

Timber Windows: Avoiding common failures – window assembly

Failures on developments that incorporate timber windows are increasing. These failures range from failing joint integrity, the presence of drafts and water ingress resulting in damage to internal surfaces.

This article forms one of a series of articles that aim to highlight those common issues and the practices that should be advocated to mitigate their occurrence.

A major cause of failure for timber windows is loss of structural and weatherproofing integrity at joints formed within the frame.

Provision of information

A full set of design drawings and specifications shall be made available to the warranty provider and all other interested parties prior to the production of any windows, doors or door sets.

The following should be available:

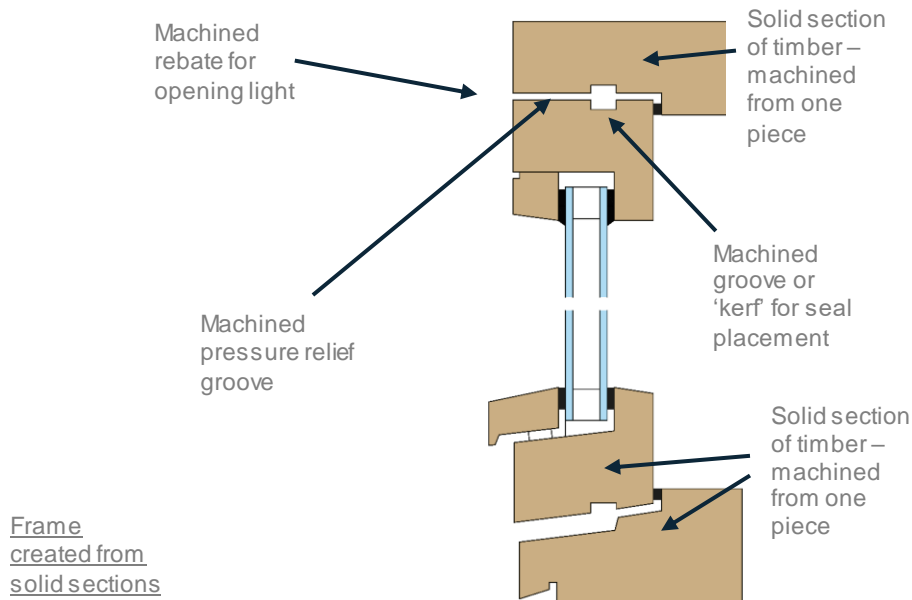
- A full specification for review for the frame timber species and production, the glazing, weather proofing, ironmongery and finishes in order to prove and demonstrate performance as set out by applicable British and European standards.
- Supporting evidence of any testing carried out to:
 - BS6375-1, in relation to testing the air permeability, water tightness and wind resistance for windows and external doors. This demonstrates the weather performance of the product you have tested and also is a requirement in supporting any Energy Rating given for thermal performance.
 - BS6375-2, in relation to the performance requirements for the operation and strength of glazed, fully finished windows. This includes tests to measure the level of deflection in frame components when subjected to opening and closing cycles.
- Any product certification or manufacturers accreditations that support the proposed system, such as membership to any British Woodworking Federation Groups such as 'The Wood Window Alliance'.

It should be noted that where supporting test evidence or certifications/accreditations are not available e.g. bespoke window designs produced by small joinery workshops, a full specification for the windows shall be made available for review before production commences.

On-site testing at completion of the installation will be required. For guidance on site testing for water penetration' reference should be made to CWCT test methods e.g. Technical Note No. 41 for guidance on site hose testing methodology.

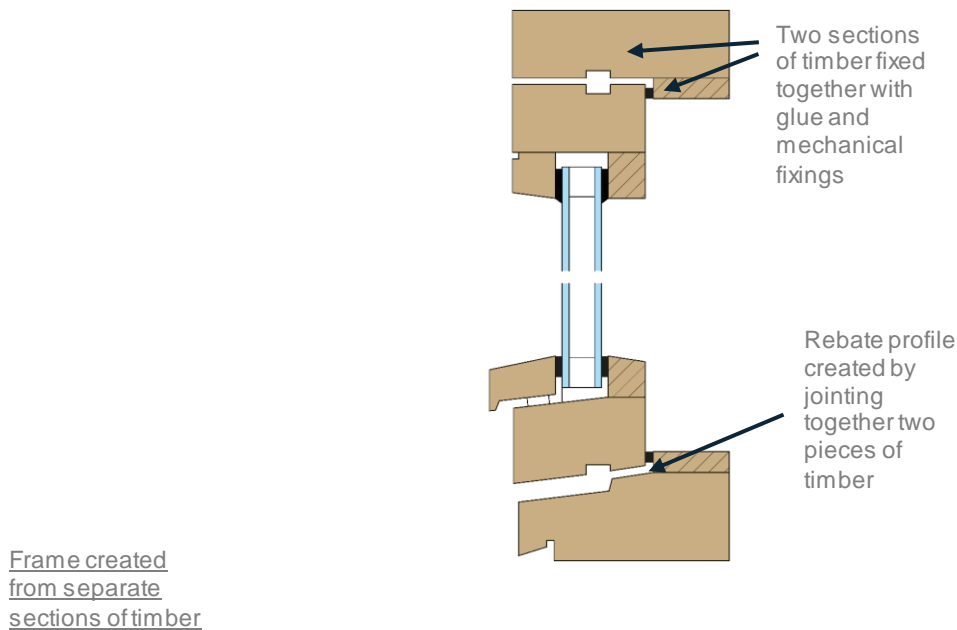
Timber framed windows – machined and manufactured timber frame sections

'Machined' timber frame sections are traditionally produced from solid sections of timber. A square section of timber is taken, and portions removed to give it a functional shape or 'profile'. The removal of an area of timber from the the solid section is known as creating a 'rebate' and this then can receive glazing or opposing rebates are used to facilitate opening portions of the window, arranged and aligned to provide weather protection when the opening light is closed.



Common failures due to poorly constructed timber frame sections

Increasingly suppliers of framing sections are using several sections of timber bonded together using high performance adhesives, and these can be referred to as 'manufactured' timber frame sections. The process can be viewed as a means to reduce waste and improve dimensional stability by orientating grain to reduce the opportunity for risk of twist, shrinkage and warping.



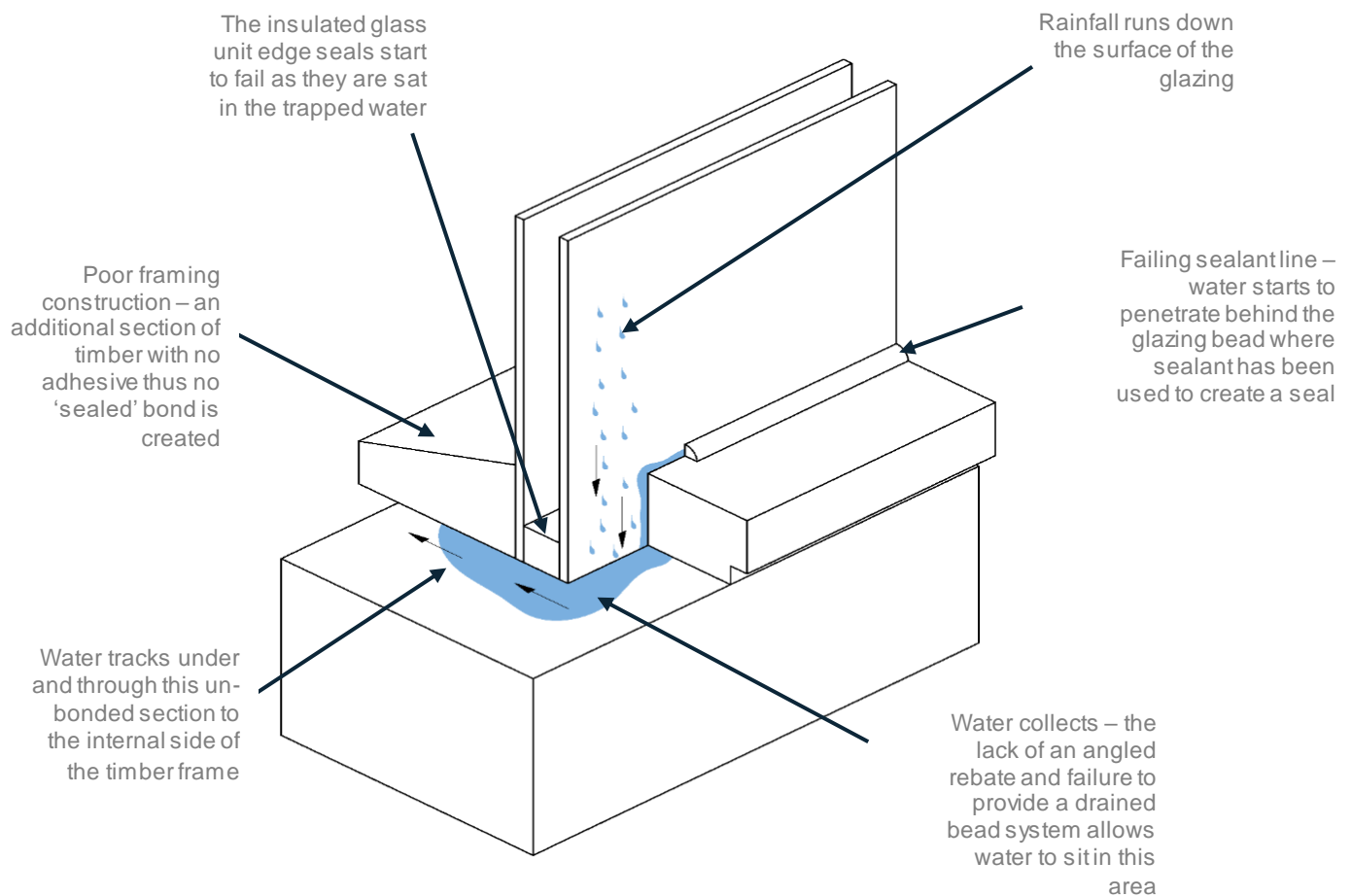
The practice of 'manufacturing' timber frame sections in uncontrolled environments e.g. off-site in workshops not using the correct methodology and machinery, or 'ad-hoc' carpentry window 'build-ups' being created on-site, is resulting in timber window failures in service.

Investigations into these failures has revealed that the joints created between timbers are:

- Incorrectly positioned in relation to exposure to weather (generally considered as the first 40mm from the external face of the frame),
- Not formed in keeping with good carpentry practices or not bonded with adhesive - most are simply pinned or nailed into position. Even where adhesives have been used, they are often incorrect in their specification and do not perform as required.

As a result, any water collecting within the rebate section of the frame freely passes between timber sections and appears on the internal face of the timber frame as staining or as physical water deposits on window boards and adjacent surfaces.

Failure of the frame - a combination of defects



Timber framed windows – structural joints

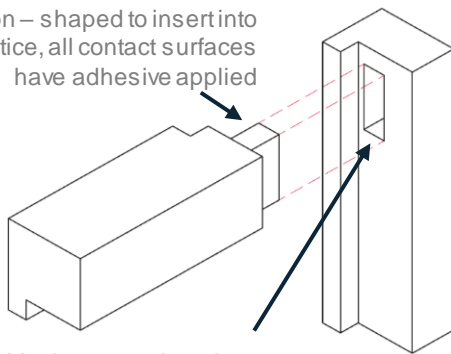
Frame joints

Traditionally the various structural joints found within timber frame manufacture have been those created using intersecting elements, adhesive and nails or screws. Typically, two that are encountered in most situations are the mortice and tenon joint and the comb joint.

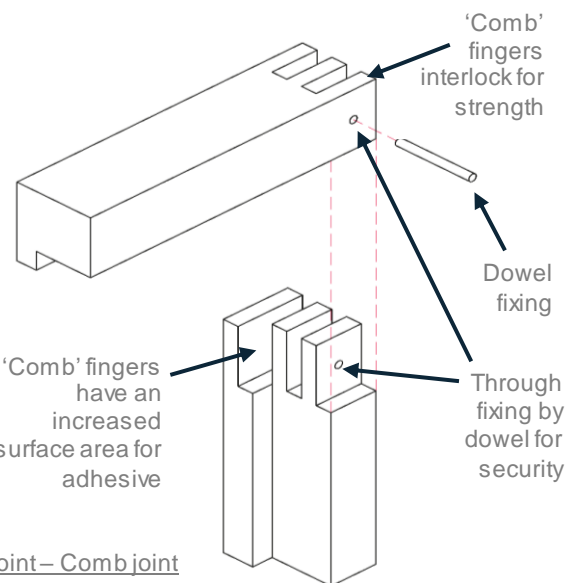
It is largely recognised that their strength is not only their intersecting nature, but that they also provide a large surface area for the application of adhesive and also have the joint secured with non-ferrous screws, nails or star dowels whilst glue sets.

Framing joint – Mortice and Tenon

Tenon – shaped to insert into mortice, all contact surfaces have adhesive applied



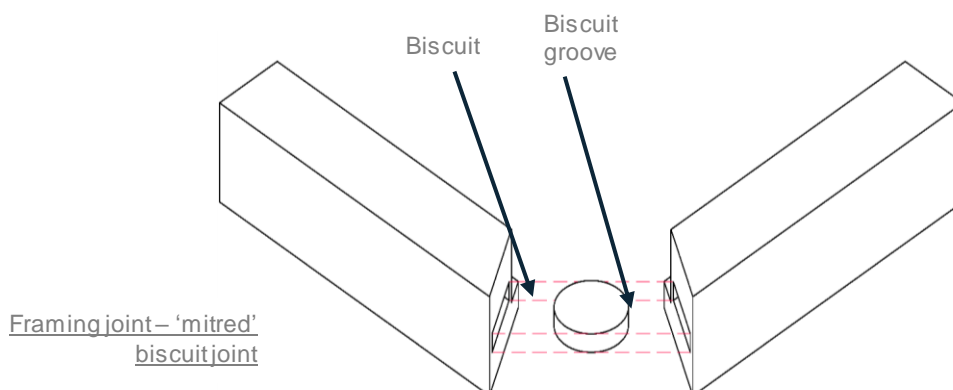
Mortice – receives the tenon.
Joint is clamped together and mechanically fixed whilst adhesive sets



Framing joint – Comb joint

Increasingly however the use of the timber frame joints that are created differently to those with intersecting elements are now becoming more regular. This method uses profile scribed butt joints or mitres, to create the joint.

A 'biscuit' (biscuits are pieces of pre-made oval shaped timber) and adhesive completes the joint. The biscuit increases the surface area for adhesive, and creates an intersecting part to the joint.



Framing joint – 'mitred' biscuit joint

Common failures in poorly constructed frame joints

Opening of structural joints

Timber frames when completed do not receive surface treatments and finishes in the factory. They are then left open to the elements during the build process without adequate protection, and we are experiencing resultant failure in service.

Moisture uptake causes local stress and swelling in the exposed glued joints, and these stresses 'open up' joints, leading to irrecoverable paths for moisture. Whilst applying timber filling compounds can provide aesthetical solutions, it must be recognised that the original weather resisting capability of the joint and frame as designed and assembled is adversely affected.

Failures can range from water staining at the joints on the inside face of the window to a physical failure of the joint in service e.g. rotting end grain, broken adhesive bonds.

Loss of performance of joint adhesive or incorrect specification of adhesive

Adhesive bonding is a critical part of frame joint assembly. Increasingly we are seeing failures in joint strength which suggests joints are either not being glued correctly or are using an incorrect glue specification. It should also be recognised that the above issues of lack of protection to completed work may be adding to the issue and exposing adhesives to situations beyond their tested performance.

Glue specification should follow the guidance of BS EN 12765 and BS EN 204 to determine its suitability. As window construction is exposed to the weather, a durability class of C4/D4 would be expected for the adhesive, but the completed assembly must be protected by an adequate surface coating for the adhesive to remain functional.

The management of quality

When subject to a suitable specification and manufactured within a controlled factory environment with appropriate levels of quality control, it must be recognised that timber framed windows and doors can deliver a robust and reliable frame in service.

A means to demonstrate that a quality management system is in place for manufacturing operations is to have a clearly defined set of processes with supporting documentation that proves and demonstrates an assurance that manufacturers are creating products in accordance with applicable pre-defined quality standards. Typically, this is in the form of accreditation given under such schemes as ISO 9001.

However where this is not the case, or where the timber frames are being subjected to conditions on site during the build that are outside their tested performance, it potentially results in defects arising early on and often results in an increase in the likelihood of a Warranty claim in service.

Warranty Stance

To ensure that timber windows are not subject to premature failure and moisture ingress it is essential that certain safeguards are in place.

For the purpose of warranty:

- Ensure that full specifications have been made available – in the event of a review as part of the risk management process, they should demonstrate how the aforementioned failure items have been avoided.
- Timber used in the manufacture of window and doors should be a species classified as suitable in BS EN 942 and preservative treated; if not, use a moderately durable species or better (sapwood excluded). Guidance on selection is provided in TRADA Wood Information Sheets 3.10 and 4.16.
- Timber frame sections should preferably be 'machined' from a solid piece of timber. Where timber frame sections are 'manufactured', the work should be carried out in a factory controlled environment, with appropriate quality assurance (QA) procedures.

These procedures must be part of a recognised quality management system of work – see 'The management of quality' section of this article.

Note: The Warranty surveyor, at their discretion, may ask for evidence of any quality management system in place at the place of manufacture for the workshop or manufacturing facility producing the timber components (e.g. ISO 9001 accreditation).

- As a result of the above - **on site frame 'build-ups' must be avoided.**
- Completed timber frames should be supported by relevant testing – please refer to the 'Provision of Information' section at the start of this article for details.
- Timber windows should be supplied to site fully finished and fully glazed to minimise the opportunity for moisture ingress to affect any part of the window during the build stage. Where this is not the case, the windows should be protected using appropriate weather resistant sheeting until paint finishes are applied.

Every care was taken to ensure the information in this article was correct at the time of publication (October 2022). Guidance provided does not replace the reader's professional judgement and any construction project should comply with the relevant Building Regulations or applicable technical standards. For the most up to date Premier Guarantee technical guidance please refer to your Risk Management Surveyor and the latest version of the [Premier Guarantee Technical Manual](#).

Ref: TS-3329