TEST FOR NON-FRAGILITY

(see also Non-Fragility Testing Video)

The ACR document, ACR [M] 001:2014 "*Test for Non-Fragility of Large Element Roofing Assemblies*" [fifth edition], commonly known as the 'Red Book' prescribes how a roof assembly should be tested to resist the impact of a person falling onto it, and then supporting their weight, clarifying how the assembly is then defined as 'fragile' or 'non-fragile', classified A to C. It is important to understand that the test is not of any single product, but all of the elements required of a correctly installed roof.

The impact testing is a 'soft-body' test specifically defined to concentrate a destructive load over a small area, at the most critical, worst case scenario locations of that assembly. Only by extensive testing for all failure modes can the tester gain a clear understanding of how and where the assembly will fail.

You can view the non-fragility testing video at https://bit.ly/2t8ACwq

Human impact loads can occur anywhere on a roof. Therefore, any test which purports to check fragility of a roof, should check its resistance to impact everywhere by a suitable means. This test satisfies this requirement by checking a roofing product's ability to first arrest and then retain a load falling through gravity and impacting at locations, which, in the opinion of people with many years' experience in the roofing industry, are most susceptible to fracture under impact loads. The test rig is relatively rigid, designed to simulate the most rigid localised areas of a roof.

The rigidity of the test rig should never be reduced (for example by using more flexible purlins or omitting stiffening struts), even where an actual roof may be more flexible in certain areas. Where an actual roof may be more rigid (for example if concrete purlins are being used) then the rigidity of the test rig should be increased accordingly.

Defining non-fragility

According to the Red Book, an assembly can be classed as either **fragile** or **non-fragile**. The test covers all components - including all of the fasteners, sealant tapes etc - that are required to be representative of the finished installation.

The application of the test and classification for in-plane rooflights is further described and defined in the National Association of Rooflight Manufacturers (NARM) Technical Document NTD03.

The test procedure

The test should be carried out by a competent person. It involves an 'impactor' comprising a 300mm diameter cotton weave sandbag filled with 45kg of soft sand, being dropped from a height of 1.2 metres onto the roofing assembly.

The test sample is built on a standard roof rig representing a typical metal roof structure one metre high from the ground.

The impactor should be dropped in specific worst-case scenario zones, depending upon the assembly, where are generally:

- Within 150mm of the centre of the sample
- Within 300mm of a support point
- Within 150mm of the assembly edge, adjacent to the underlap with the next sheet
- Where ever the competent person deems the worst-case scenario to be

Classification of results

If the assembly fails to survive the impact, and the impactor passes through, then the assembly is classed as **fragile**.

If the impactor is retained by the assembly after the first drop for a minimum of five minutes, it can be classified as **non-fragile** and may be used for, or within, roof construction.

If, after the second impact at the same location, the impactor is retained for a further five minutes, the assembly can then be rated as **Class B non-fragile**.

If the impactor is not retained for at least five minutes after the second impact, then the assembly is rated as **Class C non-fragile**.

Class A non-fragile is only achieved where no part or component of the assembly suffers any damage or detriment because of the test, that might affect the long-term strength or weatherability of the assembly.

Note:

Such is the destructive nature of the test; no known self-supporting lightweight metal roof assembly can achieve an 'A' rating irrespective of the performance of the rooflight. Most metal cladding system manufacturers design their systems to achieve Class B. It should be noted that where any part of a roofing assembly is unfixed or partially fixed, it should **always be treated as fragile**.

Period of non-fragility

A number of factors will impact on the period of non-fragility which will be achieved by a roofing assembly including the quality and durability of the roof materials, and the quality of installation of the whole roof assembly.

Manufacturers can only indicate the expected period of non-fragility from extensive testing carried out and cannot offer performance guarantees for considerations such as installation quality, which are out of their direct control.

Note:

Imported rooflights claiming the same or similar specifications and not manufactured to BS EN1013, and the UK Annex to this Standard, cannot be assumed to achieve the same non-fragility ratings, or for the same periods of use. In such cases, proof of conformant non-fragility testing should be requested by the specifier/contractor.