should be a right parallelepiped with a length and breadth not exceeding 1200 mm × 600 mm. The thickness of the test specimen should be the full thickness of the insulation board laminate including facings.

A.4 Number of test specimens

One test specimen should be tested.

A.5 Conditioning

Test specimens should be conditioned immediately before testing for a period of not less than 16 h at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5)%.

A.6 Procedure

Conduct the test at (23 ± 2) °C. Mark the test specimen in a manner that identifies the upper and lower faces. Cut the test specimen parallel to either axis into strips 50 mm wide, each strip being marked so as to identify its original position relative to the other strips (see Figure A.1). Examine both faces of each strip to determine whether any of the facings are not bonded to the core.

Remove any areas of facing and measure the unbonded area(s).

NOTE 1 The necessity for identifying each individual strip and its relative position is to enable unbonded areas of the facing that might extend continuously across more than one strip to be computed as a single area. Individual areas may therefore be computed as well as the sum total of all such areas.

NOTE 2 Felt marker pens are most suitable for marking the edges of the test specimen.

A.7 Expression of results

Measure all unbonded areas individually as well as the sum total of all such areas and express the results as a percentage of the original area of the test specimen.

When tested in accordance with **A.1** to **A.6** boards should have no single area of non-adhesion between the facing and the core exceeding 72 cm^2, and in total the unbonded areas for any one face should not exceed an area greater than 5% of that face.

A.8 Test report

The test report should include the following:

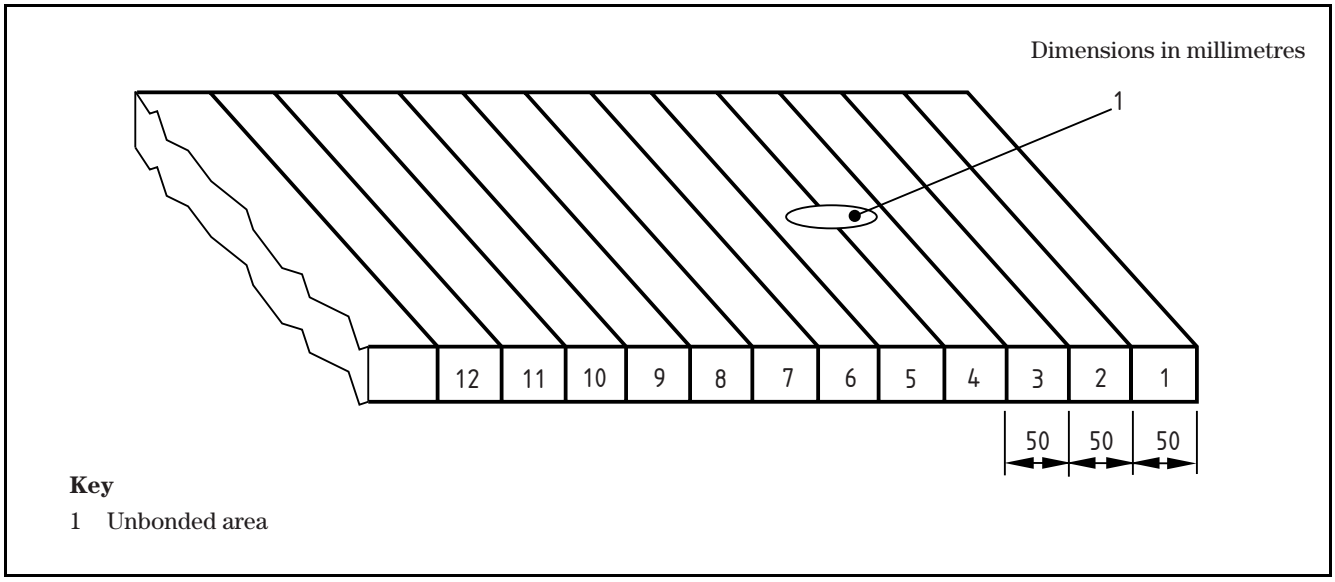
a) the identification of the insulation board tested;

b) the individual unbonded areas for each face measured, expressed as a percentage of the original area of the test specimen;

c) the sum of the unbonded areas for each face measured, expressed as a percentage of the original area of the test specimen;

d) the description and date of this specification, i.e. BS 4841-2:2006.

Figure A.1 **Determination of area(s) of unbonded facings: cutting and marking of the test specimen**



Annex B (informative) Information for users and designers

B.1 Guidance on sampling

In cases of doubt or dispute as to whether a consignment of insulation boards conforms to this specification, a possible procedure is to select one insulation board at random for test from each 500 insulation boards of a consignment supplied, or from the total if this is less than 500.

In the event of any insulation board not conforming to this specification, two more insulation boards should be tested from the same group of 500. If either of these insulation boards does not conform, the whole consignment should be considered not to conform to this specification.

B.2 Robustness of insulation board

The designer's attention is drawn to the need for the insulation board to possess sufficient robustness to withstand the handling procedures concerned with its delivery and installation.

B.3 Insulation board design U values

It is recommended that the nominal thickness of the insulation board be used in calculating insulation board design U values. However, the U value of the board including substantial rigid facings is obtained by taking into account the thermal resistance of any rigid facings.

NOTE The method for determining the thermal resistance of the building envelope is given in BS EN ISO 6946.

Annex C (informative) Fire performance of PIR and PUR insulation products and fire recommendations regarding their use

The fire performance of the finished structure or article which contains PIR and PUR insulation products is most relevant when considering the possible fire hazard associated with PIR and PUR insulation products.

PIR and PUR insulation products in isolation are organic materials and hence are combustible. The risk of ignition and fire growth associated with PIR and PUR insulation products in building construction should be assessed in accordance with BS 6336:1998 i.e. consideration should be given to the design of the end product formed from or incorporating the PIR or PUR insulation product core and the risks to which the product might be exposed. Care should be taken during the construction or repair of any structure or article that contains PIR or PUR insulation products. Care is specifically needed when using these products to avoid contact of the core with naked flames.

In general, the performance of the latter is primarily controlled by the type of finish or facing used on the insulation board in conjunction with the insulation product core and the way in which the composite is installed into the building.

In this standard the boards have internal lining surfaces which ensure that the products satisfy the UK Building Regulations Approved Document B [1], namely having class 0 (derived from the results of BS 476-6 and BS 476-7) or the European classification B given in **5.6**.

Annex D (informative) Notes to installers

D.1 Design considerations

Attention is drawn to the Building Regulations for England and Wales [2] which require the application of cavity barriers to minimize the spread of flame within any cavity formed within a construction. The Building Regulations Approved Document B [1] Section 9 gives specific guidance on the requirements.

In wall constructions it is recommended that the boards are not used below a height of 2400 mm where mechanical damage might occur to the face of the board. Impact resistant facings are suggested for such situations.

Where rooflights and ventilators are specified, they should be compatible with the insulated building element to maintain the spread of flame requirements under the Building Regulations [2] and the designed insulation performance, as well as to preserve a good appearance.

D.2 Storage of boards

Boards should be stored in flat and dry conditions. Boards are normally supplied in protective wrapping. The package provides protection against accidental exposure, but should not be considered adequate for long term outside protection. If outside storage is unavoidable, the boards should be stacked clear of the ground and covered with a securely anchored weatherproof sheet.

D.3 Handling

Boards should be carried on edge. Horizontal carrying can impose an undesirable strain on the boards. The boards should not be slid over each other and accordingly they should be handled with care and placed in position to avoid surface and edge damage.

D.4 Cutting of the boards

Boards should be cut using a sharp knife or fine toothed saw.

D.5 Vapour barriers

The water vapour resistance of the boards is adequate for most standard lining systems, depending on the board joints. Where the humidity is liable to exceed 65% r.h. at 21 °C, a high humidity fixing specification should be incorporated. Consideration should be given to vapour barrier continuity by means of jointing seals (see **D.6**).

D.6 Humidity: condensation risks

The major characteristic of PIR/PUR boards is their high thermal resistance value i.e. “R” value. Their prime function is to provide a highly efficient thermal insulant for a building element. In carrying out this function, they also become a separating agent between two different temperature and humidity environments.

The air below the board lining (under or over purlin) is likely to be warmer than the air above the lining. The migration of humid air from below to above can therefore lead to interstitial condensation problems.

Many buildings where PIR/PUR boards are installed as a lining are lightweight structures and therefore characterized by a fast thermal response. In many instances, the occupancy levels and processes produce high levels of temperature and humidity. Therefore, extreme care should be taken to avoid the conditions that could generate condensation within the roof/lining element.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 6336:1998, *Guide to the development of fire tests, the presentation of test data and the role of tests in hazard assessment*

BS EN 11925-2: 2002, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame – Part 2: Single-flame source test*

BS EN ISO 6946, *Building components and building elements – Thermal resistance and thermal transmittance – Calculation method*

Other publications

[1] GREAT BRITAIN, The Building Regulations Approved Document B, Fire Safety, 2004. London:The Stationery Office.

[2] GREAT BRITAIN. The Building Regulations 2000. London: The Stationery Office.

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