

NAME OF PRODUCT

Kuningaspalkki
Glued Laminated Timber

MANUFACTURER

Metsäliitto Cooperative
Finnforest, Kuningaspalkki
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Finland



PRODUCT DESCRIPTION

Kuningaspalkki is a glued laminated timber (Glulam) product for use as structural elements in buildings and bridges. Kuningaspalkki is manufactured from strength graded spruce (*Picea abies*) or pine (*Pinus sylvestris*) lamellas, using an adhesive suitable for all service classes. The mechanical properties of Kuningaspalkki conform to the European GL-strength class system.

CERTIFICATION PROCEDURE

This certificate has been issued by VTT, which is a certification body (S017, EN 45011) accredited by the Centre for Metrology and Accreditation (FINAS accredited).

This certificate is based on an initial type assessment of the product, and an initial inspection of the factory and the factory production control. The general certification procedures are based on the certification system of VTT.

The conditions of validity are described in sections 14 - 16.

REGULATIONS, STANDARDS AND INSTRUCTIONS

1. European product requirement standards

1.1 This certificate describes the product in accordance with EN 14080 and other relevant European standards and gives the necessary design information according to the Eurocodes. Since the regulations are not harmonised, the user is recommended to consider separately the relevant national regulations regarding the intended use.

1.2 Kuningaspalkki glulam fulfils the requirements specified in the following European standard and its reference standards:

EN 14080	Timber structures - Glued laminated timber - Requirements
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2. Other standards and instructions

2.1 The following European standards also have relevance for the use of Kuningaspalkki glulam (any nationally determined parameters shall separately be considered):

EN 1995-1-1	Eurocode 5, Design of timber structures. Part 1-1: General - Common rules and rules for buildings
EN 1995-1-2	Eurocode 5, Design of timber structures. Part 1-2: General - Structural fire design
EN 1995-2	Eurocode 5, Design of timber structures. Part 2: Bridges
EN 12524	Building materials and products - Hygrothermal properties - Tabulated design values.

PRODUCT INFORMATION

3. Product description, marking and quality control

3.1 Sawn spruce (*Picea abies*) or pine (*Pinus sylvestris*) is delivered to the mill where it is dried to a moisture content of about 12 %. After drying, each timber piece is machine strength graded to LS22, LS18 or LS15. These strength grades are approved based on the tension properties of the timber pieces. The machine used is a Dynagrade-strength grading machine.

Finger jointed lamellas are used to produce glulam longer than 6 m. The adhesive is applied on the ends to be jointed. After finger jointing, the lamellas are planed. Before pressing, the adhesive is applied one-sided of the lamellas. The adhesive used in both finger jointing and lamella gluing is suitable for all service classes (EN 301, type I).

All Kuningaspalkki glulam members are horizontally laminated. The lay-up of the cross-section is either homogeneous or symmetrically combined of outer and inner lamellas of different grades. The number of outer lamellas is at least 2 on both sides, and the total area of the outer lamellas is at least 1/3 of the cross section.

After pressing, the glulam is planed and sawn according to the specification of the customer. Surface treatments can also be applied.

3.2 The glulam members are classified according to their shape, strength class and surface treatment.

The glulam member is either straight or curved. The lamellas of straight members are not bent, except for a possible precamber, while the lamellas of curved members are bent during the production process.

According to the strength grades and lay-ups of the lamellas, the Kuningaspalkki combined glulam is of class GL32c or GL28c as defined in EN 1194. For glulam of class GL32c, the minimum strength grade of the outer and inner lamellas is LS22 and LS18, respectively. For glulam of class GL28c, the minimum strength grade of the outer and inner lamellas is LS18 and LS15, respectively.

Kuningaspalkki homogeneous glulam is of class GL32h, GL28h or GL24h as defined in EN 1194. For glulam of class GL32h, the minimum strength grade of the lamellas is LS22. For glulam of class GL28h, the minimum strength grade of the lamellas is LS18. For glulam of class GL24h, the minimum strength grade of the lamellas is LS15

The adhesive used is of type I as defined in EN 301. Adhesive of type I is suitable for use in all service classes.

Depending on the surface treatment, glulam can be delivered as untreated, planed, painted or lacquered.

Table 1. Dimensional tolerances of Kuningaspalkki glulam at a moisture content of 12 %.

Dimension	Range	Tolerance
Width	All	± 2 mm
Depth	$h \leq 400$ mm	+4 and -2 mm
	$h > 400$ mm	+1.0 and -0.5 %
Length	$h \leq 2$ m	± 2 mm
	$2 < h \leq 20$ m	± 0.1 %
	$h > 20$ m	± 20 mm

3.3 For straight Kuningaspalkki glulam members, the standard widths are 90, 115, 140, 165, 190, 215 and 240 mm. Furthermore, widths of 265, 290 and 315 mm can be delivered. The thickness of the lamellas is 45 mm. Hence, the standard depths of the glulam members range from 180 to 2050 mm with 45 mm intervals. The maximum length is 32 m.

For curved Kuningaspalkki glulam members, the standard widths are between 90 and 190 mm. The thickness of the lamellas depends on the radius of curvature and is between 18 and 45 mm. The standard depths of the glulam members are between 180 and 2050 mm. The minimum radius of curvature is 2.0 m.

The tolerances of dimensions are in accordance with EN 390 and are given in Table 1.

3.4 The Kuningaspalkki glulam members covered by this Certificate shall be marked as follows:

VTT C167/02
strength class GLyyy
adhesive of type I

where GLyyy is the actual strength class including information on combined or homogeneous cross-section lay-up.

Additionally, the production week and year as well as a reference to the standard EN 386 may be included in the mark.

3.5 The factory production control is regular and comprises the control of equipment, raw and incoming materials, production processes and finished product.

3.6 The manufacturer has an agreement of quality control with VTT. The continuous surveillance, assessment and approval of the factory production control are carried out at least twice a year.

4. Delivery and storage on site

4.1 The Kuningaspalkki glulam members are delivered in plastic packages. Each delivery package is labelled with the number and dimensions of the glulam members and the delivery address or order number.

4.2 Tarpaulins should be used to protect the glulam members from rain, dirt and excessive solar radiation. The plastic package is only intended to protect the glulam member during delivery and assembly, and does not provide sufficient protection against weather.

Glulam members should only be stored temporarily on the building site. The plastic package should not be removed until the glulam members are adequately protected against weather. To avoid condensation, the package should be opened at the bottom edge and stored on a well-ventilated bedding.

To protect the glulam members from any deviation from their stated shape, such as twist and bow, they should be stored on a plane underlay using a sufficient number of supports.

DESIGN INFORMATION

5. General

5.1 Kuningaspalkki glulam is used for structural applications in buildings and bridges.

6. Structural performance

6.1 The structural performance of glulam is considered in accordance with the limit state design principles specified in Eurocode 5. Alternatively, national design codes may be used if they are consistent with the Eurocode system.

6.2 The characteristic strength, modulus of elasticity, shear modulus and density of Kuningaspalkki glulam are given in Table 2. The values are compatible with the design methods mentioned above.

The characteristic strength values for glulam are given at an equilibrium moisture content resulting from a temperature of 20 °C and a relative humidity of 65 % exposed to a duration of load of 5 minutes. Furthermore, the bending and tension strength values apply to a cross-section depth of 600 mm.

In design, the effect of moisture content and duration of load on strength and deformation shall be taken into account by the modification factor k_{mod} and the deformation factor k_{def} as given in Eurocode 5. Furthermore, the effect of cross-section size on bending and tension strength values shall be taken into account by the depth factor k_h as given in Eurocode 5.

The characteristic values given in Table 2 can be used without any modifications for temperatures that do not exceed 50 °C for a prolonged period of time.

6.3 Since the dimensions of glulam remain quite stable during temperature changes, it is not usually necessary to consider any effects of temperature variations on the structural design.

6.4 Any holes and notches to be worked out during the installation shall separately be considered and accepted by the designer.

6.5 During installation, the bracing of the glulam members as well as that of the complete structure shall be considered by the designer.

Table 2. Characteristic values of combined and homogeneous Kuningaspalkki glulam to be used in design according to Eurocode 5. The values are given in N/mm^2 , except density that is given in kg/m^3 .

Property	Strength class				
	Homogeneous			Combined	
	GL24h	GL28h	GL32h	GL28c	GL32c
Bending strength	24	28	32	28	32
Tension strength					
- parallel to grain	16.5	19.5	22.5	16.5	19.5
- perpendicular to grain	0.40	0.45	0.50	0.40	0.45
Compression strength					
- parallel to grain	24.0	26.5	29.0	24.0	26.5
- perpendicular to grain	2.7	3.0	3.3	2.7	3.0
Shear strength	2.7	3.2	3.8	2.7	3.2
Modulus of elasticity					
- parallel to grain (mean)	11600	12600	13700	12600	13700
- parallel to grain (5%-fractile)	9400	10200	11100	10200	11100
- perpendicular to grain (mean)	390	420	460	390	420
Shear modulus	720	780	850	720	780
Density	380	410	430	380	410

7. Performance in relation to moisture

7.1 On delivery, the moisture content of Kuningaspalkki glulam is about 12 %. Due to changes in temperature and relative humidity of the surrounding air, the moisture content of glulam will continuously change. In service class 1 the moisture content of glulam usually varies between 8 and 12 %, while in service class 2 it usually varies between 12 and 18 %.

7.2 Glulam swells when the moisture content increases, and shrinks when the moisture content decreases. The extent of these dimensional changes depends on the grain direction. The thickness and depth of Kuningaspalkki glulam members changes by 0.2 % for each 1 % change in moisture content. The length changes by 0.01 % for each 1 % change in moisture content.

Glulam members shall be designed in such a way that depth and thickness changes do not cause harmful stresses in the structures. Special attention shall be paid to the design of joints.

8. Performance in case of fire

8.1 The fire resistance of glulam is considered in accordance with Eurocode 5. The design notional charring rate of Kuningaspalkki glulam is 0.70 mm/min.

In addition to the fire resistance of the glulam members, the designer shall consider the fire resistance of the joints.

8.2 The euroclass for Kuningaspalkki glulam without surface treatment is D-s2, d0. s2 is an additional classification for smoke production and d0 is an additional classification for flaming droplets and/or particles.

8.3 Kuningaspalkki glulam treated against fire is not covered by this certificate.

9. Thermal insulation performance

9.1 The thermal conductivity of Kuningaspalkki glulam is 0.13 W/(m K).

10. Durability

10.1 Kuningaspalkki glulam can be used in service classes 1 and 2. Although a type I adhesive can also be used in service class 3, the spruce and pine lamellas do not withstand fungal attack. Hence, the product shall not be used in service class 3 without additional treatment.

Glulam resists well temporary exposure to water without decay, provided that it is allowed to dry afterwards. Therefore, the designer shall pay attention to the details of the construction and to ensure that no water pockets will be formed.

10.2 Kuningaspalkki glulam treated against biological attack is not covered by this certificate.

INSTALLATION AND USER GUIDE

11. Manufacturer's instructions

11.1 To protect the glulam members from damage and dirt, they shall be handled carefully.

The manufacturer provides detailed information regarding the installation and use of Kuningaspalkki glulam.

11.2 Kuningaspalkki glulam can be processed using conventional woodworking tools, e.g. sawing, planing, drilling, nailing and screwing.

Glulam members may be cross cut but not cleave sawn.

11.3 After use, glulam shall be disposed of in accordance with national regulations and directives. In general, glulam can be reused, composted or burned.

TECHNICAL SURVEY

12. Initial assessment

12.1 The initial assessment of Kuningaspalkki glulam is based on requirements specified in European product standards, and on VTT's experience with the performance of glulam products as well as other timber products for use in structural applications.

12.2 The characteristic values to be used in structural performance considerations are based on the calculation method given in EN 1194 as referred to in EN 14080. Furthermore, the adhesive type is assessed in accordance with EN 301.

12.3 The moisture behaviour assessment is based on VTT's experience.

12.4 The charring rate to be used in fire safety considerations is based on the tabulated values specified in Eurocode 5. The reaction to fire performance is based on the tabulated values specified in EN 14080.

12.5 The thermal conductivity to be used in thermal behaviour considerations is based on the tabulated values specified in EN 12524.

12.6 The assessment of durability against biological attack is in accordance with EN 301 and EN 350.

13. Initial inspection

13.1 The initial inspection of the Kuningaspalkki glulam factory production control and the factory is based on requirements specified in European product standards, and on VTT's experience with production processes and control of glulam products as well as other timber products for use in structural applications.

13.2 In the initial inspection of the factory production control, VTT was assured that the manufacturer had established, documented and maintained a factory production control system that with regard to the control of production process is in accordance with EN 14080. In addition, tests are made by the manufacturer as required in EN 14080.

13.3 In the initial inspection of the factory the production process, equipment used and factory production control, VTT was assured that the factory production control is in accordance with the documented factory production control system.

VALIDITY OF THE CERTIFICATE

14. Validity period of the certificate

This certificate is valid for a maximum of five years from the date of revision.

15. Conditions of validity

The certificate is valid on the condition that no fundamental changes are made to the product, and that the manufacturer has a valid quality control contract. A list of valid certificates is available from VTT.

16. Other conditions

The references made in this certificate to standards and instructions are valid in the format used at the time the certificate was awarded.

The recommendations in this certificate concerning the safe use of this product are minimum requirements that shall be satisfied when using the product. The certificate does not override current or future requirements imposed by laws and statutes. In addition to the issues presented in this certificate, design, manufacturing and use shall follow appropriate construction methods.

The manufacturer is in charge of the product's quality and factory production control. In awarding this certificate, VTT does not bind itself to indemnification liability concerning personal injury or other damage that may directly or indirectly result from using the product described in this certificate.

The Technical Research Centre of Finland (VTT) finds Kuningaspalkki glued laminated timber to be suitable for use in construction as described in this certificate. This certificate no 167/02 has been awarded as described above to Metsäliitto Cooperative, Finnforest Kuningaspalkki.

On behalf of VTT on 19 February, 2007



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Assessment Manager



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