

NAME OF PRODUCT

Kerto Ripa elements

OWNER OF THE CERTIFICATE



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Finnforest, Kerto
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PRODUCT DESCRIPTION

Ripa elements are stressed skinned panels made of Kerto structural laminated veneer lumber and intended to be used as structural or non-structural elements in buildings and bridges.

The maximum size of the panels is 20 m x 2,5 m and the thickness varies from 150 to 650 mm. Typical lengths are from 4 to 12 m. The panels may be one-sided tapered, maximum taper is 10°.

The products are manufactured from structural Kerto laminated veneer lumber using an adhesive suitable for exterior conditions.

CERTIFICATION PROCEDURE

This certificate is based on an initial type assessment of the product, and a general inspection of Finnforest's instructions for the manufacturing methods and the factory production control system. The general certification procedures are based on the certification system of VTT Technical Research Centre of Finland.

This certificate is valid provided that there is at least one authorized factory having a certificate by VTT (see 3.1). Other conditions of validity are described in sections 16-18.

REGULATIONS, STANDARDS AND INSTRUCTIONS

1. European product requirement standards

1.1 This certificate describes the product in accordance with ETAG 019 and other relevant European standards and gives the necessary design information according to the Eurocodes. Since regulations are not harmonised, the user is recommended to consider separately the relevant national regulations.

1.2 The Ripa elements and the components of them fulfil the requirements specified in the following European standards:

EN 14374	Timber structures - structural laminated veneer lumber - requirements
EN 13501-2	Fire classification of construction products and building elements. Part 2: Classification using data from fire resistance tests, excluding ventilation services

2. Other standards and instructions

2.1 The following European standards also have relevance for the use of Ripa elements:

EN 335-1	Durability of wood and derived materials - Definition of hazard classes of biological attack - Part 1: General
EN 1990	Eurocode. Basis of structural design.
EN 1995-1-1	Eurocode 5, Design of timber structures. Part 1-1 General rules and rules for buildings
EN 1995-1-2	Eurocode 5, Design of timber structures. Part 1-2 Structural fire design
EN 12524	Building materials and products - Hygrothermal properties - Tabulated design values.

PRODUCT INFORMATION

3. Product description, marking and quality control

3.1 Ripa elements are manufactured on behalf of Finnforest Oyj at several independent authorized factories. The products manufactured by each factory shall be separately certified on basis of initial inspection of the factory and factory production control. The certification body shall state by continuous surveillance that the product is in accordance with this product certificate.

3.2 The slabs are made of Kerto Q and the ribs are made of Kerto S according to VTT certificate 184/03 based on EN14374.

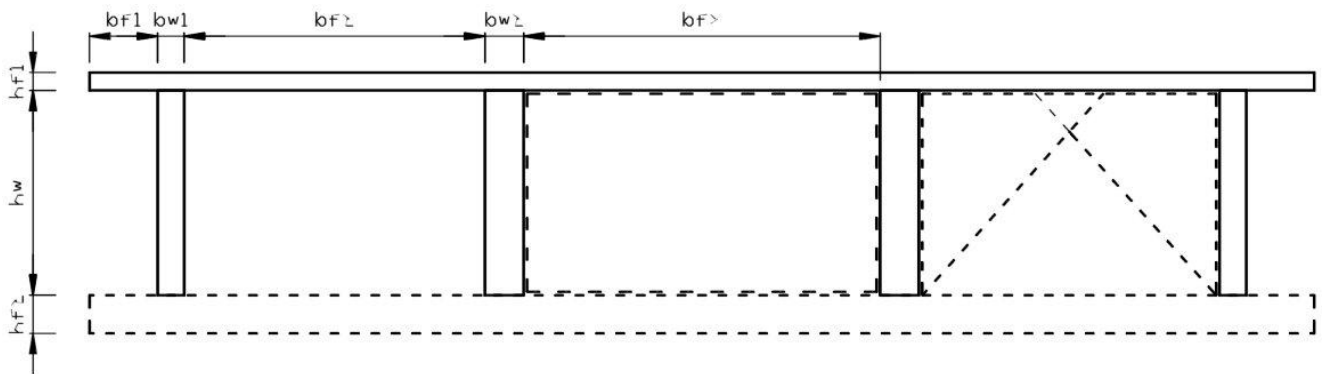


Figure 1: Cross sections of Ripa element. The bottom slab and cross bracing may be optional.

3.3 The parts are glued together using an adhesive suitable for exterior use. The adhesives used are such polyurethane glues that are approved for gluing of load-bearing structures and confirmed to be suitable for gluing of Kerto LVL.

3.4 The pressure necessary for gluing is achieved by Finnforest's screw gluing technology, or by other approved methods. The gluing procedure shall be separately assessed in case of each manufacturer.

3.5 The products are shaped according to the specification of the customer. The maximum size of the panels is 20 m x 2,5 m and the thickness varies from 150 to 650 mm. If the length of the element is more than 12 m, the handling of the element shall be considered by the designer. The panels may be single tapered, maximum taper is 10°. The ribs may be stiffened, when necessary, with additional stiffeners made of Kerto LVL.

Typical cross sections and symbols used are illustrated in Figure 1.

Typical dimensions of the members to be glued together are

$$b_w = 39 \text{ to } 75 \text{ mm}$$

$$h_w = 100 \text{ to } 600 \text{ mm}$$

$$h_f = 19 \text{ to } 68 \text{ mm}$$

Table 1. Tolerances of Ripa elements.

Dimension	Size, mm	Tolerance, mm or %
Depth of the Ripa element	All	$\pm 5,0 \text{ mm}$ or $1,5 \%^{**}$
Width of the Ripa element	All	$\pm 0,5 \%$
Length of the Ripa element	All	$\pm 5,0 \text{ mm}$

** which one is smaller

3.6 The tolerances of dimensions at the reference moisture content of $10 \pm 2\%$ are presented in Table 1.

The thickness of sanded Kerto slabs is the nominal thickness decreased by 1mm for each sanded surface. Kerto slabs used in Ripa elements shall be sanded at least from that side which is glued to the ribs. The effect of sanding to the thickness shall be taken into account in the structural calculations of Ripa elements.

3.7 When the Ripa elements covered by this certificate are manufactured in a factory that has a certificate by VTT they shall be marked with the number of the factory's certificate and the code of the element.

3.8 The certificate owner may use this certificate as a technical specification for Ripa elements manufactured in a factory that does not have a certificate by VTT but by another certification body. In those cases the VTT mark shall not be used.

3.9 The factory production control of each authorized factory shall be regular and comprises the control of equipment, raw and incoming materials, production processes and finished products according to separately approved quality control manuals.

3.10 Each authorized factory that has a certificate by VTT shall have an agreement of quality control with Finnforest and VTT. The continuous surveillance, assessment and approval of the factory production control shall be carried out at least twice a year.

4. Delivery and storage on site

4.1 The Ripa elements are delivered in packages suitable to protect them during transportation and storage. Each delivery package is labelled with an ID number of the element. and the delivery address or order number.

4.2 Ripa elements shall be stored only temporarily on the building site. Any measures to keep the moisture content low and to avoid condensation shall be done carefully. Tarpaulins shall be used to protect the Ripa elements from rain, dirt and excessive solar radiation.

Ripa elements shall be stored on a plane underlay using a sufficient number of supports according to manufacturer's instructions so that the elements do not have contact with water on the ground.

4.3 Weather exposure of rain, water flowing as well as water convection from other structures shall be avoided. The product may be exposed to the weather for a short time during installation. Products which have become wet shall be dried before use and inspected for any deficiencies. Only products free from defects are allowed to be used.

DESIGN INFORMATION

5. General

5.1 Ripa elements are used for structural or non-structural applications in buildings.

5.2 Ripa elements can be painted or stained. The suitability of the treatment shall be checked with the manufacturer of it.

6. Typical connections between Ripa elements

6.1 Ripa elements are normally connected to each other with mechanical fasteners. Diagonal screwing is recommended.

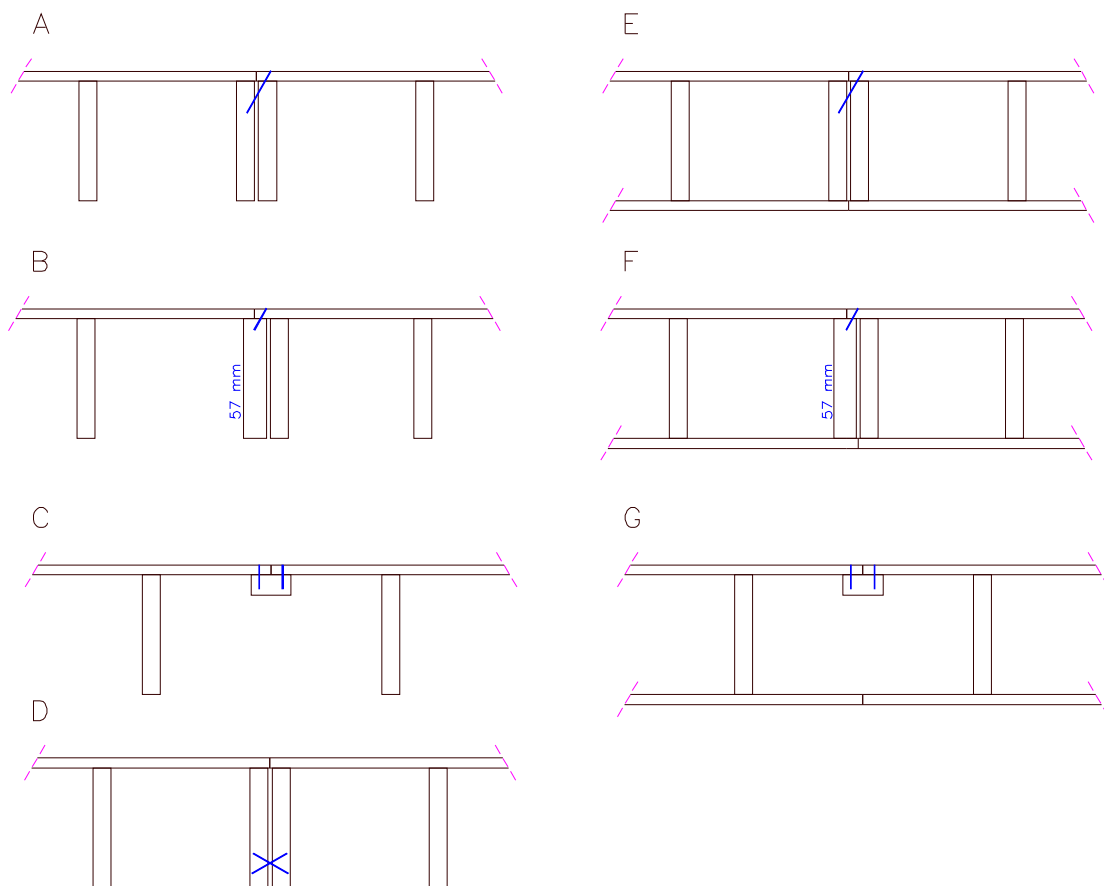


Figure 2: Principal drawing of connections between Ripa elements.

Table 2 The characteristic values of Kerto-S and Kerto-Q to be used in the design of Ripa elements.

Property	Symbol	Characteristic value, N/mm ² or kg/m ³			
		Kerto-S ribs Thickness 21 - 90 mm	Kerto-Q slabs, thickness		
			19-20 mm*	19 - 23 mm**	25 - 68 mm**
Fifth percentile values					
Bending strength:					
Edgewise (depth 300 mm)	$f_{m,0,edge,k}$	44.0	28.0	28.0	32.0
Size effect parameter	s	0.12	0.12	0.12	0.12
Flatwise along	$f_{m,0,flat,k, }$	50.0	28.0	32.0	36.0
Flatwise across	$f_{m,0,flat,k,\perp}$		14,0	8.0	8.0
Tensile strength:					
Parallel to grain (length 3000 mm)	$f_{t,0,k}$	35.0	19.0	19.0	26.0
Perpendicular to grain, edgewise	$f_{t,90,edge,k}$	0.8	6.0	6.0	6.0
Perpendicular to grain, flatwise	$f_{t,90,flat,k}$	-	-	-	-
Compressive strength:					
Parallel to grain	$f_{c,0,k}$	35.0	19.0	19.0	26.0
Perpendicular to grain, edgewise	$f_{c,90,edge,k}$	6.0	9.0	9.0	9.0
Perpendicular to grain, flatwise	$f_{c,90,flat,k}$	1.8	1.8	1.8	1.8
Shear strength					
Edgewise	$f_{v,0,edge,k}$	4.1	4.5	4.5	4.5
Flatwise	$f_{v,0,flat,k}$	2.3	1.3	1.3	1.3
Modulus of elasticity:					
Parallel to grain along	$E_{0,k}$	11600	8300	8300	8800
Parallel to grain across			2900	1000	1700
Perpendicular to grain, edgewise	$E_{90,edge,k}$	350	2000	2000	2000
Perpendicular to grain, flatwise	$E_{90,flat,k}$	100	100	100	100
Perpendicular to grain	$E_{90,k}$	-	-	-	-
Shear modulus:					
Edgewise	$G_{0,k}$	400	400	400	400
Flatwise	$G_{0,k}$	400	-	-	-
Density	ρ_k	480	480	480	480
Mean values					
Modulus of elasticity:					
Parallel to grain along	$E_{0,mean, }$	13800	10000	10000	10500
Parallel to grain across	$E_{0,mean,\perp}$		3300	1200	2000
Perpendicular to grain, edgewise	$E_{90,edge,mean}$	430	2400	2400	2400
Perpendicular to grain, flatwise	$E_{90,flat,mean}$	130	130	130	130
Shear modulus:					
Edgewise	$G_{0,mean}$	600	600	600	600
Flatwise	$G_{0,mean}$	600	-	-	-
Density	ρ_{mean}	510	510	510	510

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

7.7 Ripa elements shall be designed in such a way that width and thickness changes due to moisture content variation do not cause harmful stresses in the structures. Special attention shall be paid to the design of joints.

7.8 Ripa elements may be top slab supported. Design guide for top slab supported Ripa elements is given in Annex C.

7.9 Holes are allowed to be made in Ripa elements. Any holes and notches to be worked out during the installation shall separately be considered and accepted by the designer.

7.10 For holes in the ribs, the rules regarding Kerto LVL given in certificate 184/03 are applicable.

7.11 For holes in the slabs, the effective width shall be calculated accordingly.

7.12 During installation, the temporary bracing of the Ripa elements shall be considered by the designer.

7.13 Design support is given by the manufacturer, see 14.5.

8. Performance in relation to moisture

8.1 On delivery to the factory, the moisture content ω of Kerto LVL parts is about 8 - 10 %. Due to changes in temperature and relative humidity of the surrounding air, the moisture content will continuously change. In service class 1 the moisture content usually varies between 6 and 10 %, while in service class 2 it usually varies between 10 and 16 %. Depending on local conditions the moisture content of Ripa elements may be slightly different on delivery.

Moisture content ω is defined as follows:

$$\omega = \frac{m_{\omega} - m_0}{m_0}$$

where m_{ω} is the mass of the product corresponding moisture content ω and m_0 is the dry mass of the product.

8.2 Kerto LVL parts of the Ripa elements swell when the moisture content increases, and shrink when the moisture content decreases. The extent of these dimensional changes depends on the grain direction. Wetting causes permanent deformations, problems with surface veneers and falling of knots.

8.3 The dimensional changes can be calculated from the dimensional variation coefficients given for Kerto LVL in VTT-certificate No 184/03.

8.4 In normal conditions, harmful deformations due to moisture changes of the Ripa elements are not expected.

8.5 Water vapour resistance factor μ of Kerto LVL are given in Table 3.

Table 3. *Water vapour resistance factor μ*

	Kerto-S	Kerto-Q
In direction of thickness	80	62
In direction of width	82	9.5
Longitudinal	3.9	4.7

9. Performance in case of fire

9.1 Kerto members without surface treatment have Euroclass D-s1, d0 with regard to reaction to fire.

9.2 Ripa elements treated against fire are not covered by this certificate.

9.3 Ripa elements without slab on the lower side of the element may be protected by a gypsum plasterboard construction hanged below the element. This protective construction shall be designed and planned appropriately and its performance is outside of this certificate.

9.4 A floor construction made of Ripa elements have fire resistance class REI 30 or REI 60 if the thickness of the bottom slab is at least 22 mm or at least 37 mm respectively and the thickness of the ribs at least 45 mm and the spacing of the ribs does not exceed 600 mm. The height of the ribs must not exceed 300 mm + the height of the mineral wool layer; if this exceeds 100 mm the mineral wool shall be fixed in the ribs so that it remains at place during the fire. Moreover the deflection in the fire situation is not allowed to exceed 20 mm in the middle of the element span.

The load bearing capacity and the deflection of the Ripa element construction in case of fire shall be calculated according to EN 1995-1-2 taking into account the charring rates and notes given in Table 4.

The joint between the elements is shown in Figure 2, joint type F. The elements are fixed together with diagonal screws, e.g. ASSY (or comparable), $\varnothing = 5\text{ mm}$ c/c300 from the top slab, the penetration length of the screw tip in the Kerto member shall be 50 mm. The ribs begin to char in the joint between the elements after 40 min unless the butt joint between the bottom slabs is sealed with a wooden batten or rock wool insulation (density 140 kg/m³) installed inside the joint.

Table 4. Charring rates and notes for the calculation of load bearing capacity in fire situation.

	Ripa element without insulation in the cavity	Ripa element cavities with rock wool insulation (thickness $\geq 100\text{ mm}$, density $\geq 27\text{ kg/m}^3$) ¹⁾
Charring rate of the bottom slab	0.70 mm/min	0.80 mm/min
Charring rate of the ribs and the top slab $k_3\beta_0$	1.3 mm/min	no charring within 60 min
Design of the residual cross section as a composite structure after charring of the bottom slab	if shear stress between the rib and the bottom slab $\leq 1.5\text{ N/mm}^2$ ²⁾	always ²⁾
¹⁾ Mounting of the insulation tightly against the ribs.		
²⁾ Gluing with PU-glue Purbond HB 110		

In case of fire, the floor construction of Ripa elements may be supported conventionally so that whole bottom slab rests on the underlay. Alternatively, Ripa elements may be supported by the top slab of the elements (as stated under 7.8) or by metal suspensions attached to every rib. The metal suspensions must be tightly protected in joints between elements with rock wool (thickness 30 mm, density 140 kg/m³). When designing the suspensions for the fire exposure of 60 min their temperature has to be taken into account: 500 °C at the bottom and 300 °C at the top of the suspension. Protection for the centre suspensions inside the element is not necessary.

Passage of fire to the gap between the end of the element and a supporting edge has to be prevented. Neither may the bottom slab have such holes that might act as passages for fire to the cavity inside the Ripa element.

10. Hygiene, health and environmental performance

10.1 The formaldehyde class of Kerto LVL is E1.

10.2 High relative humidity conditions may cause mould growth on the surface of Ripa elements. If these kinds of conditions are expected during erection, a brushable or sprayable surface treatment shall be used. This kind of treatment has no adverse effects to the structural properties of Ripa elements.

If, due to excessive wetting, there is mould growth on the surface of Ripa elements, this can be removed by sanding.

10.3 After use, Ripa elements shall be disposed of in accordance with national regulations and directives. In general, the products can be reused, composted or burned.

11. Acoustical performance

11.1 Measured value for weighted sound reduction index R_w and weighted impact sound pressure level $L_{n,w}$ of a typical Ripa element are given in Table 5. The thickness of the top slab of the basic Ripa element was 27 mm while the thickness of the bottom slab was 39 mm.

Measured values for some typical flooring constructions are also given.

11.2 Acoustical performance of Ripa elements that do not have the slab on the lower side of the element may be improved by a gypsum plasterboard construction hanged below the element. The performance of this kind of construction is outside of this certificate. Also in this case, the performance is strongly influenced by the flooring construction used.

Table 5 The acoustical performance of Ripa elements.

Measured construction	Airborne sound insulation (dB)		Impact sound insulation (dB)	
	R_w	C	$L_{n,w}$	C_I
Basic Ripa element with bottom slab 39 mm, Ripa element 1	31	0	86	-3
Ripa element 1 topped with 60 mm concrete slab	43	-1	78	-7
Ripa element 1 topped with 60 mm concrete slab floating on 30 mm of mineral wool	54	-1	66	-2
Ripa element 1 topped with floating screed on 30 mm of mineral wool, ΔL_w for floor covering ≥ 18 dB	48	-1	65 ... 70	0 ... -2

12. Thermal insulation performance

12.1 The thermal conductivity of Kerto LVL is 0.13 W/(m K) to be used in calculations. The Ripa element may contain additional insulation, as rock wool, in the cavities. Thus, the R-value or the U-value of the product varies according to the design.

13. Durability

13.1 Ripa elements can be used in service classes 1 and 2 as defined in Eurocode 5, which correspond to the hazard classes 1 and 2 as defined in EN 335-1. The product shall not be used in service class 3 / hazard class 3 without additional protective treatment. The designer shall pay attention to the details of the construction and to ensure that no water pockets will be formed.

During the erection of the building, Ripa elements resist well temporary exposure to water without decay, provided that they are allowed to dry afterwards.

If the elements are intended to be covered by flooring, it is recommended that the moisture content of the top slab is checked by a moisture meter calibrated for Kerto LVL: moisture content of the slab should not exceed 12 %.

13.2 When necessary and required by the local authorities at the building site, Ripa elements can be treated against biological attack according to the rules valid on the place. However, Ripa elements treated against biological attack are excluded from this certificate. Any adverse effects of the treatment on other properties shall be taken into account according to a separate clarification.

INSTALLATION AND USER GUIDE

14. Manufacturer's instructions

14.1 Ripa elements can be worked using conventional woodworking tools, e.g. sawing, planing, drilling, nailing and screwing.

14.2 To protect the Ripa elements from damage and dirt, they shall be handled carefully. Some elements may have finished surfaces.

14.3 General guidelines of wooden constructions shall be followed in installations and use of Ripa elements.

14.4 If Ripa elements are intended to be a part of the external envelope of the building, they shall be protected adequately, e.g. by a roofing or by a cladding.

14.5 Finnforest Kerto Business unit provides with design instructions of the Ripa elements. This certificate refers to version dated 14.6.2006. When the instructions are updated, the updated version shall be approved by VTT and a reference made to this certificate.

TECHNICAL SURVEY

15. Initial assessment

15.1 The initial assessment of Ripa elements is based on evaluation methods and requirements specified in the European product standards, and on VTT's experience with the performance of Ripa elements as well as other timber products, especially Kerto LVL; for use in structural applications.

15.2 The characteristic values to be used in structural performance considerations rely for most properties on the methods given in EN 14374.

15.3 As a part of the certification process, VTT has assessed the design instructions dated 14.6.2006.

15.4 The moisture behaviour assessment is based on VTT's experience of Kerto LVL.

15.5 Resistance to fire classification and charring rates given are based on Eurocode 5 and tests made by VTT.

The reaction to fire performance is based on testing according to Euroclasses system.

15.6 Release of formaldehyde is based on test made by VTT.

15.7 The assessment of acoustical properties is assessed on tests made by VTT.

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

15.9 The assessment of durability against biological attack is in accordance with EN 350.

15.10 Detailed calculation instructions are given by the manufacturer. This certificate refers to version dated 14.6.2006. When the calculation instructions are updated, the updated version shall be approved by VTT and a reference made to this certificate.

16. Initial inspection

16.1 VTT will certify manufacturers of Ripa elements on basis of initial inspection. The certificate provides for continuous survey as described in 3.10.

In the initial inspection of the factory production control system, VTT will assure 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 the methods described in 3.9. In addition, glue bond tests shall be made by the manufacturer as required.

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

16.2 When products and manufacturing will be certified by another certification body, the same principles are recommended to be followed.

VALIDITY OF THE CERTIFICATE

17. Validity period of the certificate

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

18. Conditions of validity

The certificate is valid assuming 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 service centre.

19. 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.

VTT Technical Research Centre of Finland finds Ripa elements to be suitable for use in construction as described in this certificate. This certificate no VTT-C-127-06 has been awarded as described above to Finnforest Oyj

On behalf of VTT on 14 June, 2006



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