

QUALITY REQUIREMENTS FOR LOG BUILDINGS

Keywords: log building, quality requirements

This guideline presents quality requirements for prefabricated log houses and the components employed therein.

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1 SCOPE OF APPLICATION

The quality principles presented in this guideline are applicable to prefabricated detached log houses and other log buildings intended for continuous round-the-year use, as well as the components employed therein. The principles are also to be observed in connection with log buildings intended for part-time use, where applicable.

2 TERMINOLOGY

The following terminology is used in this standard.

A log is a solid building material with a thickness of at least 68 mm, produced by industrial planing or lathing and intended for use primarily in wall structures. Solid profiled logs are manufactured from at least 75 mm thick timber. Usually the top and bottom surfaces of the overlapping logs are shaped to fit each other by tonguing and grooving. In the ends and in the middle of a log are notch jointings and other processings, which enable the log building assemblage. Logs can be lengthened by finger jointing even though the cross-section is solid wood.

A rectangular log is shown in Figure 1. Logs may be tongued and grooved.

A round log is shown in Figure 2. It is round or nearly round in cross-section.

A laminated (glued) log (Figure 3) is glued together from two or more pieces, with either a vertical, horizontal or cross seams.

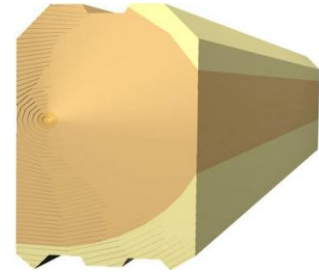


Figure 1
Example of a rectangular log profile

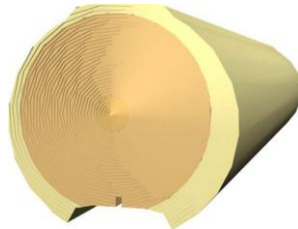


Figure 2
Example of a round log profile

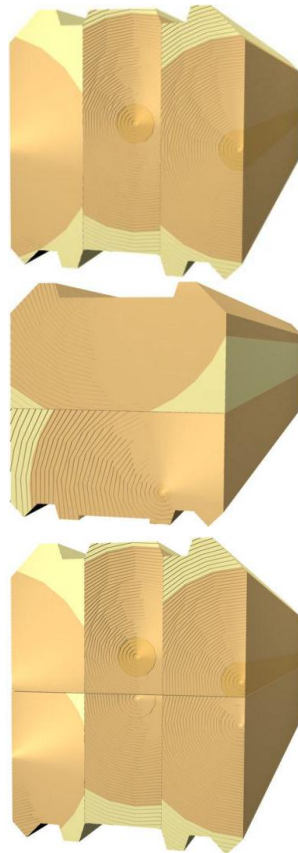


Figure 3
Example of a glued log profile (vertical and horizontal)

3. THE FRAME AND ASSOCIATED STRUCTURES

3.1 Logs

Logs shall be of pine or spruce grown in the Nordic countries or in corresponding circumstances. If the logs are of spruce, it shall be specifically mentioned in the delivery contract. The characteristics and tolerated defects for rectangular and round logs are presented in Table 1 and in Table 2 for glued logs. The fabrication of glued logs is to take place under the quality control of an institution approved by the Finnish Ministry of the Environment. Horizontal glued logs are considered equal to round and rectangular logs.

At the time of delivery, the moisture contents shall be < 24 % of the dry mass for rectangular logs, < 26 % for round logs and < 18 % for glued logs. The moisture is measured at a depth of approximately 20 mm.

The tolerance of nominal dimensions for the width and thickness of the log shall be within $\pm 1,5$ mm. The dimensions and tolerances apply to logs with a moisture content of 22 % of the wood's dry mass.

3.2 Lengthening of logs

Logs can be lengthened by using butt, finger or circular joints. If a stress-graded finger or circular joint is used in lengthening the logs, the manufacture is to take place under the quality control of an institution approved by the Finnish Ministry of the Environment.

If a butt joint is used, bracing connectors shall be used. Care should be taken to ensure sufficient lateral rigidity of the wall at the lengthening joints. Butt joints shall be positioned at intersecting corners. Positioning individual butt jointed logs in a visible section of the wall is permitted, but it shall be agreed with the customer in advance.

3.3 Dowelling

Holes for dowels and bolts shall be made in the logs at the factory. The maximum interval between two holes is 2000 mm. However, in shorter walls there must be at least one dowel, and in an intersection, the distance of the hole closest to the corner must not exceed 700 mm. Wood or steel dowels can be replaced by large wire nails. At butt joints, there must be a dowel or large wire nail in both sides of the joint. Dowels and large wire nails, together with instructions for installation, shall be included in the delivery to the customer.

3.4 Through-bolting

At each intersection, the outer part of the log wall shall be tightened by means of at least one bolt extending through the entire height of the wall. Bolts and other tightening materials, together with instructions for installation, shall be included in the delivery to the customer.

Table 1.

Characteristics and tolerated defects of solid rectangular and round logs at the time of delivery.

Characteristic/defect	Extent
Cracks	Cracks caused by drying are permitted on *visible surfaces of the log to a depth of no more than half the log thickness. In pith-centred logs, the crack may be on both sides of the log. The maximum opening of the crack is 8 mm. In log ends, cracks extending from one surface to another are permitted, if the crack length in longitudinal direction is less than the thickness of the log.
Insect damage	Not permitted.
Canker and bark shake	Permitted on non-visible surfaces. In *visible surfaces, the maximum permitted length and width is 50 mm and 10 mm, respectively.
Rot	Not permitted.
Compression wood	Permitted only to the extent that the shape of the log is not essentially altered under its influence.
Knots	Permitted.
Knot splits	Small knot splits and dry knots are permitted to a minimal extent.
Rotten knots	Big rotten knots are not permitted on visible surfaces. Small or partially rotten knots are permitted, as long as they do not dominate the appearance of the log.
Bark knots	Permitted, provided that the bark knots do not dominate the appearance of the log. In part of the log, which remains hidden, the amount and size of bark knots has not been limited.
Defects in form	
Warpage	Max 1/20 of the width of the log per 2 m length.
Edge distortion	Max 10 mm per 2 m length.
Face distortion	Max 17 mm per 2 m length.
Patches	Permitted.
Pitch pockets	Small pitch pockets are permitted.
Blue stain	Not permitted on visible surfaces.
Wane	Permitted to a minimal extent when de-barked; not permitted on the *visible surfaces of components.
Pith	Not limited.
Finger joints	Visible finger joint in the log end is not permitted.
Colour variations	Natural colour variation is permitted, e.g. pith.
Fouling	Not permitted.

Table 2.

Characteristics and tolerated defects of laminated logs at the time of delivery.

Characteristic/defect	Extent
Cracks	Cracks caused by natural drying permitted on *visible surfaces to a depth of no more than 4/5 of the lamella thickness. The maximum opening of the crack is 4 mm. In log ends, cracks extending from one surface to another are permitted, if the crack length in longitudinal direction is less than the thickness of the log.
Insect damage	Not permitted.
Canker and bark shake	Permitted on non-visible surfaces. In *visible surfaces, the maximum permitted length and width is 50 mm and 10 mm, respectively.
Rot	Not permitted.
Compression wood	Permitted only to the extent that the shape of the log is not essentially altered under its influence and it does not affect harmfully to the quality of gluing.
Knots	Permitted.
Knot splits	Small knot splits and dry knots are permitted to a minimal extent.
Rotten knots	Big rotten knots are not permitted on visible surfaces. Small or partially rotten knots are permitted, as long as they do not dominate the appearance of the log.
Bark knots	Permitted, provided that bark knots do not dominate the appearance of the log. In part of the log, which remains hidden, the amount and size of bark knots has not been limited.
Defects in form	
Warpage	Max 1/30 of the width of the log per 2 m length.
Edge distortion	Max 6 mm per 2 m length.
Face distortion	Max 10 mm per 2 m length.
Patches	Permitted.
Pitch pockets	Small pitch pockets are permitted.
Blue stain	Not permitted on *visible surfaces.
Wane	Permitted to a minimal extent when de-barked; not permitted on the *visible surfaces of components.
Pith	Permitted.
Finger joints	Visible finger joint in the log end is not permitted in logs consisting of two lamellas. Visible finger joint is, however, permitted in the area of one lamella in logs consisting of three or more lamellas.
Colour variations	Natural colour variations are permitted. e.g. pith.
Fouling	Not permitted.

* Visible surfaces refer to outer surfaces of logs and surfaces that remain visible in living spaces. Visible surfaces do not include backgrounds of fixtures, surfaces to be panelled or surfaces to be additionally insulated, walls of walk-in wardrobes and store rooms and other similar places.

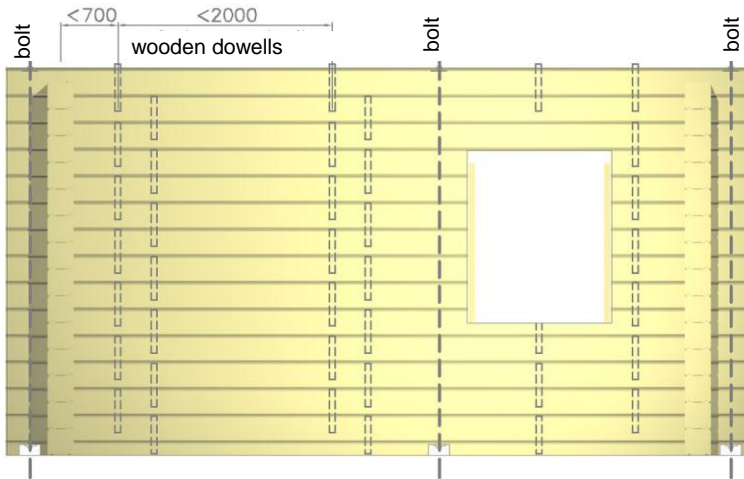


Figure 4
Example of dowelling and through-bolting of a log wall.

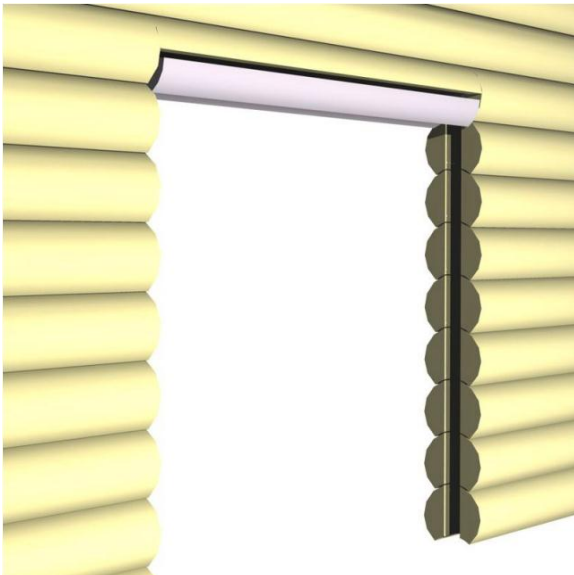


Figure 5
Door or window opening. It is possible to saw the cuts at the building site.

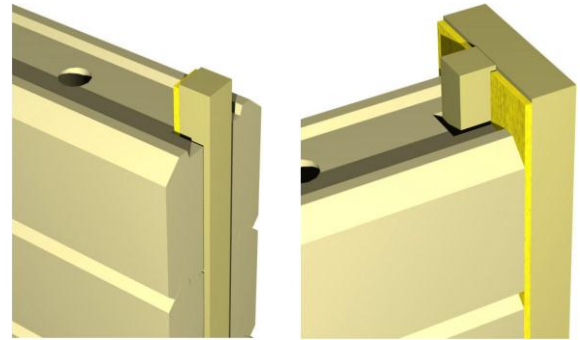


Figure 6
Example of alternative arrangements for bracing the log ends at wall openings (loose tongue and tongued jamb).

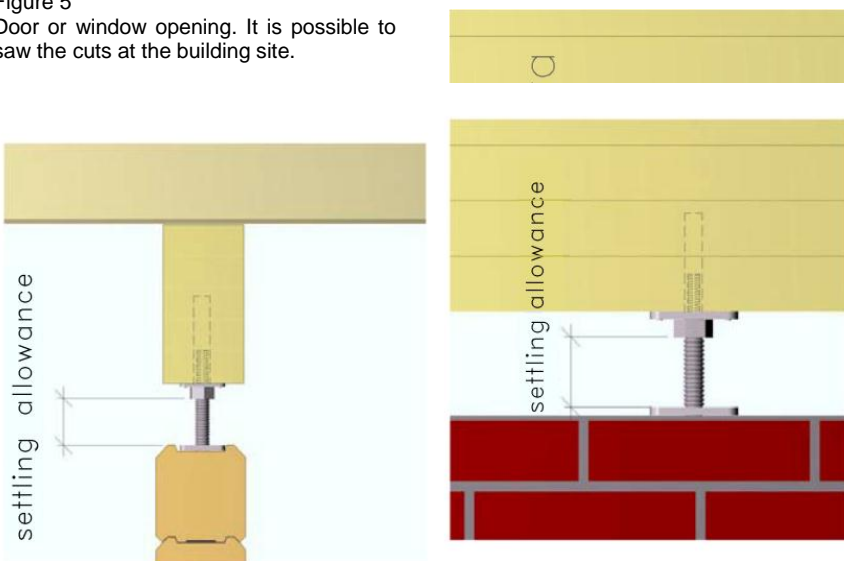


Figure 7
An example of the structure allowing the settling of a log wall.

3.5 Sealing

Suitable packing material, together with instructions for installation, shall be included in the delivery to the customer to be used in the seal recesses and notched joints of logs.

3.6 Door and window openings

Door and window openings should be cut to installation dimensions, taking the settling allowances into consideration. Grooves for tongued jambs or loose tongues shall be made at the factory in the log ends of the openings (see Figure 6). Tongued jambs or loose tongues (or another suitable method) are used at the sides of the openings to brace the wall. For transportation and erection, the part of the log above the opening (see Figure 5) can be left unsawn, but the final measurements of the opening must be marked in the logs at the factory.

3.7 Non-settling structures

Non-settling structures, such as pillars, stairs etc., shall be equipped with a proper settling allowance, which can be adjusted as settling proceeds (see Figure 7). Instructions for implementing this at the building site shall be delivered to the customer.

3.8 Finished assembly

In the log frame structures remaining visible, slight breaks and cracks caused by processing are allowed in minor quantities. Instead, fissures caused by processing, imprints caused by tools, undesired scratches or other defects impairing the appearance are not accepted in surfaces remaining visible.

The assembly accuracies for log houses and holiday houses are given in Table 3. In Figure 8 is presented the measuring method for the assembly accuracies.

Table 3.

Assembly accuracies of log walls

Dimension and location	Greatest acceptable deviation	
	Class 1 ²	Class 2 ²
Δ1 Deviation from the horizontal baseline	± 10 mm	± 20 mm
Δ2 Size of window or door opening	± 5 mm	± 10 mm
Δ3 Location of window or door opening	± 5 mm	± 10 mm
Δ4 Straightness of the log wall	± 2,0 oo/o ¹	± 4,0 oo/o ¹
Δ5 Log wall deviation from the vertical		
wall height ≤ 3 m	± 8 mm	± 10 mm
wall height > 3 m	± h/375 mm	± h/300 mm

¹⁾ measured from measuring length, when the measuring length is min 2 m

²⁾ Assembly accuracy class is chosen according to the requirements of each component and is defined separately for each component in the documents.

Class 1: Components under particular dimensional tolerance requirement and high demands of appearance.

Class 2: Components for residential, business, office or other similar buildings. Class 2 is the most common assembly accuracy class.

Class 3: Components for hall buildings and other similar spaces, which may be accepted with lower dimensional tolerances and appearance demands than class 2.

In documents, it is possible to determine more strict assembly accuracies for class 1 or determine own accuracies for class 3. When defining accuracy class it shall be taken into consideration whether the component in question is finished surface, substructure of the finished surface or structure that is covered.

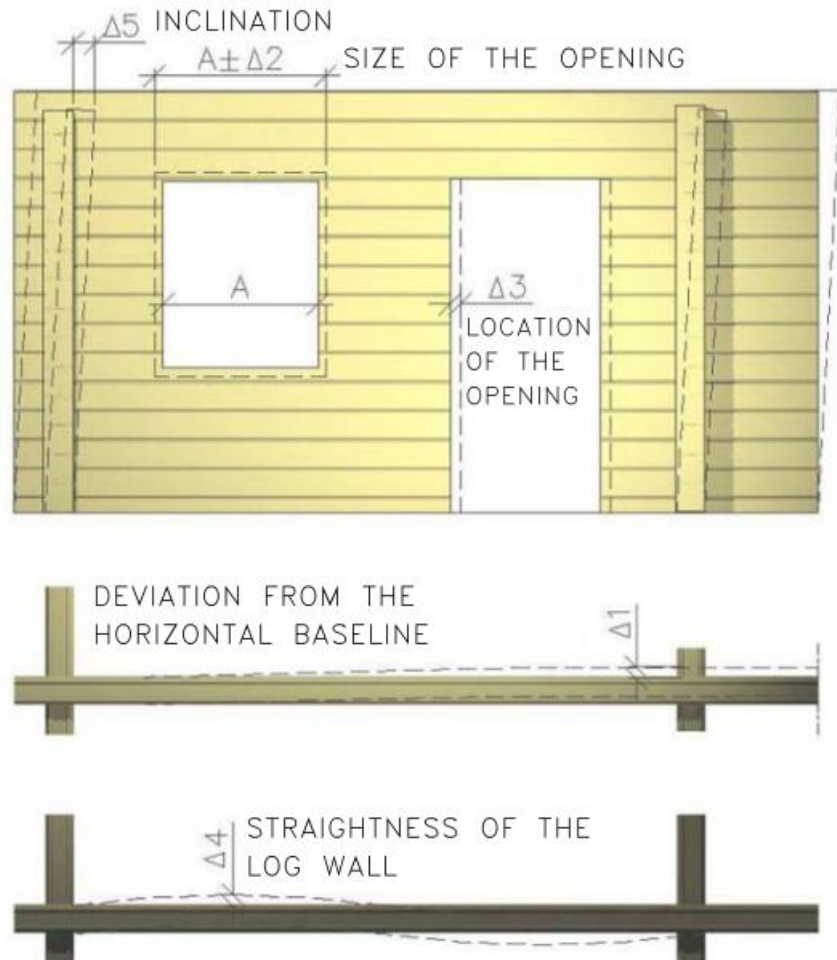


Figure 8
Assembly accuracies of a log wall

4. OTHER MATERIALS

4.1 Load-bearing structures

The load-bearing structures of the roof shall be stress-graded in accordance with the construction plans, and manufactured under the quality control of an institution approved by the Finnish Ministry of the Environment. Roof trusses shall be industrially manufactured and 'NR' labelled.

Rafters shall be made of dressed pine or spruce timber that is stress-graded in accordance with the plans.

4.2 Roof

The sheathing used as the base for the roof covering shall be made of pine or spruce timber that meets the strength requirements set out in RT 85-10141 and the related standards and guidelines. Moisture-proof construction boards can also be used as the base for the roof covering, provided that it is possible to nail on them.

4.3 Ground and intermediate floor supports

The ground and intermediate floor supports are made of pine or spruce

timber dressed to dimensions and stress-graded in accordance with the plans.

4.4 Mouldings, wall boards and dressing boards

These materials shall be of pine or spruce timber compliant with RT 21 – 10750. Any deviation from this requirement is subject to a separate agreement with the customer.

4.5 Floor and terrace boards

These materials shall be of pine or spruce timber compliant with RT 21 – 10750. Any deviation from this requirement is subject to a separate agreement with the customer. It is permitted to lengthen the floor boards by means of butt joints. If the terrace boards included in the delivery are impregnated, the impregnation shall take place at a wood preservation plant under the control of an institution approved by the Finnish Ministry of the Environment.

4.6 Doors

Doors shall conform to quality grade V of RT – 42 10643. Doors are delivered furnished with lockbodies and hinges, but without other fittings. Any deviation from this requirement is subject to a separate agreement with the customer.

4.7 Windows

Windows shall conform to quality grade V of RT- 41 – 10431. Windows are delivered furnished with lockbodies and hinges, but without other fittings. Any deviation from this requirement is subject to a separate agreement with the customer.

4.8 Stairs

Stairs shall be designed in accordance with RT 88–10777, taking the intended use of the building and the location of the stairs into consideration. Stairs are delivered as ready-to-assemble components with slide fastenings.

5. STORAGE AND TRANSPORTATION

5.1 Packaging and storage at the factory

Prefabricated logs and other products are bundled and packed in protective wrapping. Each bundle is to be clearly labelled and the contents specified.

5.2 Delivery

During transportation, the materials shall be protected against rain and any contact with water. The delivery shall include detailed written instructions for storage and erection at the building site.

OTHER GUIDELINES AND STANDARDS

In addition to these quality requirements, the following guidelines and standards shall be observed:

Erection and installation instructions issued in writing by the supplier of the log building

Design principles for log buildings. Finnish Loghouse Industry Association (HTT), 3/2001

Rakennustöiden yleiset laatuvaatimukset RYL 2000. ('General quality requirements for construction work'). Building Information Institute, 1998.

Hirsitalojen toimitusehdot ('Terms and conditions of delivery for log buildings'). Finnish Loghouse Industry Association (HTT), 3/2010.