

2.5 Application of panels in flat roof decking

2.5.1 Selection of panels for flat roof decking

The selection of wood-based panels for roof decking depends on a number of factors of which the most important are:

- the type of roof
- the load that the roof deck has to carry.

Essentially there are two basic types of flat roof design which have become known as the 'cold deck' and 'warm deck' flat roofs; the distinguishing feature is the location of the insulation relative to the wood panel deck.

In the cold deck flat roof the insulation and vapour control layer is below the roof decking and in order to reduce both the occurrence of condensation and its effect, it is essential that there is a void between the deck and the insulation and that this void is well ventilated (*Figure 2.6*). The cold deck flat roof is not permissible in Scotland.

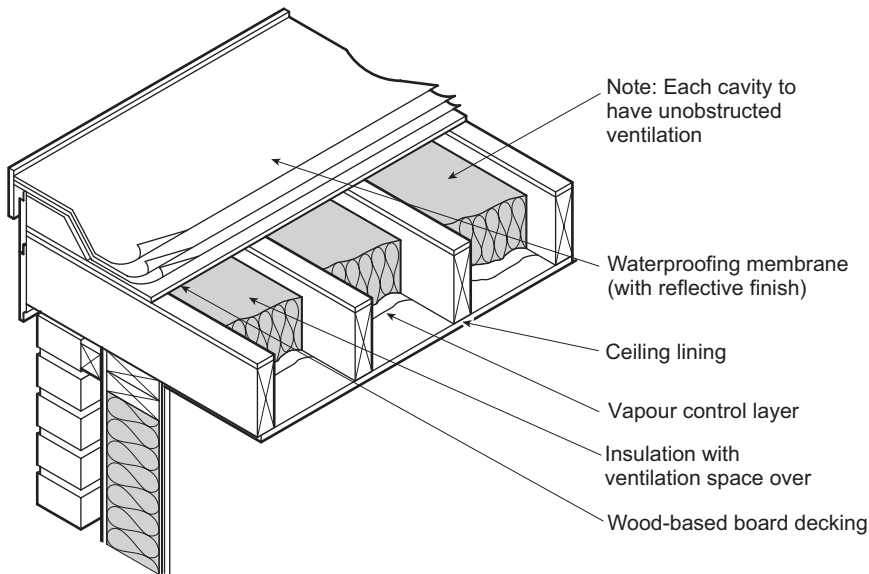


Figure 2.6: Typical cold deck flat roof

a: roof covering, b: roof deck, c: ventilated air space, d: thermal insulation, e: vapour control layer, f: ceiling lining

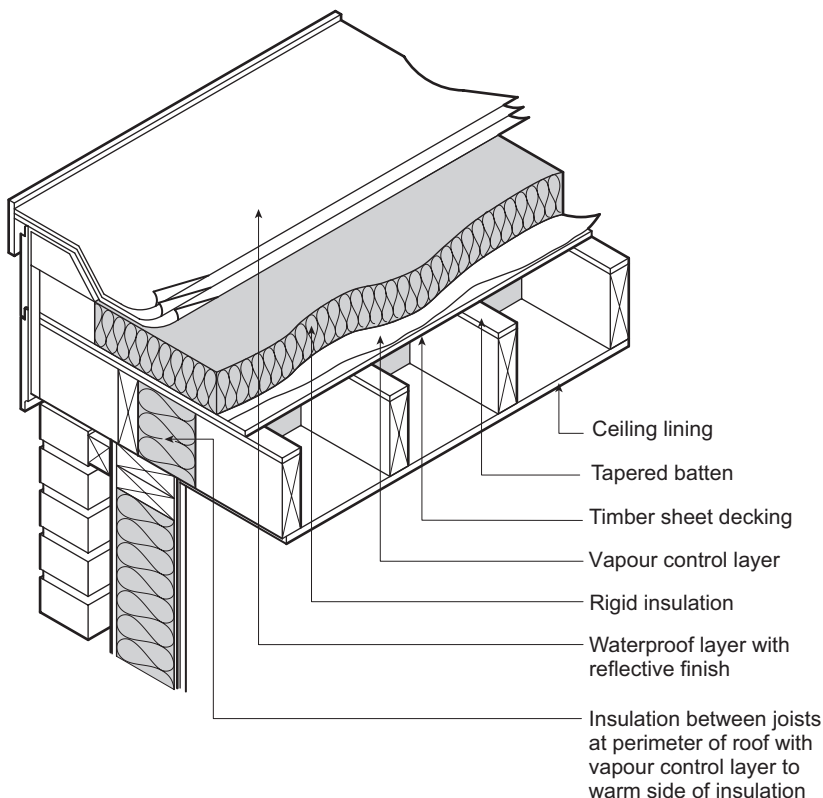


Figure 2.7: Typical warm deck flat roof

a: roof covering, b: overlay panel, c: rigid insulation, d: vapour control layer, e: structural roof deck

Table 2.4: Panel grades* for flat roof decking 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
Flat roof decking	warm deck cold deck		636-2 636-2	P5 P5	OSB/3 OSB/3	- -	- -	CBPB CBPB
Design by deemed to satisfy	✓	For the panel products listed in BS 8103-3 tables are present permitting the use of certain types and thicknesses of plywood, particleboard and OSB for different maximum spans. These are based on historic practice						
or	✓	Test using BS EN 1195 (see manufacturer's test data). Satisfy the requirements in BS EN 12871. Design using BS EN 1995-1-1 (Eurocode 5)						
Design by performance testing	or	Test using BS EN 1195 (see manufacturer's test data). Satisfy the requirements in BS 5268-2. Design using BS 5268-2						
or	✓	Using limit state design to BS EN 1995-1-1 (Eurocode 5). Characteristic values for all panels except solid wood panels and CBPB are given in BS EN 12369 Parts 1 and 2; alternatively, characteristic values for all load-bearing panels can be derived using BS EN 789 and BS EN 1058 and may be obtained from the manufacturers. Time modification factors for design for all panels except CBPB are included in BS EN 1995-1-1 (Eurocode 5), or an estimate of them can be derived using BS EN 1156						
Design by calculation	or	Using permissible stress design in BS 5268-2 (now withdrawn). Stress and moduli are derived from the characteristic values in BS EN 12369 Parts 1 and 2 except solid wood panels and CBPB: grade stresses and moduli for certain specific plywoods are included in BS 5268-2. Alternatively, characteristic values for all load-bearing panels can be derived using BS EN 789 and BS EN 1058 and may be obtained from the manufacturers. Time modification factors for design are included in BS 5268-2 for all panels except CBPB						
Guidance on application	✓	Guidance on the use of load-bearing boards in flat-roof decking is given in DD CEN/TS 12872						

* 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 have performance characteristics not directly covered by the table.

In the warm deck flat roof the insulation and vapour control layer are above the roof decking thereby almost eliminating the occurrence of condensation within the decking provided sufficient insulation is included (Figure 2.7).

The selection of wood-based panels for these two designs of flat roof is given in Table 2.4.

The load that the decking has to carry will depend on whether the flat roof has open access or whether access is restricted only to maintenance. Apart from access, the main sources of imposed loads for a flat roof will be snow and wind uplift. Beyond these factors the designer is free to design the roof to carry any specified load, and more information on loadings for roofs is provided in Eurocode 1 and BS 6399.

Moisture conditions will have markedly different effects on the performance of wood-based panels; these are quantified in terms of Service Classes as described in Section 2.3. The selection of panels for roofs subjected to the different Service Classes is set out in Table 2.4.

Increases in the required level of thermal performance in revisions to Approved Document Part L for England and Wales (with corresponding changes for Scotland and Northern Ireland) may result in the need to increase the thickness of panels above that necessary to sustain the imposed loads. Alternatively, other materials with a higher thermal performance could be incorporated in the design in juxtaposition with the wood-based panel.

2.5.2 The design of flat roof decking

The various factors to be incorporated in design together with the two applicable alternative design concepts for flat-roof decking are set out in Section 2.2.

In the absence of 'deemed to satisfy' information, recourse must be made to either designing by prototype testing, or by calculation as detailed in Section 2.2.1.4 and summarised in Table 2.4.

The typical panel sizes for roof decking are 2400 × 600mm or 2400 × 1200mm, with other sizes available to order. A panel width of 600mm makes handling easier and a length of 2400mm suits nominal joist centres of 600mm or 400mm.

Panels may be plain (square) edged, or profiled. Plain edged panels must be supported by joists or noggings at all edges. Profiled edges are usually matching tongue and groove and remove the need to provide support at all edges on plain panels. Panels may be profiled on all four edges or on long edges only.

2.5.3 Sitework

2.5.3.1 Conditioning

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

2.5.3.2 Preparation of structure

Supporting joists should be laid to line and level. Where firrings are used to create falls, these should be securely fixed to the joists. Falls of at least 1 in 40 are recommended.

Check the moisture content of the 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.

Joists and noggings should provide a minimum bearing for panel edges of 18mm.

2.5.3.3 Laying wood-based panels

Tongued and grooved (T&G) and square-edged panels should be laid across the joists with both short edges supported on a joist (see *Figure 2.8* and *Figure 2.9*). Square-edged panels should be continuously supported along all edges (see *Figure 2.9*). For maximum strength and stiffness, each panel should be laid continuously over at least two spans between joists.

Readers should note that additional materials (not shown in the figure) may be required to meet other requirements such as thermal or reaction to fire.

2.5.3.4 All panels

All perimeter and cut edges, on both T&G and square-edged panels, need to be supported on joists or noggings. Panels of both edge types should be laid to break joint, ie with staggered short edge joints to avoid lining them up.

2.5.3.5 Expansion gaps

A gap should be provided around the perimeter of flat roofs to upstands or abutting constructions to allow for possible expansion of the decking. This should be a minimum of 10mm at each edge or 2mm per metre

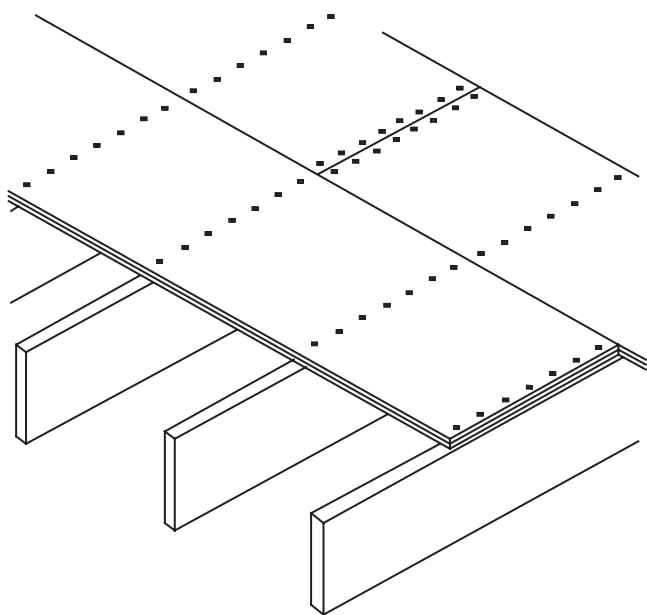


Figure 2.8: Tongued and grooved edge structural decking should be laid across the joists with short edges supported on joists

run of panel. Larger roofs may also need intermediate expansion gaps. A 3mm gap should also be left between each square-edged panel.

For T&G panels or panels which by design are tightly butted, special attention must be given to fixing down to avoid buckling.

2.5.3.6 Fixing

Panels should be fixed using corrosion resistant nails. 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.

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

Screws should be conventional countersunk woodscrews or, where fixing to steel structural frames, self-drilling self-tapping screws.

The frequency and pattern of nailing to joists and noggings should be in accordance with *Table 2.5* unless structural calculations require otherwise. To avoid tear out at panel edges, fixings should not be inserted closer to the edges than the minimum distances given, and as shown in *Figure 2.10*.

All nail heads should be punched home by 2–3mm. Screws should be countersunk.

Where manufacturer's instructions are supplied with the panels their recommendations should be followed.

2.5.3.7 Coverings

Flat roofs can be covered using traditional multi-layer finishes or proprietary single layer membranes. Built-up

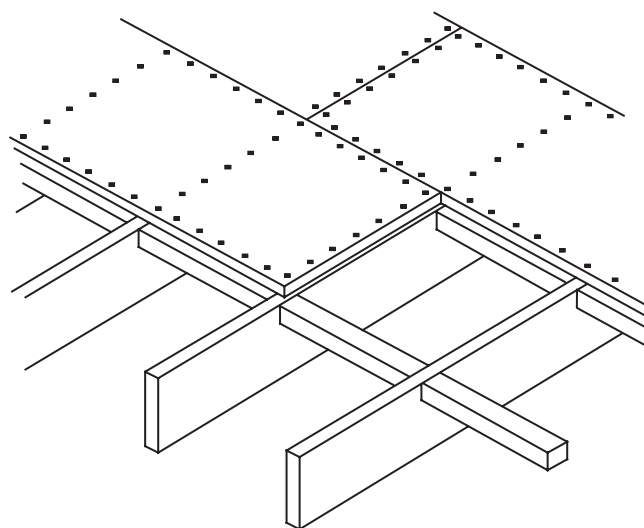


Figure 2.9: Square edge and structural decking laid across the joists and supported by noggings. Noggings are required to the long edges of square-edged panels

Table 2.5: Spacing of fixings for roof decking

Panel type	Maximum spacings (mm)		Min edge distance (mm)
	Perimeter framing	Intermediate framing	
Particleboard	100	100	8
Cement-bonded particleboard	see note	see note	see note
OSB	100	100	8
Plywood	100	100	8

Note: For cement-bonded particleboard, recommended nail spacings and edge distances vary with thickness and from manufacturer to manufacturer – examples of nail spacing range from 200 to 400mm on perimeter framing and from 300 to 610mm on intermediate framing. Nail edge distance varies from 15mm for panels less than 12mm and 20mm for thicker panels up to 25mm irrespective of thickness. Panels may need to be pre-drilled or fixed with self-drilling screws to avoid splitting. For fixing cement-bonded particleboard it is therefore essential to obtain and follow the manufacturer’s recommendations.

felt should be laid to *BS 8217 Reinforced bitumen membranes for roofing. Code of practice*⁴³, although it should be noted that this still refers to *BS 5268* for design and has not been updated to include references to *Eurocode 5* for design or *BS EN 13986* for wood-based panel material specifications.

2.5.4 Reference

- 1 BS 8217. Reinforced bitumen membranes for roofing. Code of practice, BSI

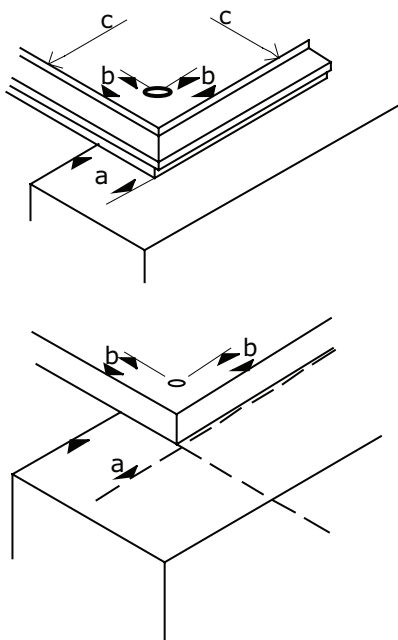


Figure 2.10: A minimum edge nailing distance of 8mm should be maintained and a minimum bearing of 18mm provided to each panel in both T&G panels (upper diagram) and square-edged panels (lower diagram)

- a: bearing
- b: edge nailing distance
- c: face dimension of panel

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