BRITISH STANDARD

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

Part 6: Specification for laminated boards with auto-adhesively or separately bonded facings for use as thermal insulation for floors

ICS 91.100.60

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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 4841-6 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 laminated boards with auto-adhesively or separately bonded flexible and/or substantial rigid facings for use as thermal insulation in floors.

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 standard (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 – Classification using test data from reaction to fire tests*

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

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

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 W/(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 substantial rigid facings (**4.4**).

4.2 Core product type

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

4.3 Flexible facings

Both flexible facings of the insulation boards shall be functional or decorative, e.g. paper, metal foil, glass tissue or mineralized glass. Both faces need not be identical.

4.4 Substantial rigid facings

4.4.1 General

Substantial rigid facings shall consist of either calcium silicate in accordance with **4.4.2** or plasterboard in accordance with **4.4.3.**

4.4.2 Calcium silicate

When tested in accordance with BS EN 13501-1:2001 calcium silicate boards shall have a reaction to fire classification of Euroclass A1 or A2.

4.4.3 Plasterboard

When tested in accordance with BS EN 13501-1:2001 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 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 roofboards or core product shall be determined on the product in accordance with BS EN 13165:2001 (including amendments 1 and 2). The declared values of thermal conductivity for the roofboards shall not exceed 29 mW/m·K at 10 °C.

NOTE See also Annex B for information on insulation board 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
$\geqslant 2.50$	$\geqslant 0.75$	$\geqslant 5$
	> 0.75	$\geqslant 10$

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).

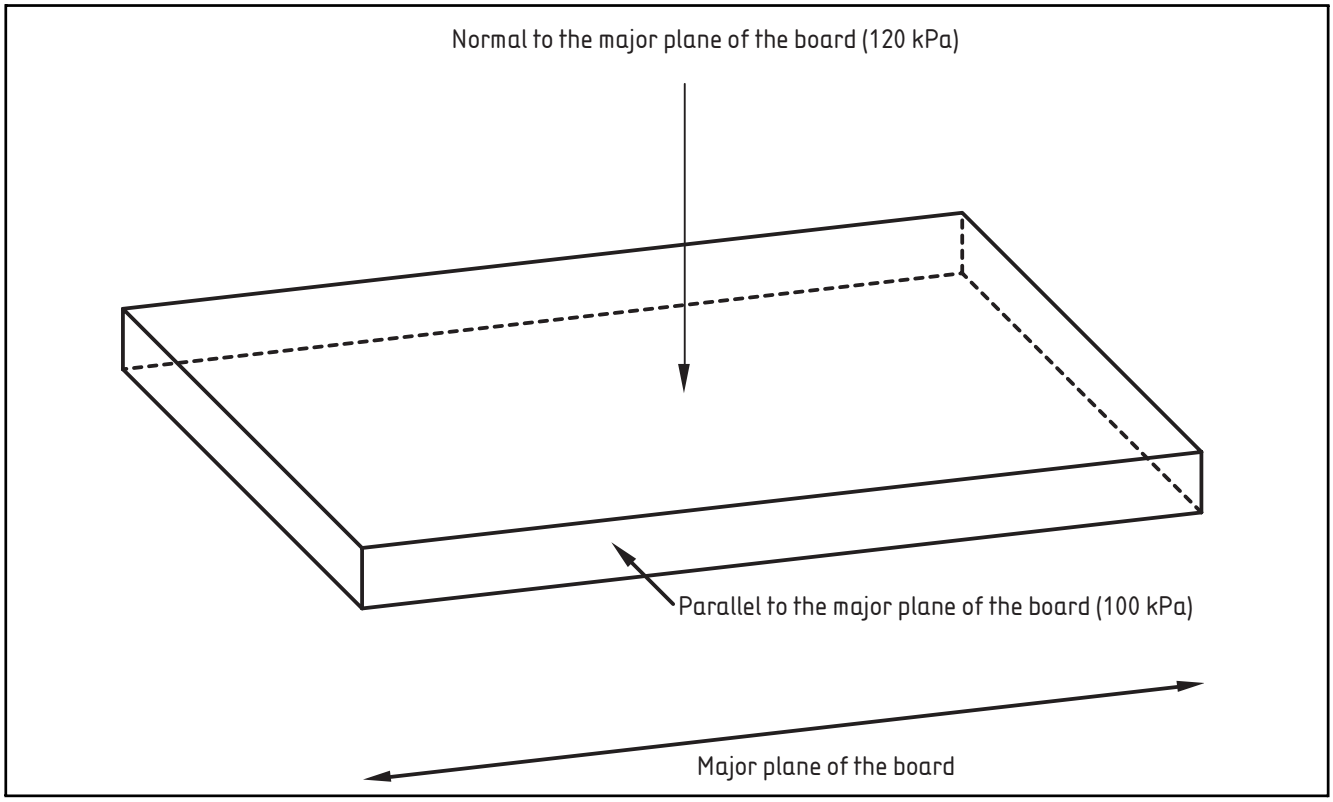
NOTE See Figure 1.

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 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 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 tested in accordance with BS EN ISO 11925-2:2002 the insulation boards shall have a minimum classification of F (no performance determined) as determined according to BS EN 13501-1:2001.

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

NOTE 2 For further information on the fire performance characteristics of PIR and PUR 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 4841-6:2006/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 PUR or PIR (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 4841-6:2006/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 (including amendments 1 and 2). 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, which may also be desirable.

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 1 200 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** insulation 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:

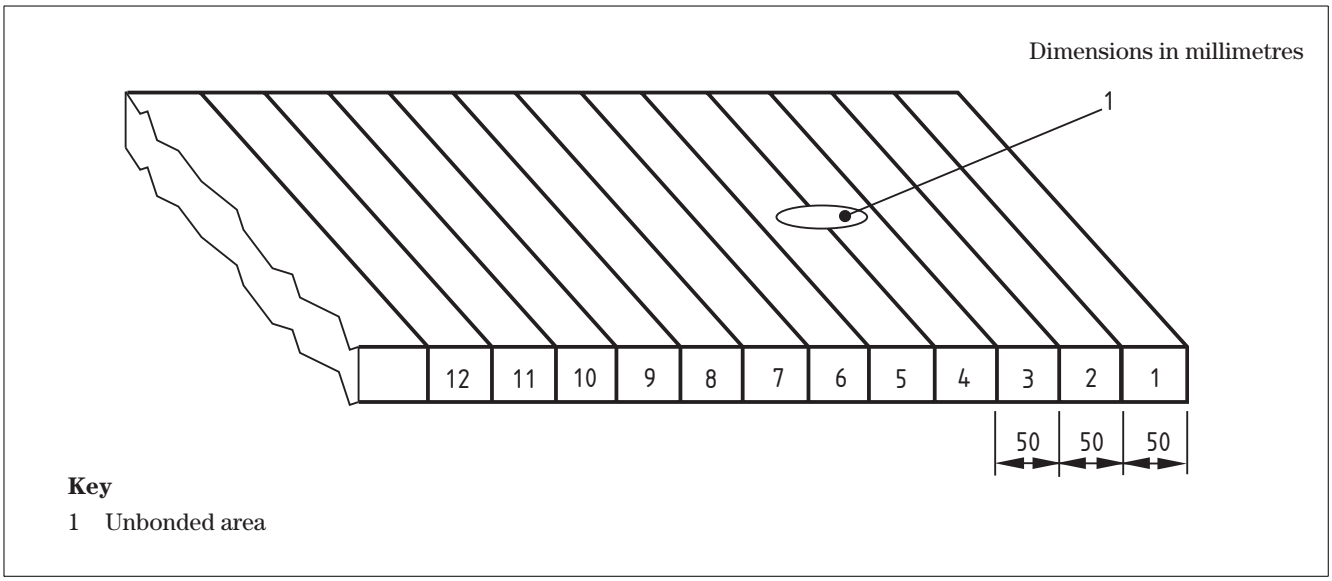
a) the identification of the insulation board tested;

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 4841-6:2006.

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, 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.

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 foams.

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 insulation board in conjunction with the core and the way in which the composite is used.

Care should be taken during the construction or repair of any structure or article that contains PIR or PUR cores. Care is specifically needed when using these products to avoid contact with naked flames, for example when using the torch-on method of bonding the subsequent layers of bitumenized membranes unless precise instructions are available on safety measures appropriate to the individual application.

However, for use of the PIR or PUR insulation products in floors, no reaction to fire requirements are specified hence the minimum class F (no performance determined) requirement specified in **5.6.**

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

D.1 Laying below the floor slab

After the site has been prepared and foundations, where appropriate, built to damp-proof course level the damp-proof membrane (minimum 300 micron/ 1200 gauge polythene) should be laid over the well compacted hardcore, sand blinded, with joints well lapped and folded to prevent the passage of ground water. The membrane should be brought up the surrounding foundation walls until it is sufficiently above the height of the wall damp-proof course (DPC) so that it will connect with or form the DPC. The PIR or PUR insulation boards should be laid break-bonded with the joints lightly butted. A strip of the boarding should be placed vertically around the perimeter of the floor slab in order to prevent cold bridging of the slab. Boards are overlaid with a separating layer of building paper in accordance with BS 1521:1972,

Grade B1F or polythene sheet (not less than 125 micron/500 gauge). The subsequent application of the concrete slab and screed or other flooring material is similar to those laid over an uninsulated floor.

D.2 Laying below the floor screed

The PIR or PUR boards are laid loose over the concrete floor slab or beam and block floor with the necessary water and vapour proof protection. Board joints should be tightly butted, staggered, and laid to a break–bonded pattern. The floor slab should be uniformly flat without steps or gaps to provide continuous bearing support to the PIR or PUR insulation boards. Beam and block floors should be level and grouted. A thin section of board should be used around the perimeter of the floor area being insulated. This should be placed vertically against the abutting wall so that it connects with the insulation laid over the slab and protects the edge of the screed, so preventing cold bridging of the floor screed. Boards are overlaid with a separating layer of building paper in accordance with BS 1521:1972, Grade B1F or polythene sheet (not less than 125 micron/500 gauge) between the screed and the PIR or PUR boards to prevent the wet screed penetrating joints between the boards. Use a sand and cement screed laid to a minimum thickness of 65 mm for domestic construction and 75 mm elsewhere.

D.3 Laying in suspended timber floors

The application of PIR or PUR insulation boards in suspended floor constructions should be carried out before commencement of floor boarding. The PIR or PUR boards should be cut to fit tightly between joists. They should be supported on softwood timber battens, proprietary galvanized steel saddle clips or galvanized nails partially driven into the side of the joists. Battens or nails should be placed at an appropriate height to suit the thickness of board being employed and nails should remain 40 mm proud of the joist. The boards should then be laid between the joists so that they are supported by the battens or nails. Any narrow gaps between a joist and perimeter wall should be insulated by specially cut pieces of board. They should be supported on blocks nailed to the underside of the joists. Where water services, including central heating pipes, run below the floor boards the location of the PIR or PUR insulation can be lowered to create an insulated duct for the services. Access from beneath the floor could later be obtained by removal of the nail supports, from the underside.

D.4 Laying between battens under a timber floor

The subfloor should be level and flat. The PIR or PUR boards should be cut to fit snugly between battens. Any narrow gaps between battens and the perimeter wall should be insulated by specially cut pieces of board. Board joints should be tightly butted.

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 1521:1972, *Specification for waterproof building papers*

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

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