2.6 Application in pitched roofing (sarking)

2.6.1 Selection of panels for pitched roof sarking

The selection and thickness of wood-based panels for use in pitched roofing as a sarking material depends primarily on whether or not the sarking is undertaking a bracing role (see *Section 2.6.2.1* and *Section 2.6.2.2*).

The term 'sarking' usually refers to panels laid across the top of structural trusses, but wood-based panels are also used in pitched roofing as part of panelised roof systems, such as a Structural Insulated Panel (SIP). These applications are most likely to be system-based and the selection and use of panels is done as part of the system, which is also usually subject to independent assessment or certification.

2.6.2 The design factors relating to sarking

2.6.2.1 Non-bracing sarking (non-structural)

Where panels are used as sarking but are not assumed to be contributing to bracing of the trusses, they can be viewed as non-structural. The choice of panel type is controlled largely by the environmental conditions they are likely to experience in service and the risk of occasional wetting from rain penetrating the outer roof covering. The panels used should therefore be one of the types shown in *Table 2.6*.

The thickness of panel used should take account of the perceived function in the design. Roofers should be warned against stepping on the sarking unless it has been specifically designed for that purpose.

Condensation risk should be assessed in accordance with *BS 5250 Code of practice for control of condensation in buildings*[44].

Possible functions of non-structural sarking are to:

- improve airtightness
- resist wind uplift loads (see *BS 5534 Code of practice for slating and tiling (including shingles)*[45])
- reduce thermal bridging (where insulation is placed between rafters)
- increase thermal resistance of insulated roof
- support tiling membranes
- provide fixing for slates (no tiling battens) – but in this case the panel should be viewed as structural
- provide temporary weathertightness during construction until tiles/slates are fixed.

2.6.2.2 Sarking which has a structural role

The sarking may perform a structural function, such as:

- to provide lateral bracing to the rafters
- to resist wind uplift on the roof
- to provide access for roofers.

In this case, the thickness and rafter centres will be interdependent and related to the imposed design loads. The panels used should be one of the types shown in *Table 2.6* and design should be designed in accordance with *Eurocode 5* or *BS 5268*.

Table 2.6: Panel grades* for sarking and the location of design and testing information

Selection	ROOFS	CONSTRUCTION	PLYWOOD BS EN 636	PARTICLEBOARD BS EN 312	OSB BS EN 300	MDF BS EN 622-5	FIBREBOARD BS EN 622-3,4	CBPB BS EN 634
	Pitched roofs (sarking)	non-bracing	636-2	P5	OSB/3	-	SBH, SB.E, SB.HLS, MBL.H, MBL.E, HB.E, HB.HLA1, HB.HLA2	CBPB
		bracing	636-2	P5	OSB/3	-	-	CBPB
Design by deemed to satisfy	✓	For non-bracing sarking, manufacturer's recommendations should be followed. For sarking that has a bracing role, deemed to satisfy performance requirements are given in BS 5268-3. Although this has now been withdrawn, there are as yet no equivalent recommendations under the Eurocode system. For pitches of less than 10° the roof may be assessed as a flat roof – see *Section 2.5*						
or Design by performance testing	✓	Design by performance testing of a number of components would be possible, but only where the load carrying requirements can be clearly defined						
	for pitch <10°		At low pitches the roof may be assessed as a flat roof. Test using BS EN 1195. Satisfy requirements in BS EN 12871. Design using BS EN 1995-1-1 (Eurocode 5)					
		or	Test using BS EN 1195. Design using BS 5268-2 (now withdrawn)					
or Design by calculation	-	Not available at present						
Guidance on application	✓	Guidance on the use of load-bearing panels as sarking is also given in BS 5534. Control of condensation risk should be carried out in accordance with BS 5250						

* The table provides the minimum grade of panel that satisfies the particular set of requirements: panels of higher quality may be substituted, and their selection may result in a reduction in required thickness.
Although all the panels meeting the grade specifications will satisfy a particular set of requirements, the level of performance of different brands of these panels may vary considerably; some may even be endowed with high levels of properties not directly covered by the table.

Sarking acting as bracing in the plane of the rafters should be specified and fixed in accordance with *BS 5268-3 Annex A*. When such sarking is directly fixed to the top face of the rafters, diagonal, chevron and longitudinal bracing in the plane of the rafters may be omitted. Care should be taken during erection to ensure that the stability, verticality and straightness of the rafters are maintained when the sarking is being installed. The minimum thickness of sarking for bracing purposes, as given in *BS 5268-3* and *PD 6693-1*, is shown in *Table 2.7*. These thicknesses assume that the tiles/slates are independently supported on battens.

Where the panels are subject to other known loads, such as access by roofers, these loads should be taken into account in the selection of a suitable panel thickness related to the rafter spacing.

Typical panel sizes are 2400 × 1200mm and 2400 × 600mm, with other sizes available to order. Panels may be plain (square) edged, or profiled. Profiled edges provide improved weathertightness and remove the need to provide support under the edges of plain panels. Profiled edges may be a form of half-lap joint, grooves to take loose tongues or matching tongue and groove. Panels may be profiled on all four edges or on long edges only.

2.6.2.3 Other design considerations for both bracing and non-bracing sarking

In order to avoid condensation on the underside of the sarking, appropriate ventilation should be provided.

Where sarking is used over a cold roof space with insulation on a horizontal ceiling, the roof space must be adequately ventilated from eaves to eaves, or with additional ridge vents if desired (see *Figure 2.11*). A condensation risk analysis should be carried out in accordance with *BS 5250*.

It is possible to construct roofs in different ways with the advent of new building products which may allow or require the ventilation to be different to that in *Figure 2.11*. Further information is given in the TRADA publication *Timber frame construction*[46].

Where sarking is used over a warm roof, such as a 'room-in-the-roof', with sloping ceilings and insulation between the rafters, there must be adequate ventilation space to the underside of the sarking over the insulation, ventilated from eaves to ridge, and a vapour control

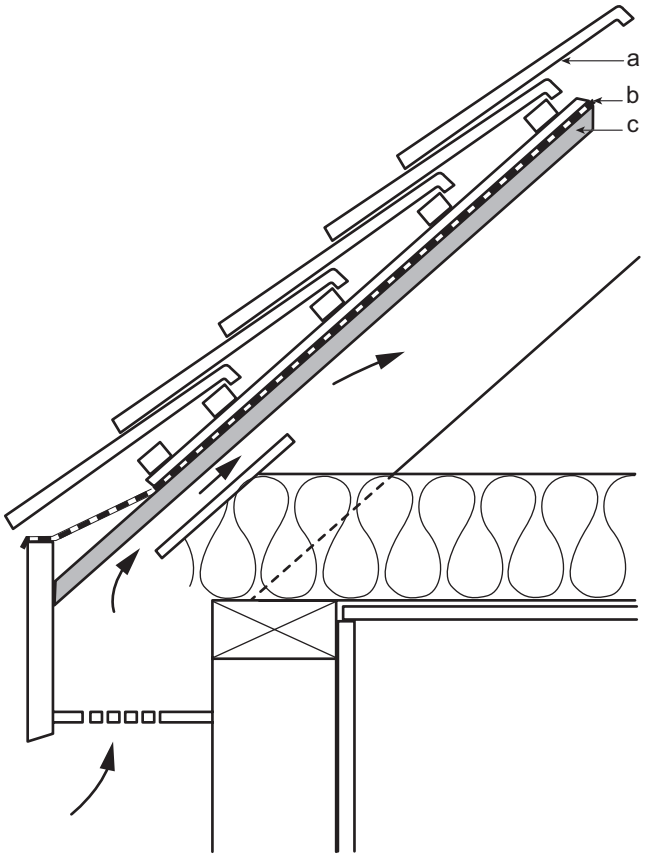

Figure 2.11: Example of a cold roof space with insulation at ceiling level. The roof space must be adequately ventilated
a: tiles on battens and counterbattens
b: tiling underlay
c: sarking

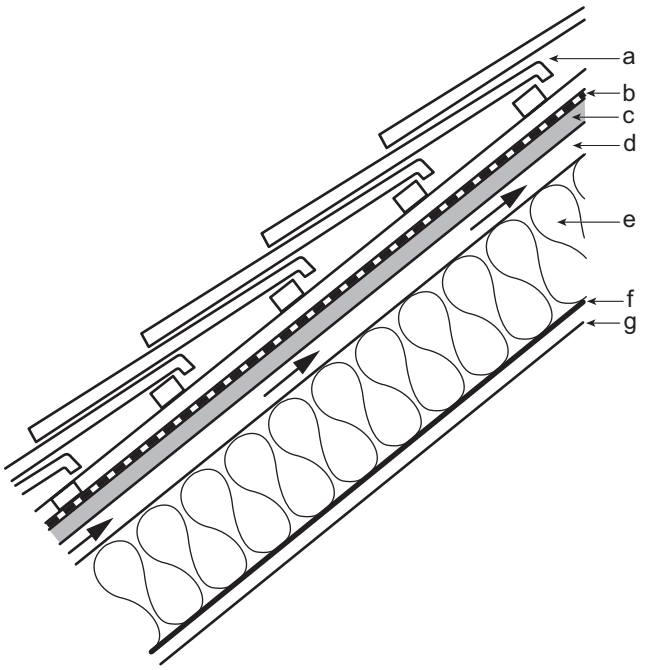

Figure 2.12: Example of a warm roof with sloping ceiling and insulation between rafters. There must be adequate ventilation above the insulation
a: tiles on battens and counterbattens
b: tiling underlay
c: sarking
d: ventilation space
e: insulation
f: vapour control layer
g: ceiling lining

Table 2.7: Minimum thickness of panels used as sarking for bracing purposes as given in PD 6693-1

Panel type	Minimum thickness	Minimum fixings
Plywood	9mm	50mm × 3mm galvanised, round wire nails fixed at a maximum of 200mm centres on each rafter
OSB	9mm	
Particleboard	12mm	

layer positioned on the warm side of the insulation (see *Figure 2.12*).

Detailed recommendations for condensation control are given in *BS 5250*, for various designs of roof. *BS 5250* now refers to *BS EN ISO 13788 Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation method*[47] as the method of calculation.

2.6.3 Sitework: roof sarking

2.6.3.1 Conditioning

It is important that panels are installed at a moisture content close to that which they will achieve in service. Advice on the conditioning of panels is to be found in PanelGuide *Section 4.2.4*.

2.6.3.2 Preparation of the structure

Supporting rafters should be plumb, in line and level.

Check the moisture content of supporting timbers as panels should not be laid on timber sections which have a moisture content above 22% prior to laying the deck, as moisture can migrate from wet joists or rafters into the panels and may cause localised swelling.

Any rafters or noggings should provide a minimum support width of 18mm for the panel edge.

2.6.3.3 Laying and fixing

Panels should be laid with long edges across the rafters, with short edges supported on rafters. It is recommended that long edges should be either tongued and grooved, supported by proprietary panel clips or by battens/noggins. Where sarking acts as bracing, all edges must be supported and fully nailed.

Panels should be laid to break joint, ie with staggered short edge joints to avoid lining them up.

2.6.3.4 Expansion gaps

A 3mm gap should be left between square-edged panels used as sarking except for impregnated softboard which should be tightly butted.

Where sarking abuts vertical or parapet walling a perimeter gap should be provided to allow for possible expansion. This should be a minimum of 10mm and, where required, 2mm per metre run of panel between adjacent walling. Larger roofs may also need intermediate expansion gaps.

2.6.3.5 Fixings

Panels should be fixed using corrosion resistant nails or, for softboard, staples. Corrosion resistant materials include galvanised or sheradised steel, austenitic stainless steel, phosphor bronze and silicon bronze.

Screws and flat headed improved nails (such as annular grooved or ringshank) have superior holding power and should be used in preference to plain shank nails.

Table 2.8: Spacings of fixings for sarking

Panel type	Maximum spacings (mm)		
	Panel end rafters	Intermediate rafters	Min edge distance (mm)
Softboard	75	150	8
Mediumboard	150	150	8
Hardboard	150	150	8
Particleboard	200	200	8
OSB	200	200	8
Plywood	200	200	8

Minimum nail length is 50mm or 2.5 times the panel thickness, whichever is greater. The minimum fixing diameter should be 0.16 times the panel thickness.

Staples should have as wide a crown as possible (11mm minimum), be not less than 15 gauge and not less than 50mm in length.

The frequency and pattern of nailing to rafters should be as follows unless structural calculations require otherwise. Where manufacturer's instructions are supplied with the panels, their recommendations should be followed. To avoid tear out at panel edges, fixing should not be inserted closer to the edges than the minimum distances given in *Table 2.8*.

To avoid buckling of the thinner and more flexible panels, nailing should commence at the top centre and continue outwards and downwards.

2.6.4 Coverings

Tiling or slating should be fixed to tiling battens on counter battens with a roofing underlay.

Battens should not be fixed to the sarking alone but should be fixed through the sarking into the rafters beneath.

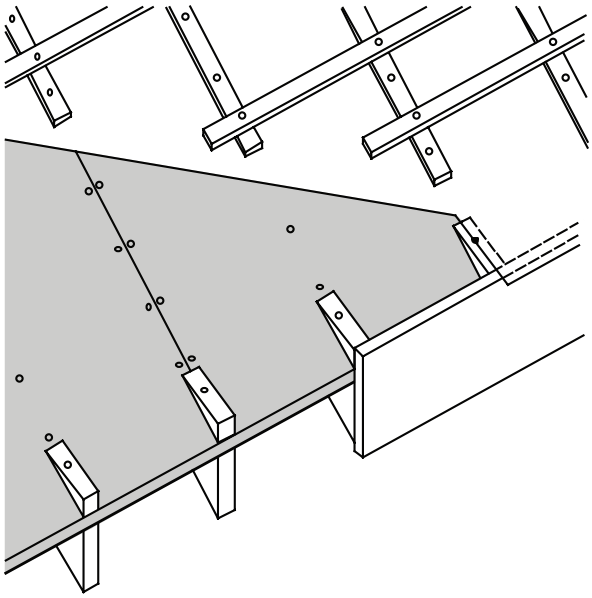

Figure 2.13: Typical pitched roof with sarking board and tiling underlay beneath the counter battens

The position of the underlay depends on its vapour resistance: if low (<5.7MNs/g) it can be laid directly on the sarking, under the counter battens; if high (>5.7MNs/g) it should be laid between the counter battens and tiling battens, forming a cavity to allow ventilation below the tiling underlay. Further guidance can be found in *BS 5250*.

2.6.5 References

1 BS 5250. Code of practice for control of condensation in buildings, BSI

2 BS 5534. Code of practice for slating and tiling (including shingles), BSI

3 Timber frame construction, ISBN 8791900510820, TRADA Technology, 5th edition, 2011

4 BS EN ISO 13788. Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation method, BSI

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