MOISTURE BEHAVIOUR

Kerto® LVL

Moisture content

The moisture content ω of Kerto® LVL products is approximately 8% to 10% when dispatched from the mill. Due to changes in temperature and relative humidity of the surrounding conditions, the moisture content of the product will continuously alter. 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%.

Moisture content ω is defined as follows:

$$\omega = \frac{m_\omega - m_0}{m_0} \qquad (1)$$

where:

m_ω mass of the product in corresponding moisture content ω
m_0 dry mass of the product

- A non-invasive moisture meter should be used to measure the moisture content of Kerto LVL products. Measurements should be taken from the face veneers, meter oriented perpendicular to the grain direction. Moisture meter should be calibrated using samples with known moisture content (for example oven dried samples) to get the most reliable results.

  Some examples of suitable non-invasive moisture meters:
  - Delta 2000H (setup: H3Spruce)
  - Doser Messgerät HD5 (setup: material group 3)

- Moisture meters based on electrical resistance give somewhat too high results due to the glue lines of Kerto LVL products. Oven drying according to EN 322 should be conducted for exact determination of moisture content of Kerto LVL.

Absorption and desorption

Moisture content of Kerto LVL is dependent on the relative humidity (RH%) and the direction of the moisture transport (drying/wetting). The curve combining equilibrium moisture content to relative humidity at a constant temperature is called a sorption isotherm, see Figures 1 and 2. When wood product dries (desorption) the equilibrium moisture content is higher in the same relative humidity than when wood product gets wet (absorption).

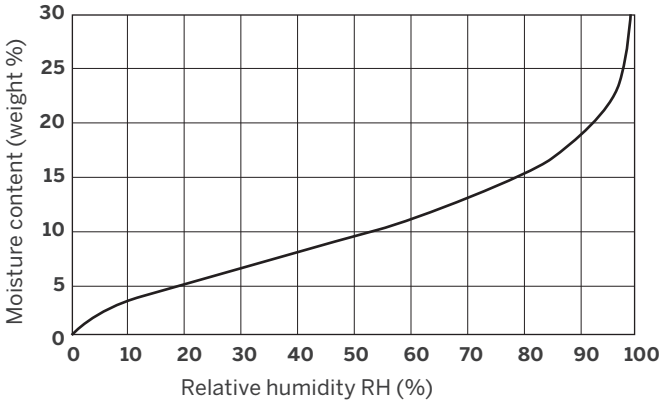

Figure 1. Average moisture content of Kerto LVL in different relative humidity and temperature of 20°C . (Source: TKK Laboratory of Structural Engineering and Building Physics, report 60, Puuviilulevyjen tasapainokosteus, 1997).

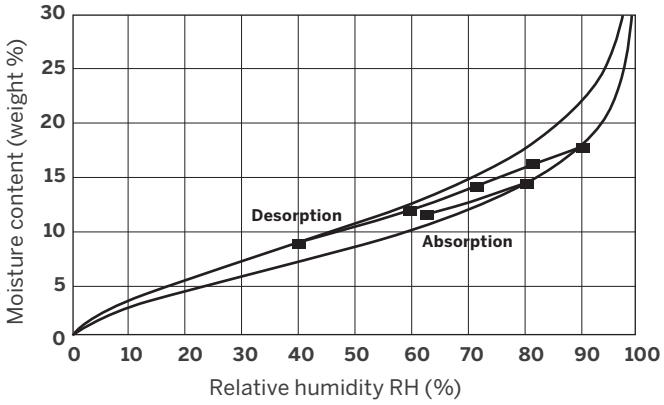

Figure 2. Isotherms of Kerto LVL in absorption and desorption in temperature of 20°C, and a curve based on weather cycling test RH 65% → 92% → 40%. (Source: TKK Laboratory of Structural Engineering and Building Physics, report 60, Puuviilulevyjen tasapainokosteus, 1997)

Dimensional changes

Kerto LVL products 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 of the product may cause also permanent deformations, problems with the surface veneers and loosening of knots.

Dimensional change ΔL due to variation in moisture content can be calculated as follows:

$$\Delta L = \Delta\omega \cdot \alpha_H \cdot L \qquad (2)$$

where:

$\Delta\omega$ change of moisture content of product [%]

α_H dimensional variation coefficient of product, see Table 1 for values and Figure 3 for dimensions

L dimension of product in corresponding direction

TABLE 1. DIMENSIONAL VARIATION COEFFICIENTS α_H

	S-beam T-stud	Q-panel Qp-beam
Thickness	0.0024	0.0024
Width	0.0032	0.0003 [1]
Length	0.0001	0.0001

[1] For Qp-beam with widths of 500 mm and more

Example:
If relative humidity changes from 50% to 85% the moisture content of a Kerto LVL S-beam increases approximately by 7%. Dimensional changes of the beam are calculated as follows:

Thickness:
45 mm → 45 + (7 × 0.0024 × 45) = 45.8 mm
Width:
300 mm → 300 + (7 × 0.0032 × 300) = 306.7 mm
Length:
3,000 mm → 3,000 + (7 × 0.0001 × 3,000) = 3,002.1 mm

Kerto LVL products may warp when the moisture content of the opposite surfaces is not equal, for example, when one surface is exposed to a higher relative humidity than the other. Kerto LVL S-beam and T-stud are more sensitive to such warping effect, especially if the height of the product is more than 8 times the width (b > 8t).

Water vapour resistance

Water vapour resistance factor μ and water vapour diffusion coefficient in air δ_p for Kerto LVL products are given in Table 2. Figure 3 describes the different dimensions of Kerto LVL.

Permanent swelling

When Kerto LVL products get wet and dry for the first time there will be permanent swelling in direction of thickness due to the manufacturing process.

Nominal thickness of the product should be used in the design.

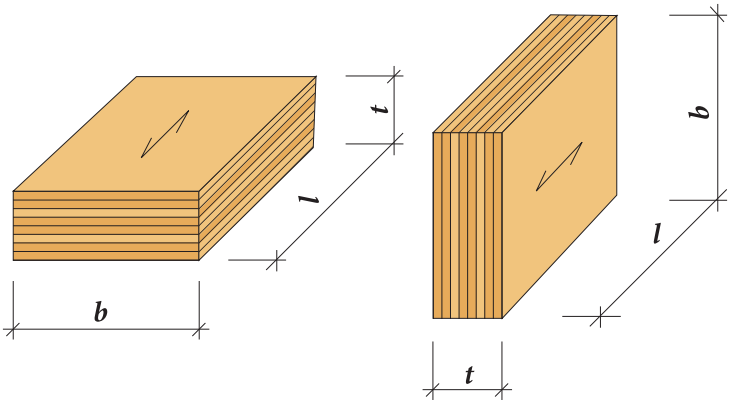

Figure 3. Dimensions for the coefficient factors in Table 1 and Table 2.
b = width (height), l = length, t = thickness.
Arrow shows the grain direction of the surface veneer.

Kerto LVL with Weatherguard® treatment – termoporary protection against rain

Kerto LVL with WeatherGuard treatment is a product with hydrophobic surface. The surface rejects rainwater and therefore reduces the amount of water absorbed by the product during construction work. At the same time, the surface allows the product to breathe and water vapour to move freely. The reduced moisture absorption further improves the dimensional stability and reduces the swelling of the treated Kerto LVL product during the construction work. WeatherGuard treatment does not affect strength properties of the product.

The WeatherGuard treated surface can be further treated with standard paints, lacquers, vanishes and protection treatments applicable to wood products. Compatibility of surface treatment should be confirmed from the supplier. Before treating large areas, it is recommended to test with a small sample.

Figure 4. Water droplets on WeatherGuard treated Kerto LVL

TABLE 2: WATER VAPOUR RESISTANCE OF KERTO LVL

	S-beam	Q-panel	S-beam	Q-panel	
	μ [-]		δ_p [kg / (Pa · s · m)]		Conditions
In direction of thickness	200		$1.0 \cdot 10^{-12}$		Dry Cup [1)]
	70		$2.7 \cdot 10^{-12}$		Wet Cup [1)]
	80	62	$2.4 \cdot 10^{-12}$	$3.0 \cdot 10^{-12}$	20°C - 50/75 RH%
In direction of width	82	9.5	$2.3 \cdot 10^{-12}$	$20 \cdot 10^{-12}$	20°C - 50/75 RH%
In direction of length	3.9	4.7	$49 \cdot 10^{-12}$	$40 \cdot 10^{-12}$	20°C - 50/75 RH%

[1)] Values are defined in EN ISO 10456. The dry cup values are tested in 23°C - 0/50 RH% and apply when the mean relative humidity across the material is less than 70%. The wet cup values are tested in 23°C - 50/93 RH% and apply when the mean relative humidity across the material is greater than or equal to 70%.