BRITISH STANDARD

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

Part 5: Specification for laminated boards (roofboards) with auto-adhesively or separately bonded facings for use as thermal insulation boards for pitched roofs

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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 11, 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*.

Information about this document

This British Standard has been introduced to specify the requirements needed to ensure fitness for purpose of those polyurethane and polyisocyanurate cored insulation roofboards with auto-adhesively or separately bonded flexible and/or rigid facings used in pitched roofs in the United Kingdom. The requirements have been written so that products conforming to BS 4841-5 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 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 polyisocyanurate (PIR) and polyurethane (PUR) cored thermally insulated laminated boards (roofboards) with auto-adhesively or separately bonded flexible and/or rigid facings for use in pitched roofs over, under or between rafters.

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

BS EN 13501-1:2001, *Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests*

3 Terms, definitions and symbols

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

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 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}	deviation from flatness in mm/m

4 Construction and composition

4.1 General

The insulation roofboards 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 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 roofboards shall be either functional or decorative, e.g. paper, metal foil, glass tissue or mineralized glass.

NOTE Both faces need not be identical.

4.4 Substantial rigid facings

4.4.1 General

Substantial rigid facings shall consist of either calcium silicate (**4.4.2**) or plasterboard (**4.4.3**).

4.4.2 Calcium silicate

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

4.4.3 Plasterboard

When tested in accordance with BS EN 13501-1: 2002 plasterboard 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 roofboards. The

degree of bonding, if required, should conform to the requirements 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 roofboards or the core product shall be determined in accordance with BS EN 13165:2001 (including amendments 1 and 2). The declared values of thermal conductivity shall not exceed 29 mW/m·K at 10 °C.

*NOTE See also **B.1** for information on roofboard design U values and thermal resistance.*

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 roofboard

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).

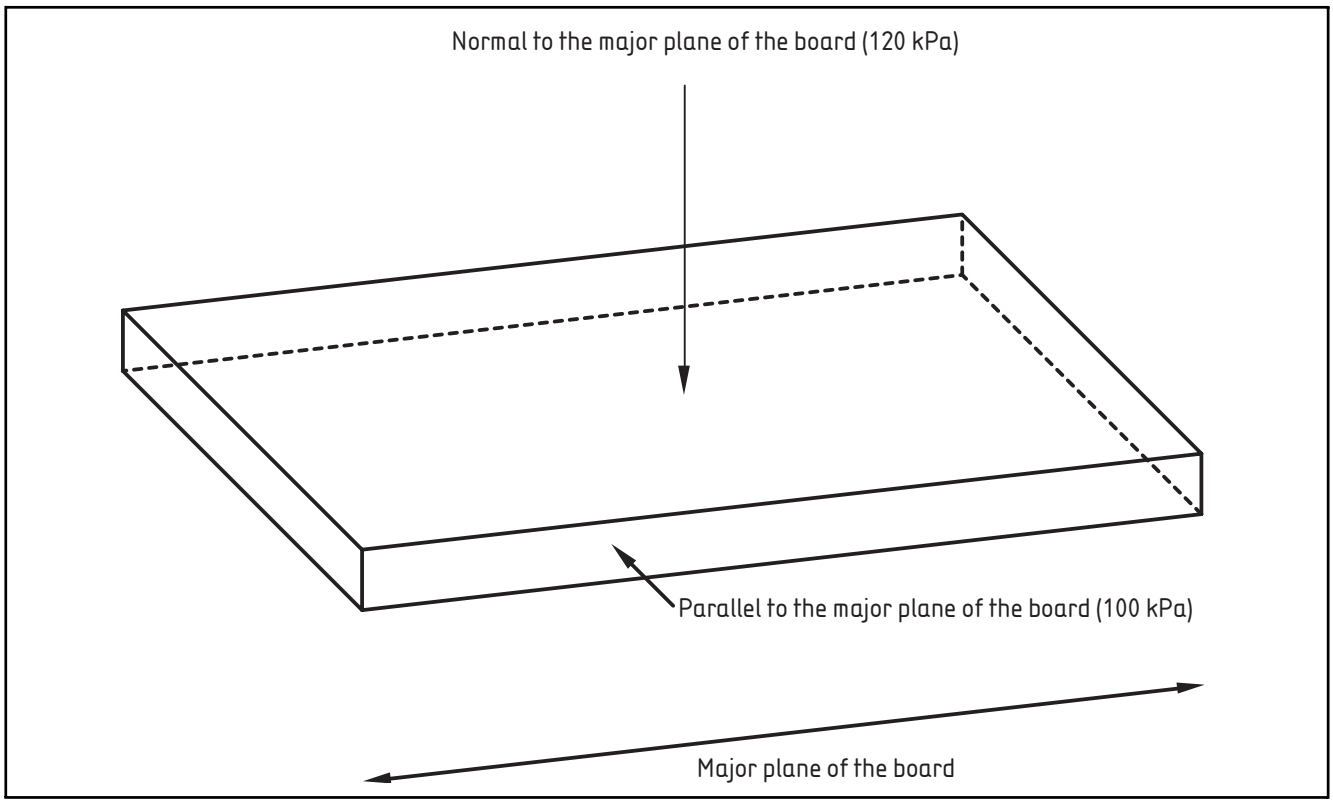
NOTE *See Figure 1.*

5.3.2 Parallel to the major plane of the roofboard

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 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, Clause **4.2.6** (including amendments 1 and 2) the roofboards 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 roofboards shall have a tensile strength of not less than 60 kPa which corresponds to the designation TR60 given in BS EN 13165:2001 (amendments 1 and 2).

5.6 Reaction to fire

When classified by the procedure given in BS EN 13501-1 the roofboards shall have a minimum classification of class F.

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

NOTE 2 The fire performance of roofboards in isolation is not significant since the UK Building Regulations Approved Document B [1] requires testing of the complete roofing assembly, of which the roofboard forms an internal part. These assemblies are subject to the requirements of the external fire performance, which is determined by testing according to BS 476-3:2004.

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

NOTE 4 It is intended that BS 476-3:2004 will become the fourth method in DD ENV 1187.

*NOTE 5 It should be noted therefore that the heat source used during testing according to BS 476-3:2004 is applied directly to the roof covering. However, it is required under the European Construction Products Directive for a fire performance to be declared for the product in isolation when it is placed on the market. Accordingly, the way of satisfying this requirement is given in **5.6**.*

6 Designation

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

The roofboards shall be given the following designation:

"BS 4841-5:2006/BS EN 13165: XX: Y: W"

where:

- XX is the thermal conductivity 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 4841-5:2006/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 areas 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 roofboard 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** roofboards 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:

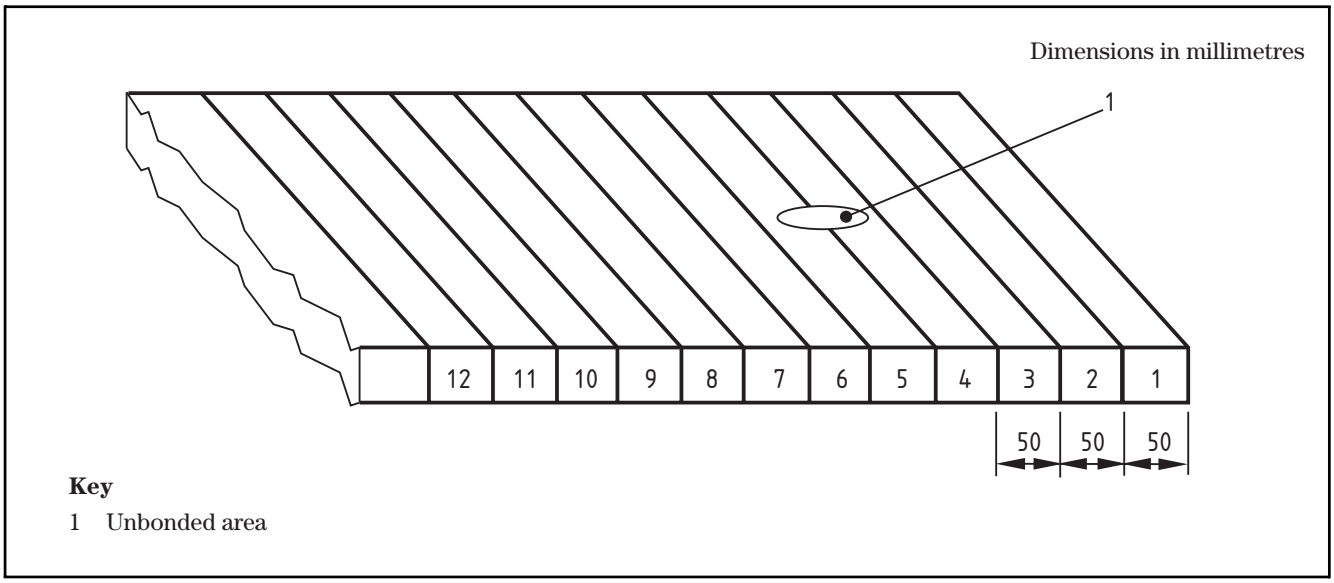
a) the identification of the roofboard tested;

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 4841-5:2006.

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

Roofboard 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 roof assemblies is given in BS EN ISO 6946.

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

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

PIR and PUR cores are organic materials and hence are combustible. The risk of ignition and fire growth associated with PIR and PUR 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 core and the risks to which it might be exposed. In general, the performance of the latter is primarily controlled by the type of finish or facing used on the roofboard in conjunction with the core and the way in which the composite is used.

Annex D (informative) Information on the installation of roofboards into pitched roofs

D.1 Over rafter layer of insulation

Over rafter insulation without a sarking board should be fixed by placing the PIR or PUR roofboards over the rafters and under 38 mm × 38 mm treated softwood counter-battens in line with the rafters. The counter-battens should be secured to the rafters by fixing through both the counter-battens and the PIR or PUR roofboards.

Over rafter insulation with slates fixed directly into a sarking board should be fixed by placing the PIR or PUR roofboards over the rafters with the sarking board overlaid. The sarking board and PIR or PUR roofboards should be secured to the rafters by fixing through both the sarking board and the PIR or PUR roofboards.

Over rafter insulation with a sarking board and tiles on tiling battens and counter-battens, should be fixed by placing the PIR or PUR roofboards over the rafters with the sarking board overlaid, and with 38 mm × 38 mm softwood treated counter-battens in line with the rafters. The counter-battens should be secured to the rafters by fixing through the counter-batten, the sarking board and the PIR or PUR insulation. The insulation roofboards should be tightly butted, they may be laid either across or down the line of the rafters and should preferably be laid

break bonded. It is essential that all roofboard joints running from eaves to ridge occur over rafters.

There is no necessity to tape roofboard joints. A preservative treated stop rail should be secured to the rafters close to the eaves.

D.2 Between rafter layer of insulation

Between rafter insulation can be installed by three methods. In cases where the insulation between rafters is to be flush with the top of the rafters but does not fill the full rafter depth, install the roofboard insulation by the use of nailable saddle clips. The nailable saddle clips are driven into the upper surface of each rafter at one metre intervals up the roof slope. The nailable saddle clips then support lengths of the PIR or PUR roofboards suitably trimmed to size and placed between the rafters.

In cases where the insulation between rafters is to be flush with the bottom of the rafters but does not fill the full rafter depth, install the insulation with the aid of battens nailed to the side of the rafters. The battens should be in the appropriate position to ensure that the insulation is flush with the bottom of the rafters.

In cases where the insulation between rafters fully fills the rafter depth, install the correct thickness of insulation in such a manner that it is flush with the bottom of the rafters. In all cases, ensure that insulation roofboards are tightly butted and that there is a tight fit between the insulation and the rafters. Fill all gaps with expanding polyurethane sealant.

D.3 Under rafter layer of insulation

Under rafter insulation is achieved by positioning PIR or PUR roofboards between the rafters as described in **D.2** (between rafter insulation) and then underlining the rafters with a composite roofboard as described in BS 4841-2:2006.

D.4 Cutting

Cutting should be carried out using a fine toothed saw or by scoring with a knife and snapping the roofboard over a straight edge and cutting the facing on the other side. Accurate trimming should be used in order to achieve close butting of the joints and continuity of the insulation.

D.5 Daily working practice

Installed PIR or PUR roofboards should be protected against inclement weather.

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 476-3:2004, *Fire tests on building materials and structures – Part 3: External fire exposure roof test*

BS 4841-2:2006, *Rigid polyisocyanurate (PIR) and polyurethane (PUR) products for building end-use applications – Part 2: Specification for laminated boards with auto-adhesively or separately bonded facings for use as thermal insulation for internal wall linings and ceilings*

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*

DD ENV 1187, *Test methods for external fire exposure to roofs*

Other publications

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

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