

Update: Slates & tiles Tiling tips: No 14

Batten nail size

For years it has been taken for granted that tile batten nails are 65mm long by 2.65, 3.0 or 3.35mm diameter steel wire nails. But why?

Nail penetration

Since September 1997 it has been recommended that all battens used for roof tiles and slates should be a minimum of 25mm thick to allow the tile nail to get a full 25mm of grip. If we deduct the batten thickness from the length of a 65mm long nail, the remaining 40mm of nail penetrates into the rafter or counter batten. If batten thickness was increased, nail penetration into the rafter would be reduced, so a longer nail may be needed.

The figure of 40mm penetration for the batten nail is very traditional, as in reality every roof will have a different minimum nail penetration requirement. For instance, the nail penetration for plain tile roofs could be less than

some of the load via the nails or clips to the battens, and the battens in turn transfer the load to the rafters and so on down to the foundations. The size of the load that is transferred from the batten to the rafter will depend upon four main factors:

- Rafter centers. Roofs with rafters at 400mm centers have 30 percent more batten nail fixings than those with rafters at 600mm centers.
- Batten gauge for the tiles. Plain tiles with a batten gauge of 100mm will have 71 percent more batten nail fixings than an interlocking tile with a gauge of 340mm.
- Dead load of the roof tile. Part of the wind load on the exposed surface of the tile will be resisted by the dead load of the tile. This will depend on the weight of the tile, the distance to its centre of gravity and the rafter pitch of the roof slope.

Standard		Batten Nail Comparison Chart									
		BS EN 10230 - 1					BS 1202 - 1				
All dimensions in mm	Symbol										
Nominal shank diameter	D	2.7	3	3.4	3.8	4.2	2.65	3	3.35	3.75	4
Nominal head diameter	dh	6.1	6.8	7.7	7.6	8.4	5.96	6.75	7.53	8.43	8
Nominal length	L	40-60	50-80	60-90	70-100	80-110	40-65	50-75	50-90	65-100	75-100

for an interlocking tile roof. It is better to have a nail that is longer than needed as there is a risk that if the nail penetration is too short, serious roof damage may occur during hurricane force winds.

Wind uplift load

Batten nails are one of the primary fixings for the transfer of wind uplift loads on the roof into the roof structure. Wind suction acts on the tiles, the tiles transfer

Anticipated wind uplift load. This is the predicted load that will act on the roof once in a 50 year period, as defined by calculation in BS 5534, *Code of practice for slating and tiling: Design 1997*.

Remember that battens take 100 percent of the wind uplift load acting on the underlay when the underlay is positioned directly under the batten.

By calculation, the design load on one square metre of roof slope can be found. Having deducted the dead load of the tiles the remaining load should be divided by the number of batten nail fixings per square metre of roof, to define the withdrawal load on each nail.

Nail grip

The action of a wind uplift load is to pull the nail out of the rafter. The amount of grip the nail has in the timber is critical and determined by three main factors:

- Exposed surface of the nail. The more exposed surface that comes into contact with the rafter timber, the greater will be the grip. The exposed surface area is defined as the circumference of the nail, times the nail penetration depth, less the nail point. A nail with a larger diameter provides more grip than one of a smaller diameter. Also more nail penetration also provides more grip than less nail penetration. Remember nail penetration is not always the length of nail. If the counter batten being nailed into is 25mm thick and laid on insulation, only 25mm of nail penetration is possible, regardless of the length of the nail.
- Surface finish of the nail. Nails that are smooth are easier to pull out than those with an improved surface, such as ring shank grooves or a spiral square section.
- Timber grade being nailed into. Higher density timber will grip the nail better than a lower density timber.

BS 5268: Part 3: *Structural use of timber*, can assist further with the resistance of different fixings to a withdrawal load.

European standard

In January 2000, European standard BS EN 10230: Part 1: *Steel wire nails for general applications*, became effective. Now all steel batten nails should be supplied to the new standard. The

2.65mm diameter increases to 2.7mm, and 3.35mm increases to 3.4mm. Whilst these figures are not large, roofs constructed using batten nails to the old British Standard 1202: Part 1: 1974 may be fit for purpose, but may not truly be said to be constructed in accordance with current British and European Standards, and this fact may invalidate a manufacturer's guarantee. The specification for nails used with the new generation of nail guns fall into the same category, especially with regard to diameter and head design.

Galvanized nails

The new European Standard for steel nails states that the nail diameter is measured before galvanizing. Logic says that for bending and compressive strength the pre-galvanized dimension should be used. For the withdrawal load on the nail, the post-galvanized dimension may be used.

Batten nail calculations

Whilst there are so many variations to be considered, experience tells us that for most homes in populated parts of the UK a 65mm long batten nail is adequate. But as soon as the building rises above three storeys, or the roofing material becomes lighter, and the exposure of the building requires a higher level fixing specification, it is likely that the size and type of batten nail will need to be calculated. Major tile manufacturers will automatically calculate the tile batten nail size at the same time as the tile fixing specification, others may not.

Advice

Seek the advice of the tile manufacturer early in the specification/tendering process. Also check that the batten nails being used comply with the new BS EN 10230 specification.

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