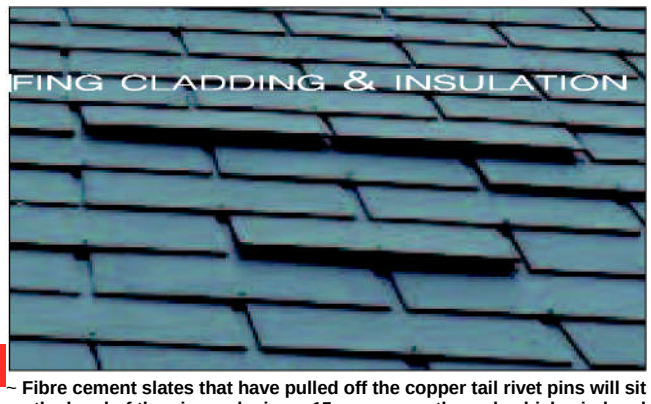
Update:
Slates & tiles

Slating & Tiling TIPS 20

Copper tail rivet fixings



~ Fibre cement slates that have pulled off the copper tail rivet pins will sit on the head of the pin producing a 15mm gap up through which wind and rain can drive.

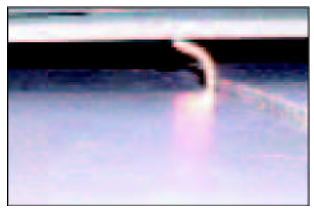
Most materials such as steel, timber, or plastic, if placed under load will bend before they break. Whilst materials such as concrete or rock do bend under load, they are more likely to break before bending can be seen in a small component like a slate.

With best quality natural slate, the maximum uplift wind force expected once in 50 years in the UK, acting on the exposed surface of the slate, is unlikely to generate any measurable bending through its length. That is unless the slate is too thin or faulty, then the slate will snap at its weakest point.

A fibre cement slate that is 4mm thick will bend under wind loads and thermal stress and therefore needs some assistance to resist the bending forces. This is achieved with a copper tail rivet, positioned in the centre of the slate close to the leading edge, to clamp the top slate to the two lower slates. This little device – like an upturned mushroom – is slid up in the gap between the lower slates and located through a pre punched hole in the top slate, and the pin is bent over to lock the slates and the rivet together.

The majority of the wind uplift load on the exposed section of the slate is transferred to the copper tail rivet. The load in turn transfers to the edges of the two slates below, which in turn transfers the load to the two centre fix nails of the lower slates.

To stop the rivet pulling up through the gap between the slates, British Standard 5534 recommends that the gap should not be wider than 5mm, when using a Copper tail rivet with a base diameter of 19mm. At best, 7mm to 8.5mm of the disc will lay under each of the lower slates. However, if the setting out of the slates is less than perfect the rivet pin could lay to one side, making the lap under the other slate as little as 5.5 mm. If the slates are laid with gaps between 5mm and 9mm, the risk of the rivet pulling through the gap increases. When the slate gap is 10mm, and the rivet pin is not central, the lap under one of the slates can be as little as 0.5mm and the force needed to pull the rivet through the gap negligible. If the rivet can pull up on one side, it can rotate and completely detach from the lower slates.



~ Unless the tail rivet is bent at right angles, the upper slate can pull off the copper disc rivet pin under high wind uplift loads and then sit on the head of the pin.

Another mode of failure can occur if the rivet pin is either not bent over at right angles onto the top surface of the top slate, or is not long enough and therefore cannot be bent over far enough to clear the hole in the slate. In both instances the uplift force required to either straighten the rivet pin or damage the hole in the slate and allow the rivet pin to pull through can be within the limits of normal wind force. Once the uplift force on the slates has bent the rivet pin to 45° from the vertical, the slate can lift off the pin under wind suction and not relocate onto the pin, but will sit on the head of the pin and show itself as a lifted slate. If left the rivet can vibrate down the gap between the slates and the slate will drop back into position, but without a tail rivet fixing.

The hole in the slate for the copper tail rivet should be slightly larger than the 2mm-diameter rivet pin. Too large and the length of the rivet pin will need to be increased to stop it pulling through after it has been bent over. The position of the hole back from the leading edge is also critical. Too close to the leading edge and it will weaken the edge of the slate and break away under load. Too far away and the efficiency of the fixing will be reduced. The length of the pin should protrude approximately 10mm above the slate before it is bent over. With most FC slates being approximately 4mm thick this should not be a problem, but if thicker slates are used, the pin on the rivet needs to be equal to two thickness of slate +10 mm.

Some roofers have been known to once nail and tail rivet some slates on a roof. After a short time, each once nailed slate rotates about the nail fixing and closes the gap between the slate on one side and opens up the gap on the other, making the grip of the tail rivet less than it should be. Also with the slate being held down only on one side, the other side is able to lift allowing the tail rivet in some instances to fall out.

The worst case is where isolated slates have been broken during construction and new slates inserted. As it is impossible to re-nail the new slate into position, the tail rivet is used as the only means of fixing. This is totally unacceptable, as over time the slate will slide down the roof until the rivet disengages with the lower slates, and then is blown off or continues to slide.

- Twice nailing and tail riveting FC slates is a very efficient system provided the slates are set out with gaps up to 5mm wide and the copper tail rivets are installed correctly.
- Setting out should be carefully controlled to ensure the perp lines do not drift and upset the spacing of the slates.
- All slates must be twice nailed and tail riveted or fixed using proprietary slate fixings.
- All copper tail rivet pins should be long enough and be bent over at right angles onto the top surface of the slate.

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