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Historic steel-framed windows

Rare steel-framed windows contribute greatly to the historic significance of their modernist buildings. With the right advice and skilled workmanship they can be given a new lease of life.

The Generator Building at Stow Maries

All too often the heritage values of steel windows are overlooked, and they are dismissed as substandard and not worthy of conservation. Yet historic steel window frames belong to a specific era in architectural development, contributing to the historic significance of those buildings in which they are found.

Production of mild-steel window frames started in the second half of the 19th century, but it was in the aftermath of the first world war (when there was a severe shortage of timber) that they became the glazing of choice for modernist architecture. They were used for everything from shop fronts and offices to council houses, and could even be found in utopian built communities such as Hampstead Garden Suburb. They could be mass-produced, making them more affordable, and their sleek lines allowed in more light; they were 'modern' and offered security. Several companies produced steel windows, although one in particular – Crittall Windows – dominated the market. The Crittall name is now synonymous with steel windows. Some window elements, especially the brass window furniture, may bear the maker's stamp.

Steel window frames were either riveted and tenoned, or welded together. Glazing bars often consisted of T-shaped or other simply moulded sections, with the glass held in place with clips and sealed with putty. Longer-lasting hardwood and metal beading was used to seal the joint between glass and frame on later windows.

The Generator Building, looking towards the Officers Mess

Window furniture was usually brass. The frames were secured into their openings using screws (when the window surround was made of wood), or metal lugs bolted on to the frame and inserted into the mortar joints of the wall, or nails fixed in the bedding mortar.

To prevent corrosion, steel windows had to be painted and regularly maintained. Galvanising was introduced in 1948 and became mandatory for steel windows in 1956. From then on, a painted finish became a matter of aesthetics rather than necessity. Shortly afterwards extruded aluminium became a more popular choice for window frames, given its light weight, durability and ability to be extruded into very complex sections. The use of mild steel declined.

Distortion and loss where there has been water ponding

Deterioration

Poor maintenance or poor design can quickly lead to moisture collecting at the bottom rails, under cills, or in joints or hinges, leading to rusting. Ungalvanised steel windows are especially susceptible to corrosion, and those with faulty galvanising or mechanical damage may be affected too.

As rust builds up, windows may become difficult to open or close, and thus subjected to rough treatment that causes further damage, including breakage of the glass, more likely. Rust jacking (that is, pressure exerted on surrounding fabric as the corroding metal expands in volume) may eventually distort the steel frame, interfering with the operation of the window and cracking the glass (and also the surrounding fabric). Water running off corroding steel will stain the surrounding building fabric, adding to the general poor perception of steel windows.

Maintenance and repair

Regular painting is essential to prevent corrosion of steel. It is also important to make sure that joints between the frames and the surrounding building fabric are watertight. Maintaining hinges, handles, locks and stays in good working order will help prevent damage from mishandling.

Repairing steel windows may involve addressing distortion, corrosion, losses or missing glass panes. To realign very distorted frames, the glass panes have first to be removed, and sometimes the window has to be taken off site to be straightened using heat. The distorted corroded section may sometimes need to be cut out to relieve the pressure, and the frame re-welded back together.

Superficial corrosion of steel can be simply rubbed down, before applying a zinc-rich metal primer and repainting. Deeper, but non-structural, losses should be raked out as thoroughly as possible, then primed and filled with a suitable metal filler before repainting. In many cases, windows are capable of refurbishment and repair, but where the corrosion loss is so great that the strength of the frame is compromised, the window will need to be replaced. In such cases, finding sections with matching mouldings from current manufacturers can be a problem.

In complex cases, where moisture problems are endemic to the building and removal of the window frame for repair would be difficult and damaging, cathodic protection (which uses electrical potential to transfer corrosion from the steel window to a sacrificial metal anode) may be considered to prevent corrosion of historically significant steel frames.

Replacement glass should be cut about 3mm smaller than the frame, to allow for thermal movement. All old putty and mastic should be removed, and any corrosion treated by cleaning and priming, before the new glass is fitted. The best method of setting in the replacement glass depends on how the pane was fixed in the first place. Putty should be profiled in such a way that water will not be trapped in the frame.

Stow Maries Great War Aerodrome

Stow Maries Great War Aerodrome in Essex has the largest surviving group of Royal Flying

Steel windows in storage, showing the cavetto (curved) moulding

A side view of steel windows in storage, showing assembly detailing

Further reading

Historic England (2012) *Glass and Glazing: practical building conservation series*. London: Routledge

Corps buildings on a first-world-war aerodrome. It saw brief use between 1916 and 1919, and was then abandoned for military purposes. The majority of the first-world-war buildings remain. Most of them are of single-skin brickwork on minimal foundations or footings, with steel-framed windows. Although displaying good levels of craftsmanship, they were not designed to last. Because of their exceptional rarity and architectural interest, all 22 remaining buildings are listed Grade II* (under a single list entry). Although a repair programme is under way, the site remains on Historic England's buildings-at-risk register. More than 100 windows are suffering from corrosion and distortion, and need repair. This is a major issue to make the buildings weather tight.

When conservation work first started on the site about 10 years ago, the metal windows were assumed to be cast iron and the site managers at the time assumed that they were beyond repair. Windows in three of the buildings were replaced, some with cast aluminium and others in new cast iron, none of which have the same moulding profile as the originals.

The trust now managing the site is seeking a more sustainable approach, preserving the historic windows and their detailing, in keeping with the approach applied to the rest of the site and building fabric in general. Earlier this year, Historic England commissioned a survey by Geoff Wallis Conservation to reassess conservation options.

Close inspection showed that the frames are riveted together, and the glazing bars are tenoned through them and riveted over – evidence that they were assembled from individual rolled-steel components, not cast in iron as a single unit as had been previously thought. The sections comprising the fixed frame (including the glazing bars) carry cavetto mouldings, derived from the sections used in Victorian cast-iron windows. The weathering seal is poor, as the mouldings on the fixed frames have not been dressed off where they face the casement: this detail was improved in later windows designs.

The condition survey found that the steel frames and casements were rusting generally, but many sections were capable of repair and could be retained. Where corrosion is most severe (particularly at low level on the fixed frames and on the casements), affected sections will need to be renewed. Several casements are so badly corroded that they must be completely replaced; any serviceable sections will be salvaged and used to repair other casements. All replacement will follow the original moulding profiles and construction methods. The quoted costs for refurbishment and limited replacement using matching sections are lower than for wholesale replacement (with a profile different to the original) quoted for by current windows manufacturers.

This case study illustrates the importance of commissioning the right specialist to survey and assess conservation options, based on an understanding of the original metal frames and their present condition. With the right advice and skilled workmanship, these rare windows can be given a new lease of life.

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