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Rakennusalan tuotteita koskevan jäsenvaltioiden lainsäädännön lähentämisestä 21 päivänä joulukuuta 1988 annetun neuvoston direktiivin 89/106/EEC mukaisesti ilmoitettu tuotehyväksyntälaitos

EOTAN JÄSEN

## Eurooppalainen tekninen hyväksyntä European Technical Approval

ETA-07/0029

### **Kauppanimi:**

Trade name

### **Kerto Ripa Elements**

### **Hyväksynnän haltija:**

Holder of approval:

Metsäliitto Cooperative  
Finnforest, Kerto  
P.O. Box 24  
FIN-08101 LOHJA  
Finland

### **Tuotetyyppi ja sen käyttötarkoitus:**

Generic type and use of construction product:

### **Puuaineinen Kerto ripalaattaelementti rakenteelliseen käyttöön**

Wood-based composite slab element for structural purposes

### **Voimassaoloaika:** Validity from/to

**From 2007-02-14 to 2012-02-14**

### **Valmistuspaikka:**

Manufacturing plants:

According to Annex N kept by VTT

### **Tämä hyväksyntä sisältää**

This European Technical Approval contains

Sivuja/liitteitä

Pages/Annexes

16 sivua sisältäen 2 liitettä

16 pages including 2 Annexes



Eurooppalainen tekninen hyväksyntäorganisaatio  
European Organisation for Technical Approvals

## I LEGAL BASIS AND GENERAL CONDITIONS

1. This European Technical Approval is issued by the Technical Research Centre of Finland (VTT) in accordance with:
  - Council Directive (89/106/EEC)<sup>1</sup> of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products, modified by the Council Directive 93/68/EEC of 22 July 1993<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - Laki rakennustuotteiden hyväksynnästä (230/2003) luvut 3 ja 10, Ympäristöministeriön asetus rakennustuotteiden hyväksynnästä 3 § sekä Ympäristöministeriön 14.10.1997 antama valtuutus päätös (12/352/94).
  - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC<sup>4</sup>;
  - Guideline Nr 019 for European Technical Approval of Prefabricated wood-based loadbearing stressed skin panels.
2. The Technical Research Centre of Finland (VTT) is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.
3. This European Technical Approval is not to be transferred to manufacturers or agents of manufacturer other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European Technical Approval.
4. This European Technical Approval may be withdrawn by the Technical Research Centre of Finland (VTT) pursuant to Article 5 (1) of the Council Directive 89/106/EEC.
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6. The European Technical Approval is issued by the approval body in its official language. This version should correspond fully to the version used by EOTA for circulation. Translations in other languages have to be designated as such.

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<sup>1</sup> Official Journal of the European Communities N° L 40, 11.2.1989, p. 12

<sup>2</sup> Official Journal of the European Communities N° L 220, 30.8.1993, p. 1

<sup>3</sup> Official Journal of the European Union N° L284, 31.10.2003, p. 1

<sup>4</sup> Official Journal of the European Communities N° L 17, 20.1.1994, p. 34

## **II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL**

### **1 Definition of product and intended use**

Kerto Ripa Elements are composite slab elements made of Kerto structural laminated veneer lumber. The adhesive is of type I (full exposure to the weather) as defined in EN 301. Kerto Ripa Elements may contain thermal or acoustic insulation inside the cavities. The materials, dimensions and tolerances are given in Annex 1.

Kerto Ripa Elements are intended to be used as structural or non-structural elements in buildings and bridges. Kerto Ripa Elements may function as directly load bearing as well as structural stiffening members. With regard to moisture behaviour of the product, the use is limited in service classes 1 and 2 as defined in Eurocode 5. If Kerto 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.

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. Typical lengths are from 4 to 12 m. The panels may have one-sided tapered ribs; maximum taper is 10°.

Kerto Ripa Elements can be painted or stained. The suitability of the treatment shall be checked with the manufacturer of it. Surface treatments of the elements are not covered by this ETA.

The provisions made in this European Technical Approval are based on an assumed intended working life of Kerto Ripa Elements of 50 years<sup>5</sup>.

### **2 Characteristics of product and methods of verification**

#### **ER 1 Mechanical resistance and stability**

##### Structural performance

The elements are manufactured according to an individual design made on a case by case basis.<sup>6</sup> Kerto Ripa Elements may function as directly load bearing and structural stiffening members.

The structural performance of Kerto Ripa Elements is considered in accordance with the limit state design principles specified in Eurocodes and detailed described in the manufacturer's instructions for design. These methods follow EN 1995-1-1.

Kerto Ripa Elements are not intended to be used in areas where they might support seismic action.

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<sup>5</sup> This means that it is expected that when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements of the works. The indications given as to the working life of a beam cannot be interpreted as a guarantee given by the producer or the approval body. They should only be regarded as a means for the specifiers to choose the appropriate criteria for beams in relation to the expected, economically reasonable working life of the works.

<sup>6</sup> Method 3 as described in GP L has been used.

## Dimensional stability

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

When necessary, the dimensional change  $\Delta L$  of a Kerto product due to change of moisture content can be calculated as follows:

$$\Delta L = \Delta \omega \cdot \alpha_H \cdot L$$

where  $\Delta \omega$  is change of moisture content [%] from the equilibrium moisture content,  $\alpha_H$  dimensional variation coefficient and L dimension [mm]. The dimensional variation coefficients are presented in Table 5.

*Table 1. Dimensional variation coefficients*

	Kerto-S	Kerto-Q
Thickness	0.0024	0.0024
Width	0.0032	0.0003
Length	0.0001	0.0001

## ER 2 Safety in case of fire

### Reaction to fire

Untreated Kerto LVL is classified to have reaction to fire class D-s1, d0. If thermal insulation is used inside the elements, it shall be classified to have reaction to fire class A1 or A2. Kerto Ripa Elements treated against fire are not covered by this ETA.

Kerto 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 not covered by this ETA.

### Resistance to fire

A floor construction made of Kerto Ripa Elements may have resistance to fire class REI 30 or REI 60 provided that the conditions in Annex 2 are fulfilled. The load bearing capacity and the deflection of the Kerto Ripa Element construction in case of fire shall be calculated according to EN 1995-1-2 taking into account the charring rates and limitations given in Annex 2.

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 Kerto Ripa Element.

Kerto Ripa Elements without bottom slab may be provided with a protective cladding that shall be designed according to EN 1995-1-2. This kind of protective cladding is part of the works and outside this ETA.

## External fire performance of roof coverings

Not relevant. Kerto Ripa Elements do not contain any roofing.

## ER 3 Hygiene, health and environment

### Water vapour permeability and moisture resistance

Kerto Ripa Elements may contain thermal insulation in the cavities. The construction resembles a timber frame construction where any moisture possibly coming into the cavities is ventilated or will be removed by diffusion. In cases where resistance to fire is demanded, ventilation is, however, not possible.

In special cases when the performance shall be calculated, e.g. when there is a separate ceiling construction that is not part of the Kerto Ripa Element, the water vapour resistance factors  $\mu$  given in Table 2 may be used.

*Table 2. Water vapour resistance factor  $\mu$*

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

### Dangerous substances

Based on the declaration of the manufacturer, Kerto Ripa Elements do not contain harmful or dangerous substances as defined in the EU database, with exception of formaldehyde. The formaldehyde release of the LVL is classified to be E1 in accordance with EN 14374. The product does not contain pentachlorophenol.

High relative humidity conditions may cause mould growth on the surface of Kerto 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 Kerto Ripa Elements. If, due to excessive wetting, there is mould growth on the surface of Kerto Ripa Elements, this can be removed by sanding.

Kerto Ripa Elements treated against biological attack are not covered by this ETA.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

## ER 4 Safety in use

### Slipperiness of floors

Not relevant. Kerto Ripa Elements do not have finished floor surfaces.

Impact resistance

Kerto Ripa Elements are assessed to have acceptable impact resistance for the intended uses.

**ER 5 Protection against noise**

Airborne sound insulation and impact sound insulation

Measured value for weighted sound reduction index  $R_w$  and weighted impact sound pressure level  $L_{n,w}$  of a typical Kerto Ripa Element are given in Table 5. The thickness of the top slab of the basic Kerto 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.

*Table 3 The acoustical performance of Kerto Ripa Elements.*

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

Acoustical performance of Kerto 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 ETA. Also in this case, the performance is strongly influenced by the flooring construction used.

Sound absorption

NPD.

**ER 6 Energy economy and heat retention**

Thermal resistance

Based on individual design Kerto Ripa Elements may have energy economy related function. The thermal resistance (R-value) or thermal transmittance (U-value) of the product varies according to the design.

The thermal conductivity  $\lambda$  of Kerto LVL is 0.13 W/(m K) to be used in calculations, according to EN 12524. The natural density variation of the materials is taken into account in this value. Correspondingly, the thermal conductivity value of the insulation given in the CE-marking shall be used.

#### Air permeability

The finished construction made of Kerto Ripa Elements, including the joints between the elements, provides adequate air tightness in relation to the intended use, taking into account energy economy and heat retention, risk of cold draughts and risk of condensation within the construction.

#### Thermal inertia

NPD.

### **Aspects of durability, serviceability and identification**

#### Durability

Kerto 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. During the erection of the building, Kerto 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 15 % unless the flooring material to be used does not provide for a lower value.

The designer shall pay attention to the details of the construction and to ensure that no water pockets will be formed. If Kerto 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.

Durability may be reduced by attack from insects such as long horn beetle, dry wood termites and anobium in regions where these may be found.

When necessary and required by the local authorities at the building site, Kerto Ripa Elements may be treated against biological attack according to the rules valid on the place. Any adverse effects of the treatment on other properties shall be taken into account. These kinds of treatments are not covered by this ETA.

#### Serviceability

Serviceability of Kerto Ripa Elements is understood as their ability to resist loads without unacceptable deformation or vibrations. This characteristic is treated under ER 1.

#### Identification

Kerto 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. The product label also bears the CE-marking.

Kerto Ripa Elements are identified by the flanges and ribs being of LVL. LVL parts may bear occasionally the marking of the LVL manufacturer.

### **3 Evaluation of Conformity and CE marking**

#### **3.1 Attestation of conformity**

The system of attestation of conformity specified by the European Commission in Decision 2000/447/EC - Official Journal L 180, 19.07.2000 is System 1, according to Council Directive 89/106/EEC Annex III.2.(i), without audit-testing of samples, and provides:

(i) Certification of the conformity of the product by an approved certification body on the basis of:

- (a) (tasks for the manufacturer)
  - (1) factory production control;
  - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;
- (b) (tasks for the approved body)
  - (3) initial type-testing of the product;
  - (4) initial inspection of factory and of factory production control;
  - (5) continuous surveillance, assessment and approval of factory production control;

#### **3.2 Responsibilities**

##### **3.2.1 Tasks of the manufacturer**

###### **3.2.1.1 Factory production control**

Kerto Ripa Elements are manufactured at several independent factories licensed by the ETA holder. The manufacturers shall exercise permanent factory production control according to the written quality manual, which is endorsed by the approved body. The manual is property of the ETA holder and fulfils the requirements of ETAG 019. The manual specifies how the factory production control measures are carried out, and at which frequencies.

Manufacturers having an FPC system, which complies with EN ISO 9001 and which addresses the requirements of this ETA, are recognized as satisfying the FPC requirements of the Directive.

###### **3.2.1.2 Testing of samples taken at the factory**

Testing of samples taken at the factory according to a prescribed test plan is part of the factory production control. The test plan is part of the quality manual deposited at the VTT, and is available to approved bodies involved in the attestation of conformity to this ETA.

###### **3.2.1.3 Declaration of conformity**

When all the criteria of the Conformity Attestation are satisfied, the manufacturer shall make a Declaration of Conformity.

### 3.2.2 Tasks of approved bodies

#### 3.2.2.1 General

Several approved bodies may be involved in the certification so that the products manufactured by different manufacturers in different MS may be certified by different approved certification bodies. Each manufacturer and the respective certification body shall have a certification contract regulating the duties of the parties. The approved certification bodies shall report to VTT.

#### 3.2.2.2 Initial type testing of the product

Approval tests have been conducted by VTT or under its responsibility in accordance with section 5 of the ETA Guideline. VTT has assessed the results of these tests in accordance with section 6 of the ETA Guideline, as part of the ETA issuing procedure. The product characteristics determined by the initial test programme and by the experience of the external inspections is found sufficient to serve as initial type testing. This shall be validated by the approved body for the purpose of certification of conformity.

In case of a new manufacturing line, an approved certification body has to conduct initial type testing to verify that the production line in question is able to manufacture products in conformity with the ETA. The initial type testing can be limited to testing of the adhesive bonded connections between slabs and ribs and has to be agreed between VTT and the approved bodies involved.

#### 3.2.2.3 Initial inspection of the factory and the factory production control

An approved body shall conduct initial inspection of each manufacturing line in order to ensure that the premises and technical equipment are acceptable, personnel is qualified and a factory production control system which is in accordance with the provisions in the ETA Guideline and this ETA is followed. The gluing procedure shall be separately assessed in case of each line.

#### 3.2.2.4 Continuous surveillance, assessment and approval of the factory production control

The approved body shall visit the factory at least twice a year for regular inspection. It shall be verified that the factory production control is performed according to this ETA, including tests of samples according to the prescribed test plan.

#### 3.2.2.5 Certification

When all the criteria of the Conformity Attestation are satisfied the approved certification body shall issue a Certification of Conformity with this European Technical Approval for each manufacturing line separately.

In cases where the provisions of the European Technical Approval and the prescribed test plan are no longer fulfilled, or the manufacturer has not made products according to the ETA during the latest 6 months, the Certification of Conformity shall be withdrawn.

### **3.3 CE-Marking**

The CE marking shall be affixed on each Kerto Ripa Element. The CE marking shall be accompanied by the following information:

- identification number of the notified certification body (System 1)
- the name or identifying mark of the producer and the registered address of the producer
- last two digits of the year in which the marking was affixed
- the number of the EC certificate of conformity (System 1)
- number of the ETA
- information regarding the performance of any thermal insulation contained (reaction to fire class, R or U of the element)
- project number and element number or a corresponding identification of the characteristics of Kerto Ripa Element

## **4 Assumptions under which the fitness of the product for the intended use was favourably assessed**

### **4.1 Design of works**

For each individual building project, a specific structural design shall be made according to the instructions of the ETA holder by a person responsible for the task according to the laws of the MS. The design also shall take into account any aspects regarding installation of the elements, as any temporary bracing and supporting. When relevant, also other performances in addition to ER1 shall be documented in the design (ER2, ER6). Finnforest Kerto provides with design instructions of the Kerto Ripa Elements. When the instructions are updated, the updated version shall be approved by VTT.

### **4.2 Manufacturing**

Kerto Ripa Elements are manufactured in accordance with the provisions of this European Technical Approval as identified during the inspection of manufacturing places by VTT. The ETA holder has separate agreements with the manufacturers that act as independent companies.

Gluing of slabs to ribs shall be performed according to ETA holder's instructions based on relevant standards for structural gluing of wood material. Gluing pressure may be achieved by screws or nails as specified in detail in the instructions of the ETA holder. When the instructions are updated, the updated version shall be approved by VTT.

### **4.3 Installation**

Kerto Ripa Elements shall be installed by appropriately qualified personnel, following the installation plan.

## **5 Recommendations**

### **5.1 Recommendations on packaging, transport and storage**

Kerto Ripa Elements shall be protected against harmful wetting during transport and storage and stored only temporarily on the building site. Any measures to keep the moisture content low and to avoid condensation shall be done carefully. Weather exposure of rain, water flowing as well as water convection from other structures shall be avoided. Tarpaulins shall be used to protect the Kerto Ripa Elements from rain, dirt and excessive solar radiation, especially when the elements have finished surfaces. Protective treatments may be adequate for Kerto Ripa Elements without bottom slab.

Kerto 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.

## **5.2 Recommendations on use, maintenance and repair**

Before the installation it shall be controlled that Kerto Ripa Elements are not damaged during transport or storage. Damaged Kerto Ripa Elements shall be replaced by sound ones.


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.

Holes in Kerto Ripa Elements to provide openings for ducts, pipes etc. or modification or repair of the construction may only be made after consultation with the person responsible for the design as described in 4.1.

The manufacturer shall ensure that the information of these provisions is given to those concerned.

On behalf of VTT

Espoo, 14 February 2007



Liisa Rautiainen

Assessment manager

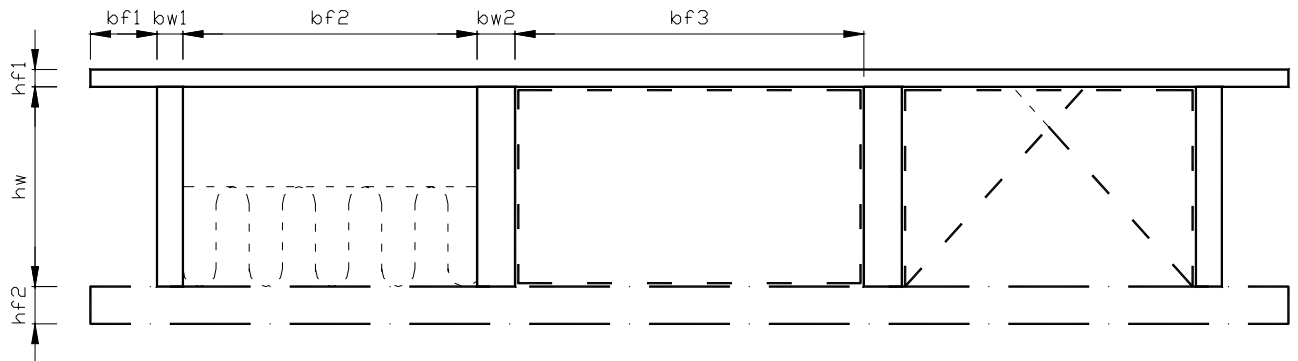


Kirsti Riipola

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## ANNEX 1 DESCRIPTION OF KERTO RIPA ELEMENTS

### 1 Cross sections and sizes



*Figure 1-1: Cross sections of Kerto Ripa Element. The bottom slab, cross bracing, and insulation may be optional.*

The design of Kerto Ripa Elements is shown in Figure 1-1. The products are individually designed based on 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 have one-sided tapered ribs; maximum taper is 10°. The ribs may be stiffened, when necessary, with additional stiffeners made of Kerto LVL. Kerto Ripa Elements may contain insulation in the cavities.

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

Typical dimensions of the members to be glued together are

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

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

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

Tolerances of dimensions at the reference moisture content of  $10 \pm 2\%$  are presented in Table 1-1.

*Table 1-1. Tolerances of Kerto Ripa Elements.*

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

\*\* which one is smaller

The thickness of sanded Kerto slabs is the nominal thickness decreased by 1mm for each sanded surface. Kerto slabs used in Kerto 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 Kerto Ripa Elements.

Table 1-2 The characteristic values of Kerto -S and Kerto -Q to be used in the design of Kerto Ripa Elements.

Property	Symbol	Characteristic value, N/mm <sup>2</sup> or kg/m <sup>3</sup>			
		Kerto -S ribs Thickness 21 - 90 mm	Kerto -Q slabs, thickness		
			19-20 mm*	19 - 23 mm**	25 - 68 mm**
<b>Fifth percentile values</b>					
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					
	$\rho_k$	480	480	480	480
<b>Mean values</b>					
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					
	$\rho_{mean}$	510	510	510	510

\* For Kerto Q with lay-up |—| |—|

\*\* For Kerto Q with two parallel surface veneers

The characteristic strength and stiffness values for Kerto LVL ribs and slabs to be used in the calculations are given in Table 1-2. The characteristic strength values are given at an equilibrium moisture content resulting from a temperature of 20 °C and a relative humidity of 65 % exposed to duration of load of 5 minutes. The characteristic values given in Table 1 - 2 can be used without any modifications for temperatures below or equal to 50 °C for a prolonged period of time.

Furthermore, the reference width (depth of the beam) in edgewise bending is 300 while the reference length in tensile parallel to grain is 3000 mm. The effect of member size on edgewise bending and tensile strength values shall be taken into account. This is made by the factors  $k_h$  and  $k_l$  given in Eurocode 5 for which the  $s$ -values are given in Table 2. This also applies for the effective width of the tension flange.

The modification factors  $k_{mod}$  and  $k_{def}$  for LVL, as defined in Eurocode 5, shall be used in the design of Kerto Ripa Elements.

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

## **2 Specifications of components**

The slabs are made of Kerto Q LVL (laminated veneer lumber) and the ribs of Kerto S LVL produced by the Finnforest Lohja Mill or Punkaharju Mill or corresponding LVL. The material properties comply with EN 14374. The characteristic strength values of the LVL to be used in calculations are given in Table 1-2.

The adhesive is of type I (full exposure to the weather) as defined in EN 301. 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.

Insulation material used in the cavities is mineral wool as defined in EN 13162, thermal conductivity  $\lambda = 0,037$  W/(m K) or better. When the insulation is used in constructions subject for fire regulations, additional provisions according to Annex 2 apply.

Screws or nails according to the specification of the ETA holder that are used according to the manufacturing instructions do not have any structural function in the finished product.

## **3 Manufacturing**

Kerto Ripa Elements are manufactured on behalf of Finnforest at several independent authorized factories. The pressure necessary for gluing is achieved by approved methods developed by Finnforest.

## **4 Typical connections between Kerto Ripa Elements**

Kerto Ripa Elements are normally connected to each other with mechanical fasteners. Diagonal screwing is recommended. Kerto 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.

Kerto Ripa Elements may be top slab supported. Design guide for top slab supported Kerto Ripa Elements is provided by the ETA holder.

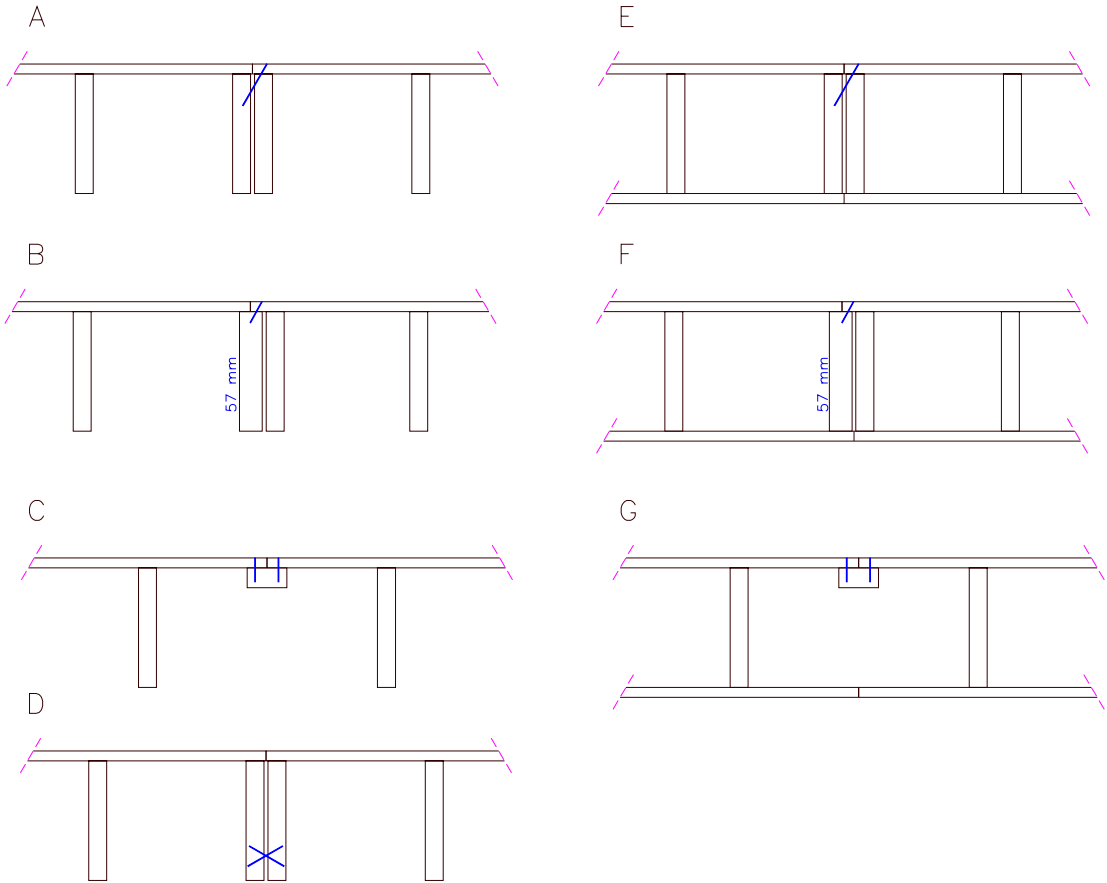


Figure1-2: Principal drawing of connections between Kerto Ripa Elements.

## ANNEX 2

### PROVISIONS FOR RESISTANCE TO FIRE CLASSIFICATION

When resistance to fire classification of the Kerto Ripa Elements is needed, the following provisions shall be fulfilled.

A floor construction made of Kerto Ripa Elements has resistance to fire class REI 30 or REI 60 if the thickness of the bottom slab is at least 22 mm or at least 37 mm respectively. The thickness of the ribs shall be at least 45 mm and the spacing of the ribs must not exceed 600 mm. The cavities may contain rock wool or not. The height of the ribs must not exceed 300 mm added by the height of the possible rock wool layer. The elements shall be glued with polyurethane glue Purbond HB 110 or another glue with corresponding strength properties.

To have an effect on resistance to fire, insulation in the cavities shall be rock wool installed tightly against the ribs and the thickness of it shall be at least 100 mm and the density of it at least 27 kg/m<sup>3</sup>. If the thickness exceeds 100 mm the rock wool shall be fixed in the ribs so that it remains at place during the fire.

The load bearing capacity and the deflection of the Kerto 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 deflection in the fire situation is not allowed to exceed 20 mm in the middle of the element span.

*Table 3-1. Charring rates for the calculation of load bearing capacity in case of fire.*

	Kerto Ripa Element without insulation in the cavities	Kerto Ripa Element cavities with rock wool insulation
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 N/mm <sup>2</sup>	always

Joint type F shown in Annex 1 Figure 2 shall be used between the elements. The elements are to be 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 at least 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/m<sup>3</sup>, thickness 30 mm) installed inside the joint. If the density of rock wool is less than 140 kg/m<sup>3</sup> the width and thickness of insulation should be increased in such a manner that the amount (kg/m) of compressed insulation is the same as when the insulation with density 140 kg/m<sup>3</sup> is used.

In case of fire, Kerto Ripa Elements may be supported so that whole bottom slab rests on the underlay, or by the top slab of the elements, 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/m<sup>3</sup>). 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.