



## **FIXING SOLAR PANELS TO TIMBER RAFTERS & BATTENS (PITCHED ROOFS)**

### **INTRODUCTION**

The most common method of fixing a solar panel to a pitched roof structure is to fasten a series of brackets to the timber roof structure with a wood screw.

Many solar products are imported to the UK market from other countries where building methods can differ widely. In the UK it is common to use rafters 35-50mm wide, whereas in other European countries rafters are often much wider. This can be extremely important because the strength of a screw fixing into timber is not only a function of the strength of the screw, but also the strength of the material around the screw. This technical note is intended to offer guidance to solar installers and product suppliers on appropriate fixing methods which comply with UK building regulations.

### **THE UK BUILDING REGULATIONS**

*The Building Regulations 2000 Part A reference BS5268-2:2002 Structural Use of Timber. Code of practice for permissible stress design, materials and workmanship has been withdrawn and replaced by BS EN 1995-1-1.*

BS EN 1995-1-1 offers guidance to allow the calculation of the strength of screws in timber, but these apply only to the situation where a screw of diameter  $D$  is fixed into a timber of width  $W$ , where  $W$  is greater than or equal to 12 times  $D$ . For example, for an 8mm screw the rafter would have to be  $12 \times 8 = 96\text{mm}$  wide. Clearly this is not practical with regards to UK rafter sizes and therefore any guidance on fixings will fall outside of this standard. Load testing is an acceptable alternative to calculations, and is explicitly mentioned in Section 8 of BS5268 and is therefore another way of satisfying Building Regulations.

### **OTHER CONSIDERATIONS**

#### **Condition of Timber**

Timber in older properties may suffer from decay. The condition of timbers in the roof should be checked for deterioration which may affect its ability to bear the weight of the installation and could affect the pull-out strength of fixings.

#### **Splitting**

Screwing into timber also introduces the risk of splitting the timber, especially in the case of relatively large screws into narrow rafters. NFRC recommends that appropriate pilot holes are pre-drilled for all screws irrespective of diameter. Screws should be fixed as close to the middle part of the rafters as possible, rather than at the edges. Although it is acknowledged that screws of 8mm are commonly used and may be acceptable (where backed up by test results), other test results have shown that screw sizes of 6mm can be used instead, however the installer should consult the manufacturer before substituting 6mm screws for 8mm screws. It is important to ensure that the type and grade of screw is also specified by the manufacturer if not provided with the fixing kit. Manufacturers may advise widening the rafter by fixing timber noggins/pads to one or both sides with timber lock screws.

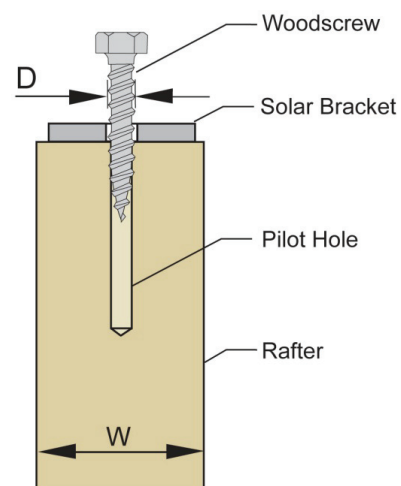


Figure 1. Fixing into Rafter

## Fixing Kits with Rafter-Spanning Boards

Fixing kits are available in which the solar mounting brackets are screwed to plywood (or similar) boards spanning between two rafters. The manufacturer will normally provide appropriate screw fixings in to the board and will provide the uplift resistance value for the mounting bracket. However, where the plywood boards are screwed into the rafters the rules given below will also apply.

## Mounting Brackets Fixed to Battens

There is no standardized way to calculate the resistance of tile battens to point loads. Existing battens could be as small as 19mm x 38mm. Any solar fixing kit relying on attachment to battens must provide resistance values based on test data. The size of the battens used in testing should be checked.

## Load Testing Methods

Where test evidence is provided the test method used should be based on EN 14437 or alternative methods recommended by MCS012. The loading applied during test should simulate the load that would be experienced on a roof.

## RECOMMENDED APPROACH

Based on the above, NFRC recommends the following approach

1. Check the condition of the rafters to ensure they are in a sound condition and carry out any remedial works as required before commencing with the installation.
2. Note down the rafter width and the screw diameter of the proposed panel fixing product and check the necessary testing has been carried out to show that the proposed screw size is suitable for the rafter size. This is important to ensure that the rafters will not split. Where possible, use a maximum screw size of 6mm. Where no test evidence is available, installations in to rafters narrower than 9 times the screw diameter should not proceed until approval has been obtained from the manufacturer.
3. Drill pilot holes for all screws to manufacturer's instructions, irrespective of the screw diameter.
4. If advised by the manufacturer, then ensure noggins are securely fixed to the side/s before screwing into the rafter.
5. If, in the unlikely event, the rafter width is greater than or equal to 12 times the screw diameter then it may be acceptable to screw directly to a sound rafter and use the manufacturer's claimed resistance providing the following conditions are met:
  - (a) The screws are not closer than 4 screw diameters from the edge of the rafter
  - (b) The screws are not closer than 10 screw diameters from the end of the rafter
  - (c) The spacing between screws is at least 5 screw diameters

If the above conditions are not met then it is necessary to check with the manufacturer whether the claimed resistance of the fixing kit is calculated or tested. The loading applied during test and the grade of timber used should both be appropriate for the conditions that would be experienced on a roof. If the above conditions are not met then it is necessary to check with the manufacturer whether the claimed resistance of the fixing kit is calculated or tested.

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