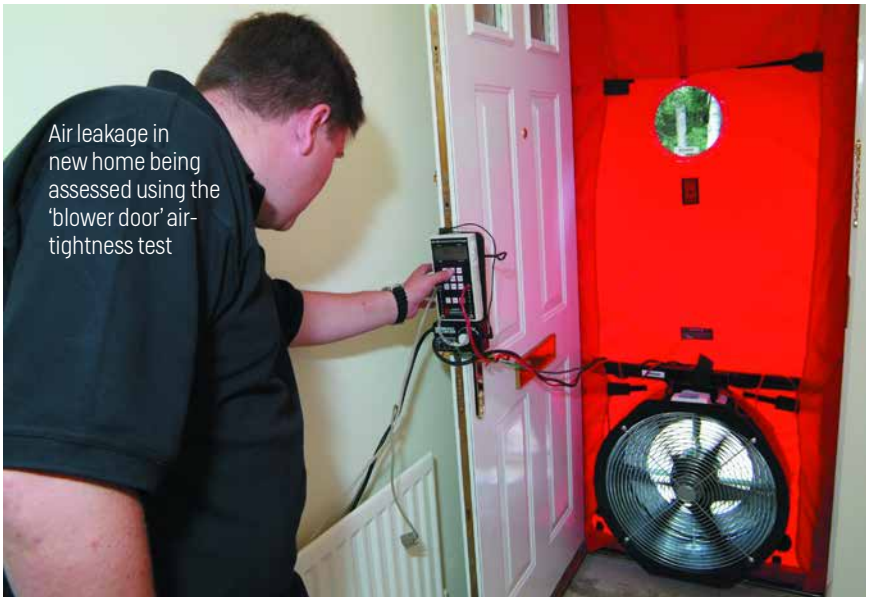
ROOFING AIRTIGHTNESS – build tight but ventilate right!

Despite widespread improvements throughout Europe in regulations affecting thermal insulation levels, designers of energy efficient buildings still have to deal with the problem of potential air leakage paths and thermal bridges. The high performance criteria set by standards such as Passivhaus can therefore be difficult to achieve unless the right products are used.

Example of Passivhaus design combining roof windows and photovoltaic panels



Air leakage in new home being assessed using the 'blower door' air-tightness test

WITH SUCH a high proportion of heat lost through the roof, airtightness depends on a high standard of installation. With roof windows, for example, a lack of care is often taken with basic detailing such as cutting the underlay. In such situations, despite the fact that specialist tapes or sealants may have been specified by the architect, an air leakage test will quickly reveal poor performance if the wrong products have been used. Sadly, this happens all too often and with the rough and uneven surfaces in roof spaces the products soon fail. As a result, there is an increasing trend towards trying to 'design out' such problems, by adding features such as integral self-adhesive strips on underlays and air barriers, to seal laps and junctions with walls, chimneys etc.

Passivhaus and EnerPHit® (for refurbishments) demand the highest levels of thermal insulation. If installed correctly, 'passive' windows help ensure that a building requires virtually no heating through having no more than 0.6 air changes per hour. This guarantees an environment which offers enhanced comfort for the home owner, whatever the weather outside.

Truly energy-efficient roof windows aren't common

Surprisingly, there are still few roof windows which either meet Passivhaus requirements or have achieved certification by the Passivhaus Institute. They must be triple glazed but not all triple-glazed roof windows meet the demanding minimum U-value performance required. The U-value measures how quickly heat from inside a building leaks to the outside or, in the case of an individual product, its insulation performance.

U-values are measured in W/m²K*. We don't need to go into a definition of this term here other than to say that the 'Uw' value refers to the performance of the entire window while the 'Ug' covers

just the glazing unit. Passivhaus requires a window to achieve a Uw of 0.80 W/m²K or lower (0.85 for EnerPHit) and to put this into context, better double-glazed roof windows achieve a Uw figure between 1.2 – 1.4 W/m²K. Passivhaus-certified roof windows are around twice as effective, at around 0.7 – 0.8, though the best standard product currently available is actually quadruple-glazed and has a Uw of 0.58!

Thermal losses through (as distinct from around) a window will occur if inadequate seals and spacers between panes are used, or if joints are poorly constructed. Accessories such as an insulation collar around the frame (which more often than not is used anyway in energy efficient designs) won't make up for a window's poor performance.

Timber windows should be manufactured using material that will remain dimensionally stable over time, ideally, one with a close grain. Whitewood pine, which is favoured by some roof window manufacturers, is fast growing and therefore has an open grain. Redwood pine, by contrast, is slower growing, more dense and tends to be used in better performing products.

Airtightness and controlled ventilation

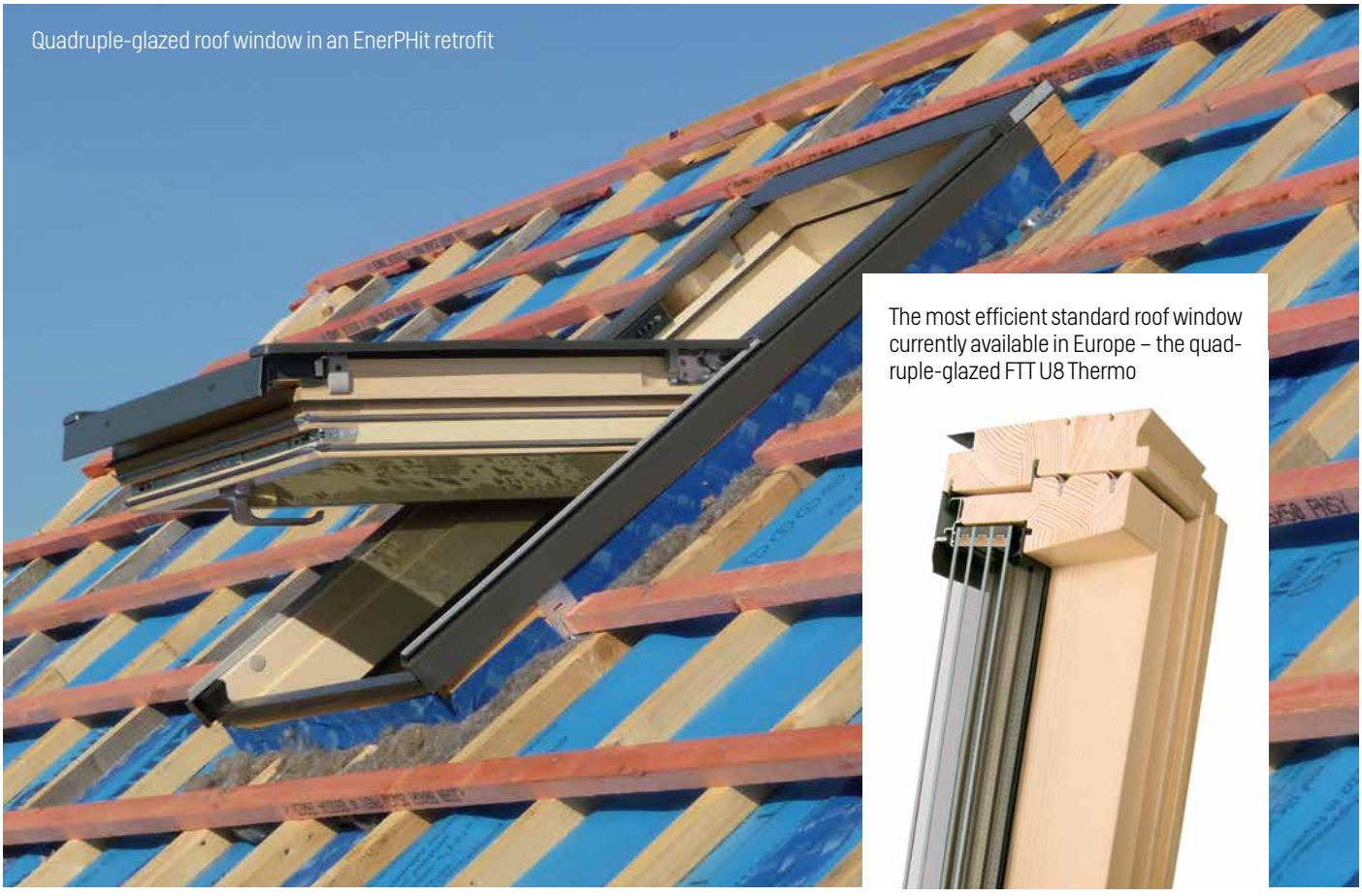
An airtight building still needs to have controlled ventilation in order to provide fresh air and this is usually provided by a mechanically operated ventilation system with heat recovery (MVHR). MVHR works on the principle of extracting warm, moist air and then passing it through a heat exchanger. Fresh, incoming air is then pre-heated via the heat exchanger and ducted to each room. A system requires non-vented roof windows to be used but these are not widely available as standard products, though one manufacturer routinely does so.

Using the right sealants, tapes and vapour control layers

With roofs, an air barrier (or vapour control layer) must be provided over the ceiling using specialist tapes and sealants to seal gaps. These include holes made for pipes and wires in order to ensure that the air barrier is continuous. Some air barriers now also have a reflective surface to help maximise the value of heat generated.

Air leakage of homes can be assessed at different stages of construction with pressurisation and depressurisation tests being undertaken as part of the Passivhaus certification process. Where remedial work is needed, specialist products from the Wolf Group include Penosil EasyPRO Roof & Façade Elastic as well as other hybrid sealants under the Penosil and Olivé brands. Designed to provide a long service life under the most demanding conditions, their contribution to airtightness is out of all proportion to their cost. If such materials are not used, the chances are that the standard of airtightness will quickly deteriorate, thereby defeating the entire purpose of the building's original concept and design.

**Watts per square metre per degree Kelvin*



Quadruple-glazed roof window in an EnerPHit retrofit

The most efficient standard roof window currently available in Europe – the quadruple-glazed FTT U8 Thermo