



Section 7

Cross Laminated Timber Quality Assurance



Make it better

Red Stag CLT Design Guide V1.4
July 2024





26. Red Stag Routine EWP Quality Assurance

Red Stag has a comprehensive Quality Assurance (QA) programme for its manufacturing processes. The QA system is supported by Red Stag Standard Operating Procedures (SOP) and qualified by the programmes routine testing.

26.1 Finger Joint Quality Assurance

Each production batch should have no less than three FJ tests completed. The specimens should be drawn as evenly as practically possible over the production batch. If a production batch extends across multiple shifts, no less than three specimens should be drawn from each production shift.

Red Stag has invested in high quality testing equipment to confirm the quality of FJ. The testing equipment includes a high-capacity hydraulic press with speed-controlled ram for standard testing, calibrated load cell and associated digital display to show the applied load in kN to two decimal places (refer to *Figure 83*).

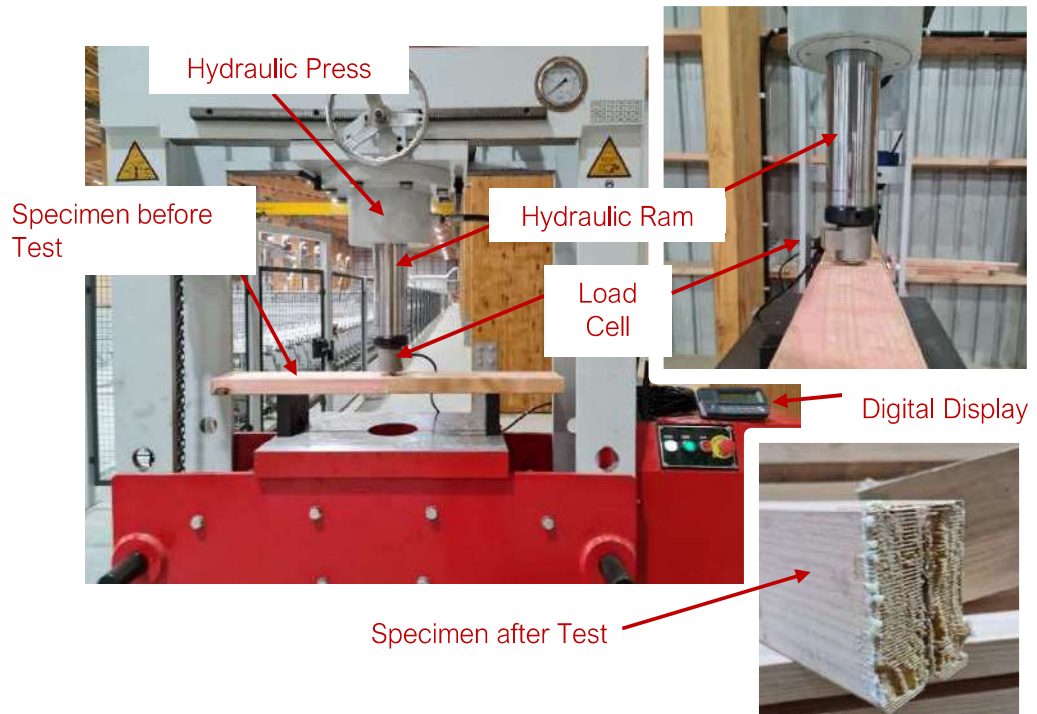


Figure 83: FJ test set-up.



26.1.1 Red Stag Finger Joint Test Report

Red Stag will maintain a documented QA programme to ensure conformance with the AS 5068:2006 and AS/NZS 1491:1996 standard. An example of the Red Stag test report for FJ testing is shown in *Figure 84*.


			Finger Joint Test Report		
			Project No:		
Date of Test		Billet No:			Test No.:
Dimension of specimen		Width		Thickness	
Species of Timber		Radiata Pine			
Timber Treatment		H1.2			
Moisture Content					
Type of adhesive		Henkel Purbond HB			
Test method		AS/NZS 1491.1996			
Test Result (kN)				MOR	
Failure Mode Criteria					
Relevant Test Observation Notes:					
Tester Name:					
Tester Signature:					
Red Stag Wood Solutions Ltd. 10/06/2022 10:07					

Figure 84: Example of the Red Stag FJ test report.

26.2 Delamination Test

To confirm the lamination bond quality of EWP, Red Stag has a comprehensive testing procedure for sampling, testing, and documenting.

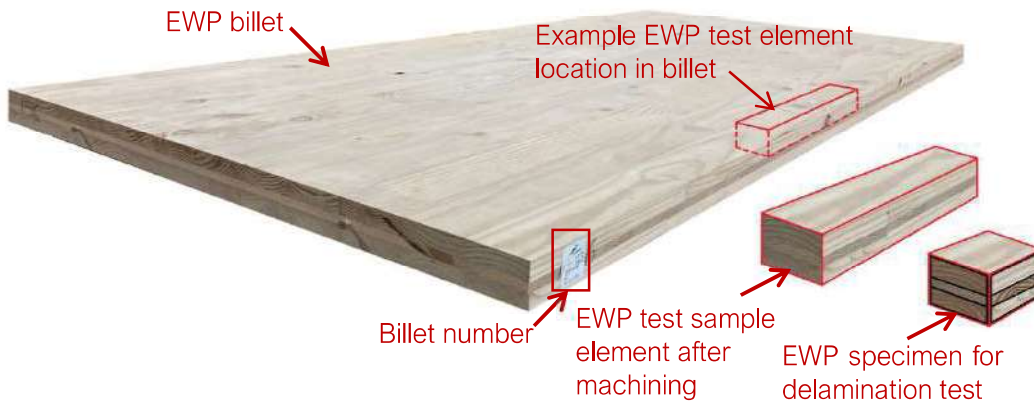


Figure 85: EWP delamination test specimen preparation.



Red Stag has invested in highly advanced automated delamination testing technology. This fully automated system can perform delamination test to demonstrate the integrity of the adhesive bond by long term weathering simulation through a short-term watering and drying process for EWP samples.

The testing equipment comprises of a pressure vessel and drying chamber. The vessel has a pressure rating in excess of 600 kPa positive pressure and 85 kPa under vacuum. The system has a pressure pump and venturi for applying positive and negative pressure respectively up to the rating of the vessel. The drying chamber circulates heated air at a velocity range of 2 - 3 m/s, with a temperature range of 65 - 75 °C and a relative humidity range from 8 - 10 % (Refer to the *Figure 86*).

The test equipment has the capability to be programmed automatically for wide range of testing standards including AS/NZS 1328.1 and BS EN 16351:2021.



Figure 86: Delamination testing equipment.

26.2.1. Red Stag Delamination Test Report

Red Stag maintain a documented QA programme to ensure conformance with AS/NZS 1328.1 and the Annex A of BS EN 16351:2021 standards. The following items are reported:

- a) Reference to the European Standard.
- b) Date of the test.
- c) Identification of test pieces and EWP billet/member from which the sample was taken.



- d) Preservative treatment (if relevant).
- e) Species of timber.
- f) Type of adhesive and trade name.
- g) Effective proportion of resin and hardener/reactive agent (if relevant).
- h) Sizes of the test piece.
- i) Linear measurement of all glue lines.
- j) The total delamination length and the maximum delamination length.
- k) Any relevant observation linked to the testing.
- l) Name and signature of the person responsible for the testing.



27. Red Stag Third Part EWP Quality Testing

27.1 Overview

In addition to internal routine EWP quality assurance testing, Red Stag has a third party testing programme for its manufactured EWP. Red Stag has a routine monthly and annual testing plan to confirm the quality of the bonding in structural FJ, and EWP elements. In parallel, Red Stag conducts large scale testing of its EWP by certified third parties such as SCION^[8] on an annual basisⁱⁱ to ensure the mechanical and structural performance of Red Stag EWP (refer to *Figure 87* and *Figure 88*).



Figure 87: SCION Research Centre. SCION is a New Zealand Crown Research Institute (CRI) that specialises in research, science and technology development for the forestry, wood product, wood-derived materials, and other biomaterial sectors.



Figure 88: BRANZ Research Campus. BRANZ is an independent research organisation that uses an impartial evidence-based approach to improving the performance of the New Zealand building systems.

ⁱⁱ Testing is targeted to be completed annually in the first quarter of each year with SCION or an equivalent third party subject to their other testing commitments.



28.1 EWP Mechanical Performance Testing

Red Stag manufactured EWP elements and associated feedstock have been tested by professional, certified third parties to ensure the durability, mechanical strength, and fire resistance. As shown in *Figure 89* to *Figure 91*, a series of large-scale experimental tests have been conducted on Red Stag CLT products to verify the quality and performance. Destructive large-scale four-point bending tests conducted by SCION confirm that Red Stag CLT panels exceed the stiffness and strength requirements to carry applied structural loads (refer to *Figure 89*). Testing on short, intermediate, and long-span CLT panels show exceptional structural performance under shear force, bending moment, and combination of the two.



Figure 89: Large scale mechanical testing conducted by SCION; (a) Long span testing; (b) Medium span testing; (c) Short span testing.



28.2 EWP Glue Bond Performance Testing

Red Stag EWP glue bond quality and durability has been assessed by delamination testing with third-party specialists. Testing is being primarily conducted in the Red Stag laboratory, with supplementary parallel spot testing completed by third parties at no less than one sample per week (refer to *Figure 90*). Third-party testing confirms an average delamination percentage under the standard allowable limit, confirming the glue line bonds are sufficiently durable. In addition to the delamination testing, repeated large-scale bending tests conducted by SCION verify that there are no adverse issues associated with glue line performance. No glue line failure or board separation was observed during all deflection testing.

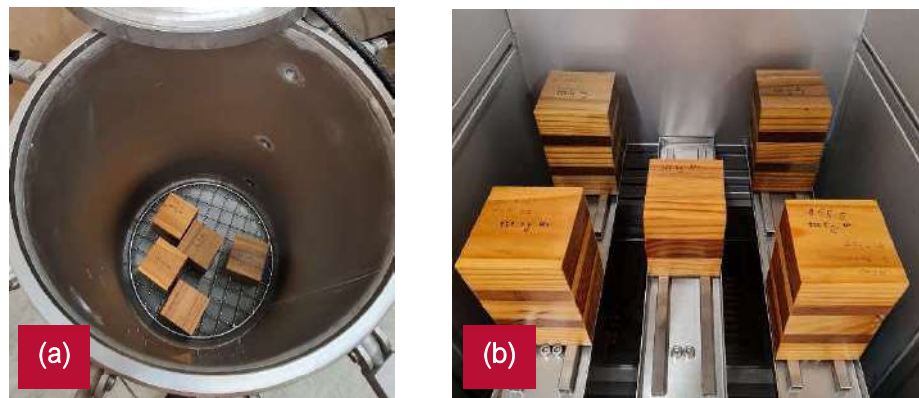


Figure 90: Delamination testing equipment; a) EWP specimens in pressure vessel; b) EWP specimens in drying chamber.

28.3 EWP Fire Performance Testing

The Fire Code is formulated to permit time for occupants to safely leave a burning building before structural collapse or succumbing to heat or smoke inhalation. The code stipulates that the safe evacuation period of up to 60 minutes in New Zealand will cover the majority of building types and uses. Large-scale CLT panel fire testing has been conducted by Red Stag to determine the overall fire resistance and fire performance of panels under structural loads (Refer to *Figure 91*). CLT test specimens were installed in a furnace to investigate parameters such as the structural performance during a fire event, temperature profile and deflection. BRANZ fire testing confirmed no structural, integrity or instability failure after more than 60 minutes at 900 degrees Celsius.



Figure 91: Large-scale fire testing on Red Stag EWP conducted by BRANZ; (a) Red Stag CLT floor test specimen after fire testing; (b) Red Stag CLT wall test specimen before fire testing.



29. Reports, Assessments and Guides

Red Stag has wide range of documents to support projects based the test reports and calculations. Supporting documents include but are not limited to: Red Stag Design Guide, Red Stag Project Guide, Red Stag Environmental Product Declaration, and Red Stag Regulatory Fire Information Report 1.1.

