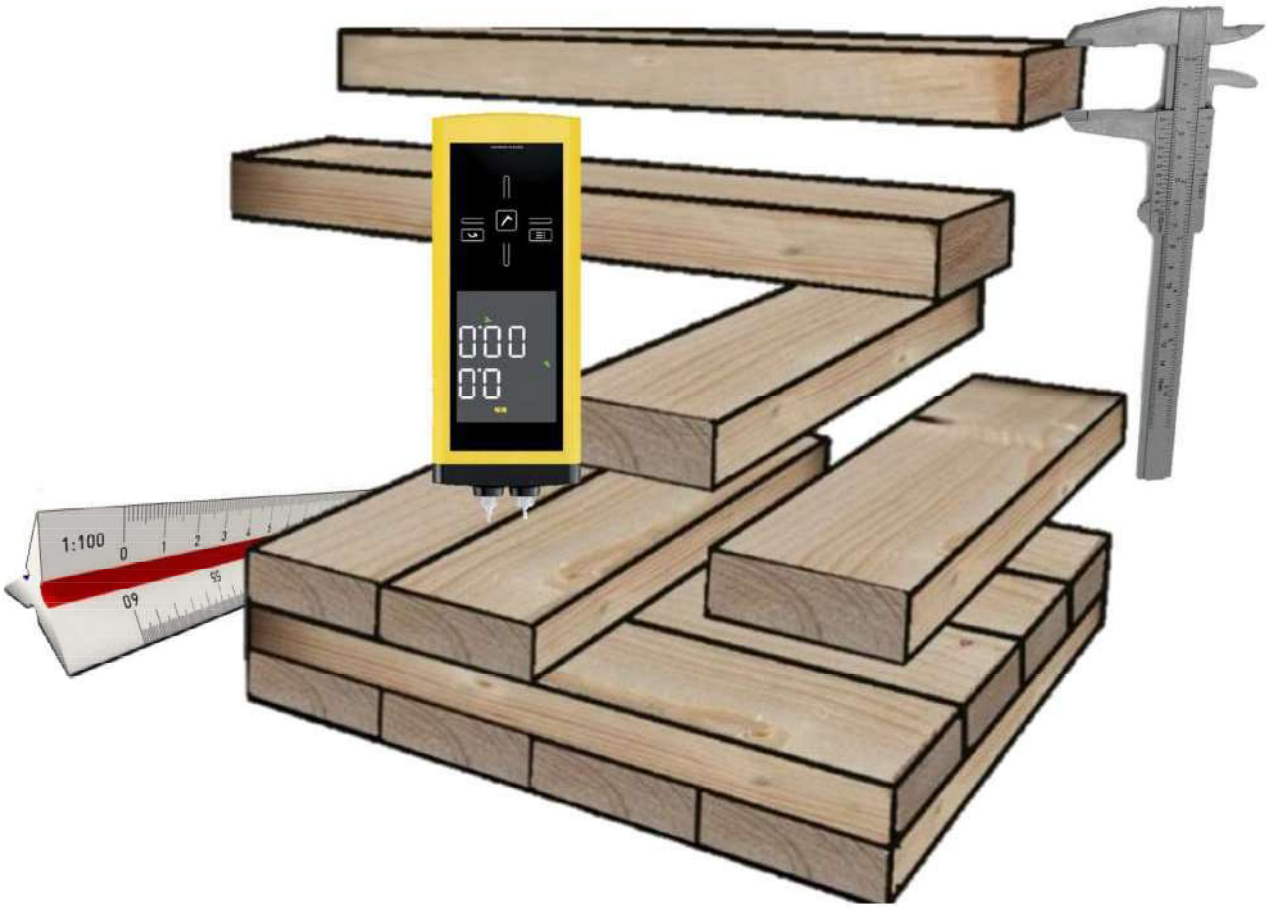
Section 12

Red Stag Engineered Wood Product Specifications



48. Product Dimensions

48.1 Red Stag Cross Laminated Timber Dimensions

Red Stag can manufacture some of the largest Cross Laminated Timber (CLT) billets in the world up to 16.5 x 4.5 x 0.42 m (Length × Width × Depth). Red Stag CLT panels are typically in three to eleven layers, with thicknesses ranging from approximately 60 mm to 420 mm depending on the structural requirements (refer to *Figure 10*). Red Stag may have the opportunity to manufacture slightly larger if absolutely required for a project; however, this needs to be considered in conjunction with transportation restrictions. Panels above 3.0 m in width will generally require piloting (3.1 m is the maximum width on New Zealand roads without a pilot vehicle and the width includes all tie downs and covers). Similarly, loads longer than 14 m also generally require the support of pilot vehicle(s). Wide and overlength loads are more challenging when needing to cross water ways such as the Cook Straight.

48.2 Red Stag Glue Laminated Timber Dimensions

Red Stag has refined its alternative solution for the manufacture and supply of Glue Laminated Timber (GLT). Red Stag GLT_b will primarily focus on a bricked vertical face laminated lamella configuration (refer to *Figure 138b*). To accommodate the light timber framed market, Red Stag predominantly manufacture lintels and beams to a GL8 specification using feedstock with a Modulus of Elasticity (MoE) of 8 GPa. The maximum length for GLT_b members in the configuration illustrated in *Figure 138* is currently 17 m. Bricked GLT_b elements will be manufactured in similar thicknesses to CLT, with the addition of 88 ± 1 mm width and typically in standard structural timber/Laminated Veneer Lumber (LVL) depths (height). To support larger portal and beam commercial structures, Red Stag will also be releasing a standard portfolio of beam sizes (height and width), and provide the opportunity for beams as thick as 420 mm. In essence, beams can be as large as 2.2 m wide x 0.42 m thick x 17 m long.

Figure 138: GLT 3D views; a) GLT horizontal brick layout; b) GLT vertical brick layout.

49. Product Tolerances

All Red Stag EWPs are manufactured to the same tolerances regardless of the configuration (i.e. CLT or GLT). A summary of the Red Stag EWP tolerances at the point of machining is summarised in *Table 54*.

Table 54: Red Stag EWP dimensional tolerances.

Item	**Tolerance**
Length	The greater of ± 3 mm, or ± 0.4 mm per
Width (CLT; GLT)	± 3 mm; ± 1.5 mm
Hypotenuse	The greater of ± 4 mm, or ± 0.4 mm per
Thickness Overall	The greater of ± 2 mm, or ± 0.4 mm per layer.
Lap Depth	± 2 mm
Lap Width	± 2.5 mm
Position and Size of Penetrations & Machining, etc	± 3 mm
Moisture Level in Lamella at the Point of	14% +/- 4% (Corrected for Treatment)[1]

[1] Boron treatment causes both probe and capacitance moisture meters to read higher than the actual moisture content due to the salts in the treatment chemicals. Please refer to the Red Stag Timber web site for correlation tables (www.redstagtimber.co.nz).

The lamella (boards) making up each layer of Red Stag EWP are not edge glued, leaving the joints between lamella free to expand and contract in response to changes in temperature and relative humidity. This format provides a natural humidity buffer for comfortable occupation and reduces the frequency of surface checking (longitudinal cracks in the timber grain) within individual boards in each lamella.

Regardless of the grade (standard or visual) of EWP, a slight gap may exist between lamella in each layer. Due to the hygroscopic properties of timber, this board gap may increase as the timber dries and may reduce when the Environmental Moisture Content (EMC) increases. Refer to *Figure 139*.

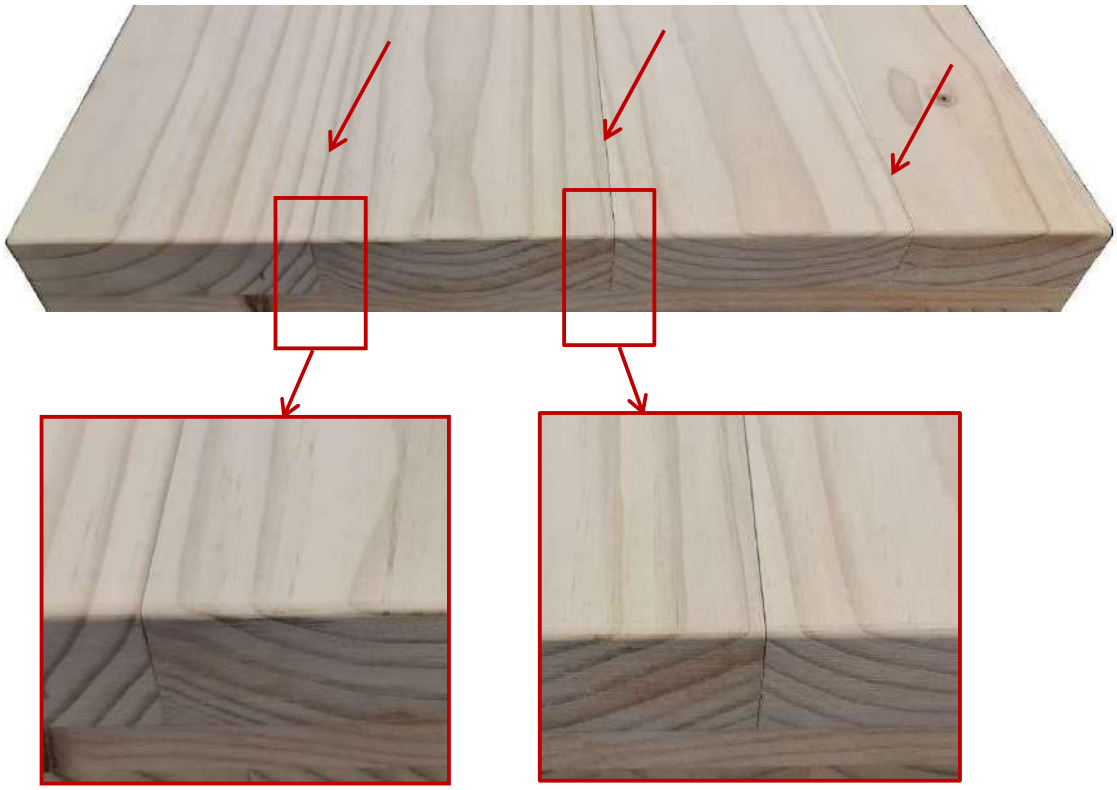


Figure 139: Gaps between lamella in each layer of Red Stag EWP elements.

Red Stag EWP lamella are Finger Jointed (FJ) across the face of each board with a 7 mm finger that is visible. The finger joints are bonded using a relatively clear Polyurethane Reactive adhesive (PUR). Typically, FJ are no closer than 0.8 m apart, and generally separated between 0.8 – 4.8 m. Examples of vertical and horizontal finger joints are demonstrated in *Figure 140*. Red Stag is reviewing the FJ and grading solutions that may

include a mixed mode of FJ types. Note changes in FJ type are not typically expected to be inside 4.6 m.

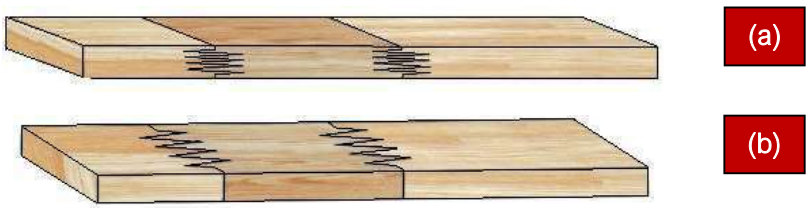


Figure 140: Red Stag EWP elements; a) Horizontal FJ, b) Vertical FJ.

50.1 Standard (Non-Visual) Grade

Red Stag's standard grade is a cost-effective option for structural applications. Standard grade has been developed for applications where the surface will not be seen or where the Client is comfortable with larger knots and visible defects such as wane, markings, loose knots, inclusions, resin, face and edge skip, etc. As standard grade is effectively a non-visual grade, no filling, aesthetic repairs, sanding or finishing is completed in factory (refer to *Figure 141*).

The sole focus for standard grade EWP is its structural performance. Red Stag Timber control the stiffness of all incoming feedstock (boards) to a required MoE (GPa), confirming the performance of each board, including any defects (e.g. knots, etc) to ensure all feedstock conforms with the specified structural requirements.

Regardless of the grade (standard or visual), Red Stag completes secondary grading on all incoming boards into the front end of the EWP remanufacturing line1. For standard grade, the focus is only on defecting sections of the incoming boards that could adversely impact the laminating process (e.g. loose knots, inclusions with bark or fibrous debris, larger ratio of wane/reduction in face gluing surface area, etc), or the material handling of the lamella through the line (larger knots or splits that may cause the lamella to break while propagating through the remanufacturing line to the pressing areas).

In standard grade, glue "squeeze through" may be visible between boards or through knots and visual defects. Knot voids where loose knots have been removed or have dropped out, are not uncommon in standard grade EWP.

Figure 141: Example of surface on standard grade EWP; a) H1.2 Treatment; b) H3.2 Treatment.

50.1.1 Standard (Non-Visual) Grade Common Properties

Figure 142a to

Figure 142g illustrate common grading inclusions in standard grade EWP. Represented dimensions in the figures are examples only and should be considered in addition to the details provided in section 50.1 above.

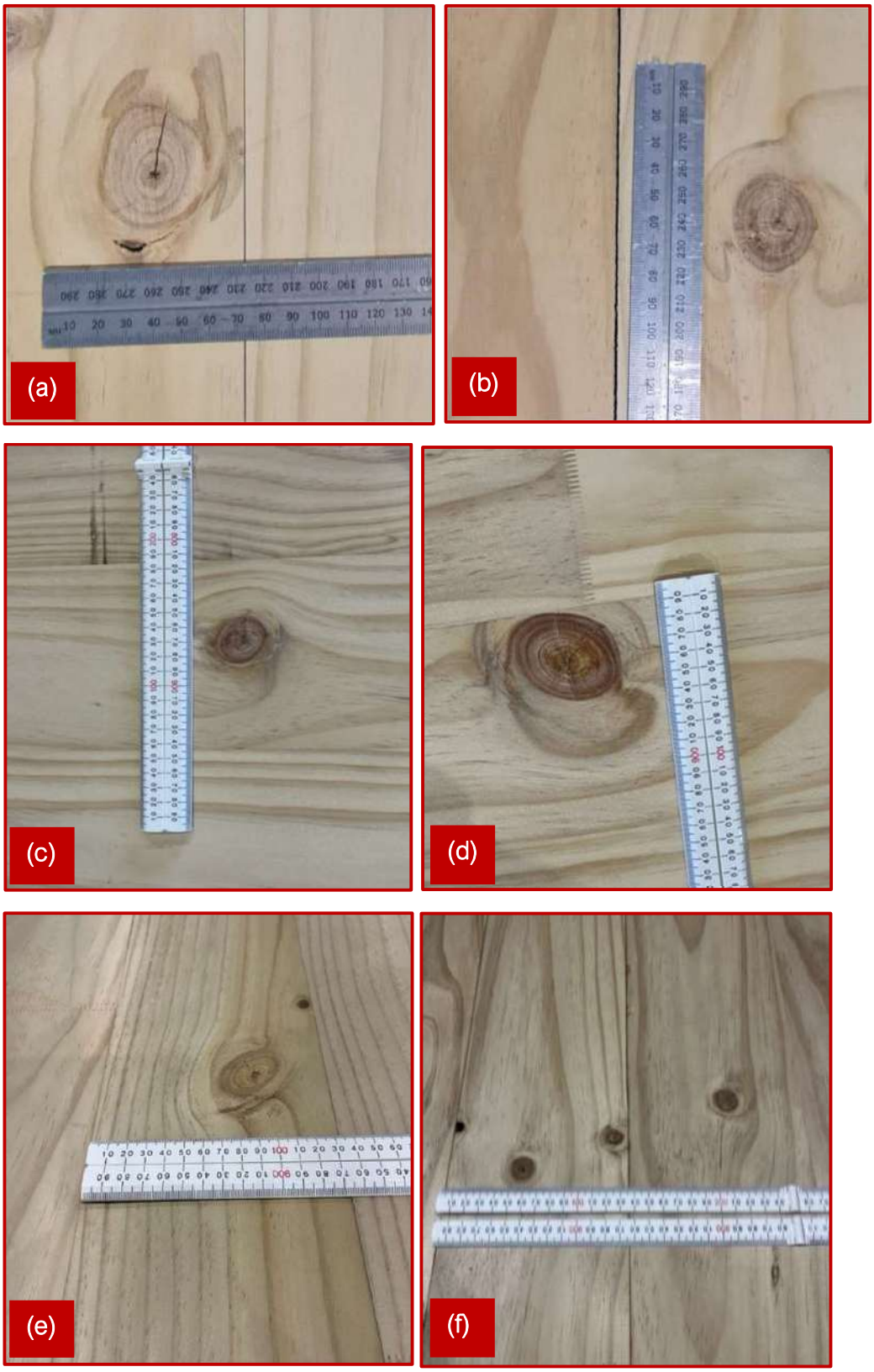

(a)
(b)
(c)
(d)
(e)
(f)

Figure 142: Example of knots, wane and knot voids in Standard (Non-Visual) Grade of CLT panels.

50.2 Visual Grade

Visual grade EWP has the same structural properties as standard grade. The only difference is the improved aesthetics generated by a higher aesthetic grading criterion. Visual grading is defined into three categories (refer to *Figure 143*):

1. Visual F1: One visual face only.
2. Visual F2: Two visual faces only.
3. Visual All: All layers are visually graded. Typically, only utilised for elements that have exposed processing through the cross section such as stairs.

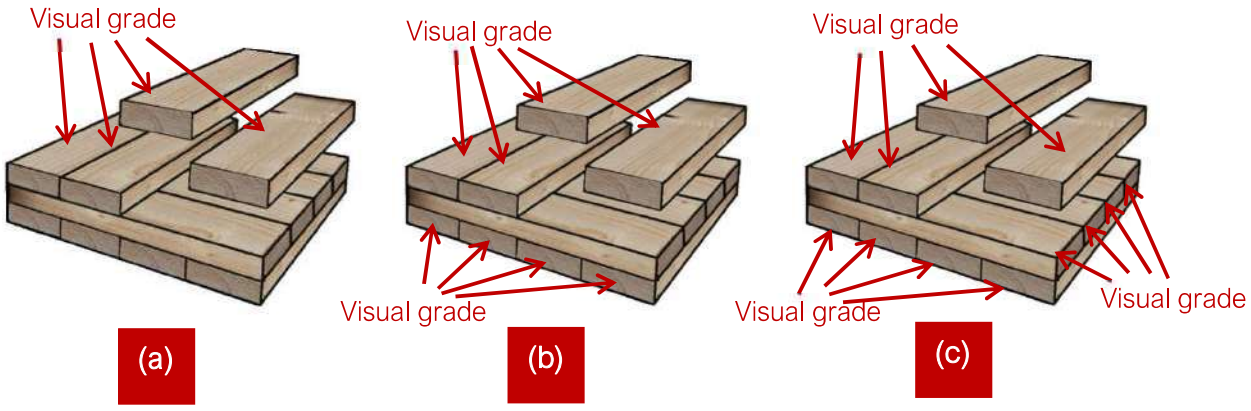


Figure 143: Visual grade options; a) Visual F1, b) Visual F2, c) Visual All.

The details on the higher grading criteria associated with a visual grade are

detailed in

Figure 142a to

Figure 142g, and summarised as follows:

- Larger knots will be removed so that their surface area on the visible face is generally no greater than 25 cm2.
- Free of resin as much as practically possible.
- Free of planer skip.
- Little to no wane, typically no more than 4 mm bevel on each lamella edge
- Lose knots and knot voids generally no greater than 10 cm2.

Filling and sanding is not included in visual grade EWP as a default service. The option exists for filling and sanding EWP elements; however, this needs to be specified, quoted, and agreed in advance with Red Stag. Typically the recommendation would be to do this on site, so that finishing can be completed once the building is fully enclose, water tight and completed with finishing trades.

If filling and sanding services are agreed for the element(s), Red Stag will use its default filler colour and type unless specifically advised by the Client and agreed by Red Stag (the specifics must be including in the Red Stag quotation for this option to be processed). Examples of visually graded EWP billets are shown in *Figure 144*.

Figure 144: EWP Visual Grade Surface; a) Standard Grade Surface; a) Visual Grade Surface.

50.3 Lamella Feedstock

Unless specified by the Client and accepted in the Red Stag order confirmation, all lamella widths will be based on the available feedstock at the time of manufacture. The feedstock lamella widths may vary between panels in a project but will not vary in the face of each billet. Please note that slight variances in the finished lamella widths will exist due to the automated software management of the remanufacturing process by the supplier's Prolam software (refer to *Section 49*).

As at the time of this document being created, the primary incoming feedstock board width at Red Stag (pre-planed) is 140x45 mm; however can technically range between 90 – 305 mm in width. Based on the dimensions of the raw billet, the Red Stag remanufacturing line Prolam control software will automatically plane all lamella in each layer of a billet to the same width to ensure the overall billet dimensions are obtained via a whole number of boards (all boards in the layer produced to a uniform width within tolerances).

If the finished gauge lamella width is particularly important for a Client, they must specify this at the onset of the project, and have it agreed to in writing in advance and specifically referenced in the Red Stag quotation. Tolerances of no less than ± 4 mm in feedstock width will still exist due to the automation of the manufacturing software to customise the lamella width with the overall billet width.

For standard grade billets, unless there is a specific fixing detail that requires a board width specification, all lamella will have a default feedstock width.

Please note that Red Stag conducted a series of tests with Scion to determine the impact on board width to thickness on the rolling shear performance in EWP panels. The results confirmed that a lamella width to thickness ratio of 2:1 still performed in excess of the design criteria for Red Stag CLT (over 1.6 MPa in testing).

50.4 Treatment

Red Stag treat all EWP feedstock to a minimum of H1.2 (Boron). H1.2 treatment is suitable for the majority of EWP applications; however, the option also exists for H3.2 (Copper Chromium Arsenic (CCA)) treatment in applications that have higher risk of exposure to moisture. It is essential that Clients refer to the Building Code and the project design specifications to confirm the correct treatment solution is selected for each application and EWP element.

EWP elements must be manufactured with the same treatment solution throughout the cross section (the opportunity does not exist to treat different layers with alternate treatment options).

50.4.1 H1.2 Boron

Boron is a natural element that is used to support the preservation of timber. Boron is frequently added to soil to lift the nutrient uptake and human dietary supplements to improve health and wellbeing.

Typically boron treatment has a light fast pink dye added to illustrate the presence of treatment. As Red Stag provides visual grade options, investment has been made in clear boron treatment infrastructure. The

clear boron solution ensures the performance of all treated feedstock (raw feedstock) adheres to the New Zealand NZS3640:2003 (Chemical preservation of round and sawn timber) standard.

Based on clear Boron feedstock being used, Clients should not see any tangible aesthetic difference between Red Stag's H1.2 treated EWP and untreated alternates. Examples of Red Stag EWP with traditional dyed H1.2 and clear H1.2 treatments are shown in *Figure 145*.

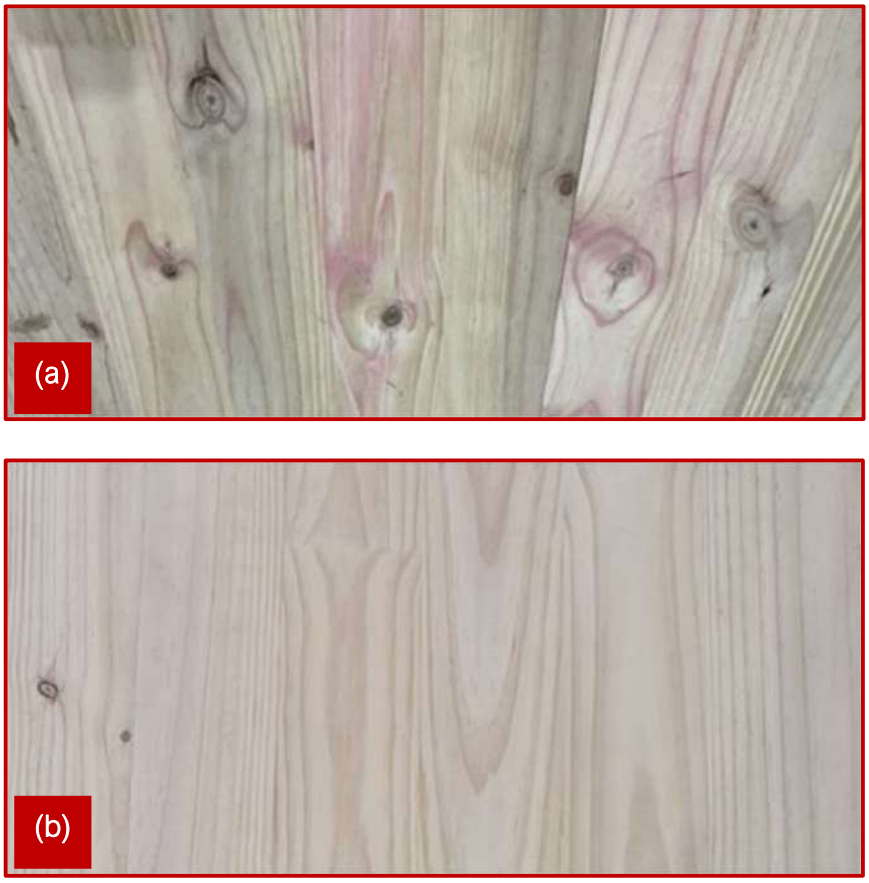


Figure 145: Red Stag H1.2 treated EWP panels: a) Traditional pink dyed H1.2 treatment; b) Clear H1.2 Treatment.

50.4.2 H3.2 CCA

Red Stag also provides the option to treat to a H3.2 level for applications where there is a higher risk of exposure to moisture.

Due to the chemical composition of H3.2 treatment (Copper, Chromium and Arsenic), the finished EWP will have a slightly green appearance in the timber (refer to *Figure 146*).

Figure 146: Red Stag H3.2 treated EWP panels generating a slight green tinge; a) Open View; b) Close View.