

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.

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. The designer is free to design his roof to carry any specified load. More information on loadings for roofs is provided in BS 6399 and Eurocode 1.

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 floors subjected to the different service classes is set out in Table 2.4.

Thermal performance. Increase in the required level of thermal performance in the revised 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. Alternately, 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 now two alternative design concepts for flat-roof decking were set out in Section 2.2 of PanelGuide.

TABLE 2.4 PANEL GRADES* FOR FLAT ROOF DECKING AND THE LOCATION OF DESIGN AND TESTING INFORMATION

	ROOFS	CONSTRUCTION	PLYWOOD EN 636	PARTICLEBOARD EN 312	OSB EN 300	MDF EN 622-5	FIBREBOARD EN 622-3,4	CBPB EN 634
Selection	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 thicknesses for different maximum spans.						
or								
Design by performance testing	✓	Test using EN 1195 (see manufacturer's test data). Satisfy the requirements in BS 5268-2. Design using BS 5268 -2.						
	or	Test using EN 1195 (see manufacturer's test data). Satisfy requirements in EN 12871. Design using EN 1995-1-1 (Eurocode 5).						
or								
Design by calculation	✓	Using permissible stress design in BS 5268-2. Stress and moduli are derived from the characteristic values in 12369 Parts 1 and 2 except solid wood panels and CBPB: grade stresses and moduli for certain specified plywoods are included in BS 5268-2. Alternatively, characteristic values for all load-bearing panels can be derived using EN 789 and 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.						
	or	Using limit state design in EN 1995-1-1 (Eurocode 5). Characteristic values for all panels except solid wood panels and CBPB are given in EN 12369 Parts 1 and 2; alternatively, characteristic values for all load-bearing panels can be derived using EN 789 and EN 1058 and may be obtained from the manufacturers. Time modification factors for design for all panels except CBPB are included in EN 1995-1-1 (Eurocode 5), or an estimate of them can be derived using DD ENV 1156.						
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 even be endowed with high levels of properties not directly covered by the table.

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 and summarised in Table 2.4.

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

Boards may be plain (square) edged, or profiled. Plain edged boards 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 boards. Boards may be profiled on all four edges or on long edges only.

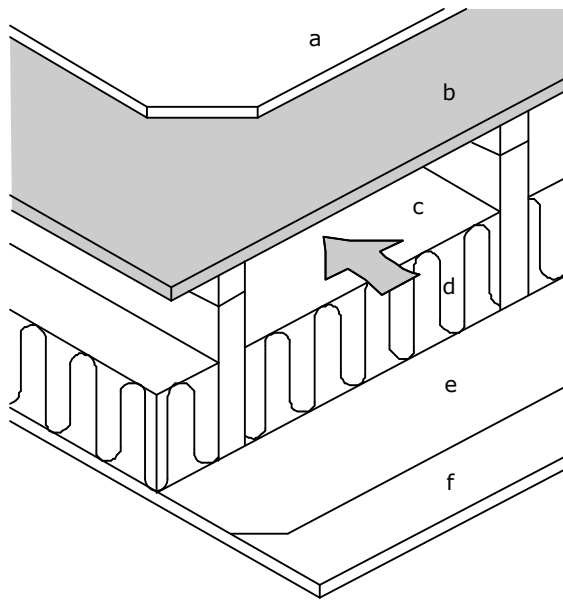


Figure 2.6 Typical cold deck flat roof

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

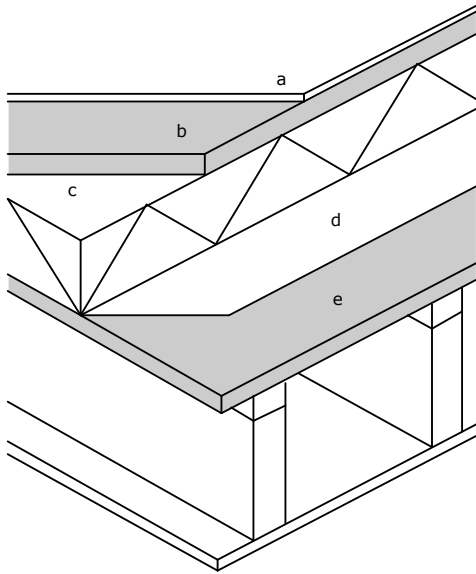


Figure 2.7 Typical warm deck flat roof

- a: roof covering**
- b: overlay board**
- c: rigid insulation**
- d: vapour control layer**
- e: structural roof deck**

2.5.3 Sitework

2.5.3.1 Conditioning

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

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.

Timber joists treated with water-borne preservative or which have high moisture contents should have moisture contents less than 22% at the time of deck laying, as water can migrate from wet joists into the boards and may cause localised swelling.

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

2.5.3.3 Laying – particleboard and cement bonded particleboard

T&G boards should be laid across the joists with both short edges supported on a joist, or other edge support (see Figure 2.8). Readers should note that additional materials (not shown in the figure) may be required to meet other requirements e.g. thermal, reaction to fire

Square edged boards should be continuously supported along all edges, preferably by placing them with long edges along the joists and short edges supported by noggings (see Figure 2.9). They can be laid with short edges butted at joists and long edges supported by noggings but this method requires a greater number of noggings.). Readers should note that additional materials (not shown in the figure) may be required to meet other requirements e.g. thermal, reaction to fire

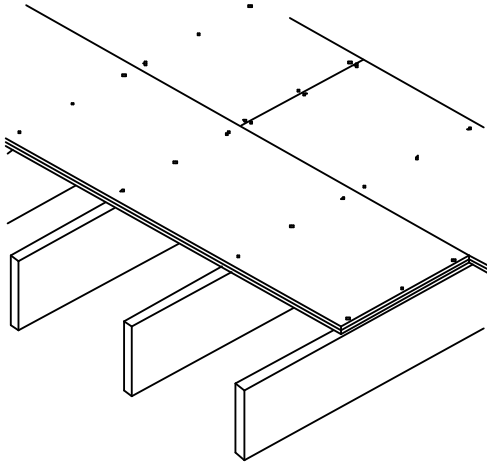


Figure 2.8 Tongued and grooved edge structural decking should be laid across the joists with short edges supported on joists.

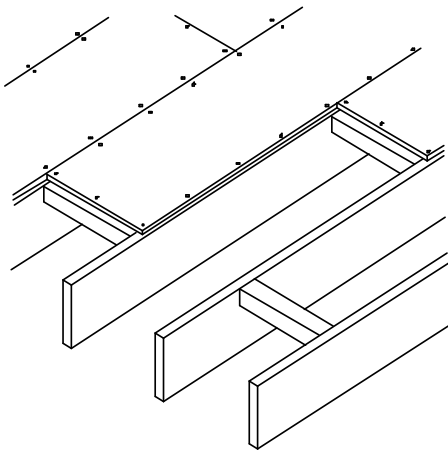


Figure 2.9 Square edge structural decking (except OSB) laid parallel to the joists and supported at all edges

2.5.3.4 Laying and fixing OSB and plywood:

There are two major but unrelated factors which affect the optimum performance of OSB and plywood joisted panel roofs:

- **The method used to support the panels**

Maximum strength and stiffness will be obtained if each panel is continuous over at least two spans between joists.

- **The composition of the panels**

Most OSB and plywood panels have a predominately stronger and stiffer axis in either length or width and are laid to best structural advantage with the strongest edge spanning across the joists. If boards are not marked with the preferred laying direction, consult the manufacturers' technical data sheets.

T&G boards should have both short edges supported on a joist, or other edge support (see Figure 2.8). Readers should note that additional materials (not shown in the figure) may be required to meet other requirements e.g. thermal, reaction to fire

Square edged boards should be continuously supported along all edges – short edges should be butted at joists and long edges supported by noggings (see Figure 2.10). Readers should note that additional materials (not shown in the figure) may be required to meet other requirements e.g. thermal, reaction to fire

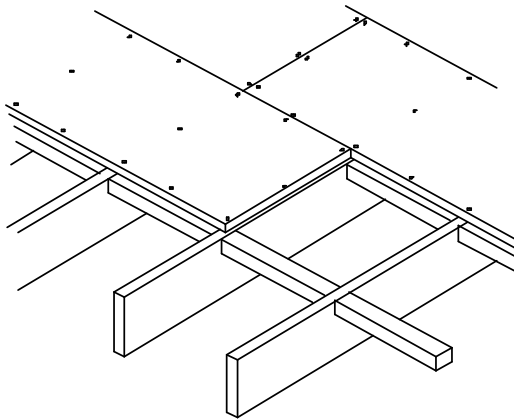


Figure 2.10 Square edge and structural decking laid across the joists and supported by noggings. Noggings are required to the long edges of square edged boards.

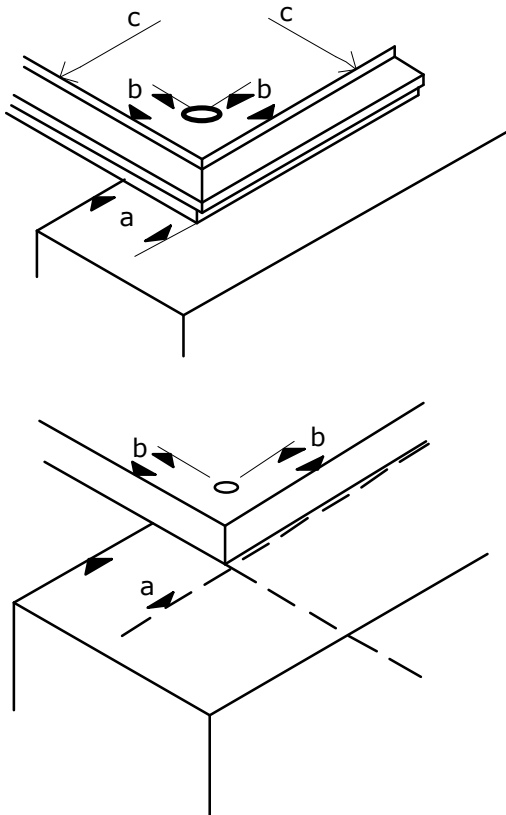


Figure 2.11 A minimum edge nailing distance of 8mm should be maintained and a minimum bearing of 18mm provided to each board in both t&g panels (upper diagram) and square-edged panels (lower diagram).

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

2.5.3.5 All boards

All perimeter and cut edges on both t&g and square edge boards need to be supported on joists or noggings.

Boards of both edge types should be laid to break joint i.e. with staggered short edge joints to avoid lining them up.

2.5.3.6 Expansion gaps

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

For t&g boards or boards which by design are tightly butted, special attention must be given to fixing down to avoid buckling.

2.5.3.7 Fixing

Boards 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 (e.g. 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 board thickness, whichever is greater.

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 Table 2.5 unless structural calculations require otherwise. To avoid tear out at board edges, fixings should not be inserted closer to the edges than the minimum distances given, and as shown in Figure 2.11.

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 boards less than 12mm and 20mm for thicker boards up to 25mm irrespective of thickness. Boards 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.

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

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

2.5.4 Coverings

Flat roofs can be covered using traditional multi-layer finishes or proprietary single layer membranes. Built-up felt should be laid to BS 8217.