BRITISH STANDARD

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

Part 1: Specification for laminated insulation boards with auto-adhesively or separately bonded facings

ICS 91.100.60

British Standards

Publishing and copyright information

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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This part of BS 4841 supersedes BS 4841-1:1993, which is withdrawn.

Information about this document

This revision has been introduced to specify the requirements needed to ensure fitness for purpose of those PIR and PUR cored laminated insulation boards with auto-adhesively or separately bonded flexible and rigid facings used in the insulation of cavity walls in the United Kingdom. The requirements have been written so that products conforming to BS 4841-1 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.

The insulation boards specified in this standard are particularly suitable for use in wall cavities since their excellent thermal insulation performance enables the thin insulation boards to be attached to the outside of the inner leaf. This provides a mechanism to insulate walls by creating partially filled cavities without destroying the principle function of the cavity which is to prevent rain penetration through the wall to the indoor area of the property. These other parts of the wall provide the strength, weather and fire resistance characteristics of the insulated wall. As the insulating board is located in the wall in a non-loadbearing position, only its ease of handling during installation plus its integrity for long-term adequate thermal insulation performance need be considered from a robustness point of view.

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.

1 Scope

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

NOTE 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 824:1995, *Thermal insulating products for building applications – Determination of squareness*

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, *Thermal insulation products for buildings – Factory made rigid polyurethane foam (PUR) products – Specification*

BS EN 13501-1, *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 part of BS 4841 the following terms and definitions apply.

3.1.1 auto-adhesively bonded facing

NOTE These facings can be flexible or rigid.

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

3.1.2 separately bonded facing

NOTE These facings can be flexible or rigid.

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

3.1.3 polyisocyanurate product

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

3.1.4 polyurethane product

rigid cellular plastics insulation material or 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 rigid facing (**4.4**).

4.2 Core product type

The cores of the product type shall be of rigid polyisocyanurate (PIR) or polyurethane (PUR).

4.3 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.

4.4 Rigid facings

Rigid facings shall be substantially of inorganic composition.

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 A 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 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.

*NOTE See also **B.2** for information on insulation board design U values.*

5.2 Dimensions

5.2.1 Length and width

The length and width of insulation boards shall be as given 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 m	**Full size product area** m^2	**Deviation from flatness** S_{max} 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 minimum compressive strength of the board shall be 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.

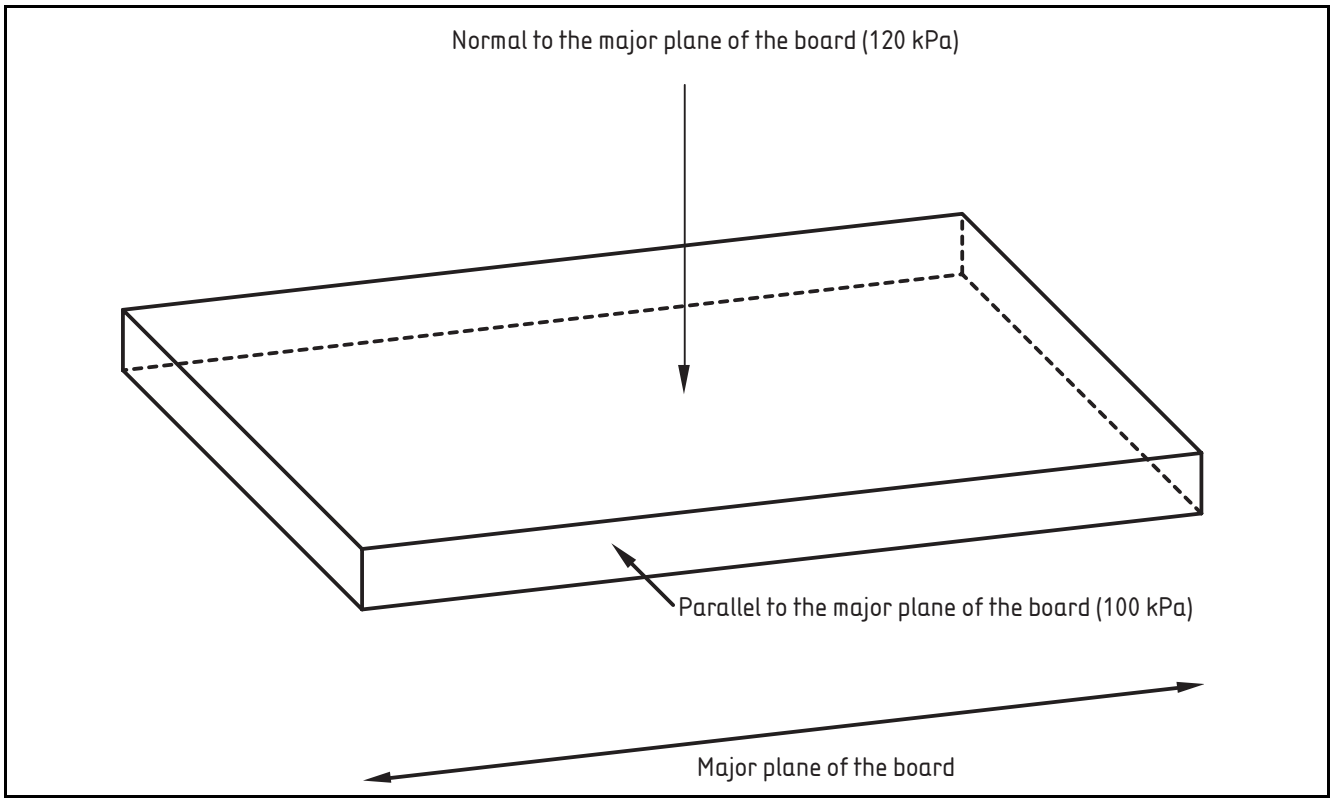
NOTE 2 The designer's attention is drawn to the need for the insulation board to possess sufficient robustness to withstand the handling procedures concerned with its delivery and installation.

5.3.2 Parallel to the major plane of the board

When tested in accordance with BS EN 826:1996 the minimum compressive strength of the core shall be 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 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**, the 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 boards shall have a minimum classification of class F.

NOTE 1 Class F is also "No performance determined".

NOTE 2 The fire performance of insulation boards in isolation is not significant in terms of this end-use application since the UK Building Regulations Approved Document B [1] for masonry cavities with leaves of at least 75 mm thick makes no fire requirements for products installed in these wall cavities.

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

NOTE 4 For other cavities see UK Building Regulations Approved Document B, B3, Section 10 [1].

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 4841-1:2006/BS EN 13165: XX: Y: W"

where:

- XX is the thermal conductivity, lD, 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 4841-1:2006/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 laminated insulation board 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 insulation product 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:

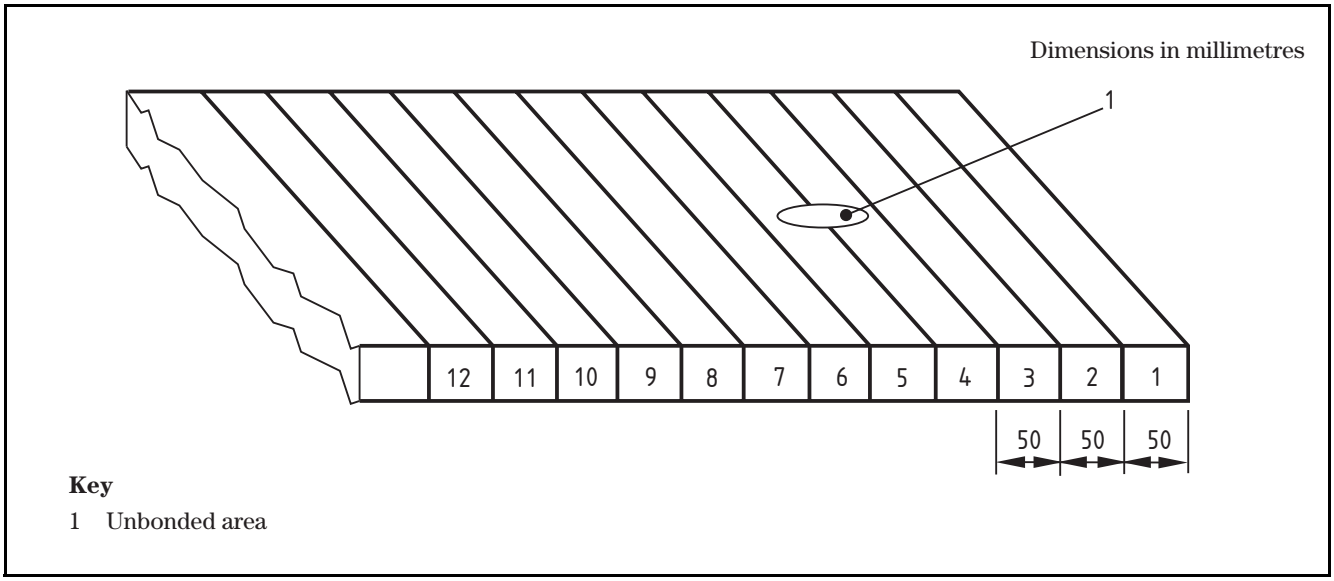
a) the identification of the insulation board tested;

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 4841-1:2006.

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



Key

1 Unbonded area

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 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 of 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 are, in isolation, 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 material with naked flames.

In general, the fire performance of the products 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 used.

These products are used to insulate wall cavities using the partial fill technique where they are fixed to the outside face of the inner masonry leaf of the cavity wall.

Annex D (informative) Information on the installation of the insulation boards into wall cavities

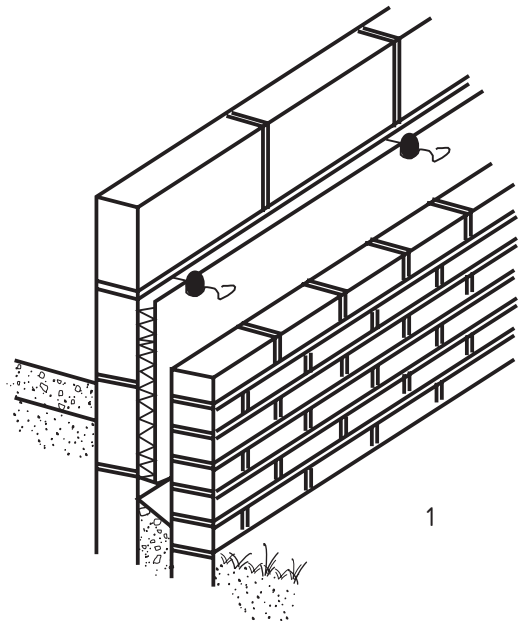
D.1 General

The walls are constructed leading with either the inner or outer leaf. It is recommended that the inner leaf be constructed ahead of the outer leaf, as PIR or PUR insulation boards fastened to the cavity face of the inner leaf give an enhanced thermal performance. It is essential that the spacing of wall ties/clips allows the long edge of each board to be secured at a minimum of two points.

D.2 Procedure

A section of the inner leaf is built with the first row of wall ties, at approximately 600 mm horizontal spacing, where the insulation is to begin. It is recommended that the wall ties are not placed directly on the damp-proof course. The first run of boards may commence below the damp-proof course level to provide some edge insulation for the floor (see Figure D.1).

Figure D.1 **Installation of PIR/PUR insulation boards**



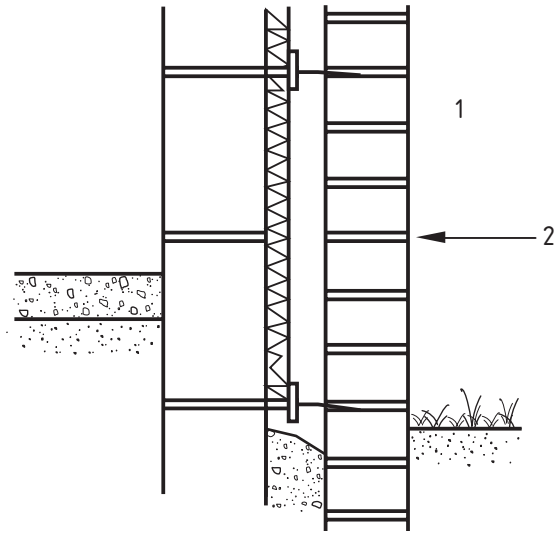
Key

1 First run commences below damp-proof course level, to provide some edge insulation for floor

The leading leaf is built up to the required height, with wall ties placed at a vertical height of 450 mm. Excess mortar is cleaned from the cavity face of the leading leaf, and the boards are placed on the wall ties, behind the retaining clips, to form a closely butt-jointed run.

The second row of wall ties is fitted to retain the tops of the boards. It is essential that all wall ties slope downwards towards the outer leaf (see Figure D.2) and at centres not exceeding 900 mm to ensure that each board is secured at a minimum of three points. Additional ties might be required to satisfy the structural requirements of BS 5628-3:2001 and/or to ensure adequate retention of boards or cut pieces.

Figure D.2 **Installation of wall ties**



Key

1 Wall ties slope down towards outer leaf

2 Damp-proof course

The other leaf is then built up to the level of the top of the boards.

Progressive staggering of boards and wall ties as construction proceeds should be in accordance with the manufacturer's recommendations.

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 5628-3:2001, *Code of practice for use of masonry – Part 3: Materials and components, design and workmanship*

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 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.

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