CLADDING: STAYING CONNECTED

The construction and fabrication of all products or systems ranging from aircraft through to consumer goods all require the designer to consider how various parts are going to be connected or joined. This is also true within the construction industry. However, in the construction industry and because of the nature of the industry most methods of mechanical jointing are performed away from the factory environment and are generally done in difficult environmental weather conditions, notably the UK climate.

Dragon Leisure Centre, Bodmin. Image courtesy of Euroclad

The principal types of mechanical fasteners used within the construction sector are nails, bolts, screws and rivets. Narrowing this down even further the cladding industry focuses on the use of screws or as we should refer to them by the generic name of fasteners and rivets.

Both of these mechanical fasteners have a place within the industry but they must be used appropriately and fully specified to ensure that they meet the demands of the situation.

MCRMA Technical Paper No 12 entitled *Fasteners for Metal Roof and Wall Cladding: Design, Detailing and Installation Guide* deals with this subject in depth and should be regarded as the initial source of information about the generic subject of fasteners for the metal cladding sector. The document should be read in conjunction with published information available from the principal manufacturers of fasteners and also the current version of BS 5427: Part 1 Code of practice for the use of profiled sheet for roof and wall cladding on buildings. These documents spell out in detail how fasteners should be specified, the environmental and physical conditions which they may encounter and also how they should be used in various applications.

Fasteners like all other products have to be fit for purpose and have to be specified accordingly. Fasteners have to accommodate a wide variety of different demands during their functional life and perhaps one of the most arduous demands is the acceptance of different loading conditions and the transfer of those loads into adjoining components and materials.

Perhaps one of the most famous and tragic cases of the specification of the wrong type of fasteners was the rivets used to fabricate the Titanic cruise liner. The plates of the steel hulled vessel were joined together, not with steel rivets, but with inferior iron rivets which were not adequate to transfer the loads to adjoining plates or to the principal structure.

Dragon Leisure Centre, Bodmin. Image courtesy of Euroclad

The incorrect specification of fasteners for an industrial or commercial building may not have the same level of consequences but structural failure of a fastener within a cladding system can result in cladding sheets detaching from the building when subjected to high wind load conditions, particularly at eaves and corners. The incorrect specification of fasteners can also result in external roofing sheets and walkable liners not performing to the levels expected from them.

Since the introduction of *ACR[M]001:2011 Test For Non-Fragility of Profiled Sheeted and Large Element Roofing* by the Advisory Committee for Roof Safety the manufacturers of profiled metal roofing systems, rooflight manufacturers and the fastener manufacturers have worked closely together to ensure roof systems perform in accordance with the requirements of the document. However, it must be noted that the roof system must work as a system and any deviation from the specification may have significant penalties.

The loads and forces on individual fasteners can generally be categories in three main groups, pullout resistance, pullover resistance and shear force resistance. Pullout resistance is the ability of a fastener's connection within its supporting material to remain intact and resist the axial and tensile loadings.

As the UK metal cladding market frequently involves primary fixing into relatively thin cold rolled purlins, rails and spacing systems, pullout of primary fasteners is often the most critical of the loadings that should be considered. BS5427: Part 1 gives some typical methods for testing the pullout strength of fasteners and there are various other internationally recognised and accepted industry tests adopted by manufacturers.

Pullover resistance is the ability of the fastener to prevent the sheet material failing by pulling over the head of the fastener. This is rarely an issue in today's metal cladding market however; pullover resistance of fasteners should always be considered particularly within applications incorporating thin gauge materials, GRP/PVC profiles, and applications including support structures thicker than 1.5mm, as pullover failure may occur at a lower value than pullout failure.

Shear force resistance on fasteners within metal roofing systems is not generally regarded as something which will adversely affect the performance of the system. However, the thermal expansion of metal cladding system and in particular aluminium systems can induce significant shear forces into the fasteners if not adequately accounted for or designed for.

Detailed advice about all of the subjects discussed in this article can be found on the MCRMA web site or by contacting individual manufacturers or one of the independent Consultants.

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