

# SINTEF Technical Approval

## TG 20766

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Provided listed on  
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SINTEF confirms that

### Stora Enso LVL

has been found to be fit for use in Norway and to meet the provisions regarding product documentation given in the regulation relating to the marketing of products for construction works (DOK) and regulations on technical requirements for building works (TEK), with the properties, fields of application and conditions for use as stated in this document



#### 1. Holder of the approval

Stora Enso Wood Products Oy Ltd  
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[www.storaenso.com](http://www.storaenso.com)

#### 2. Product description

##### 2.1 General

Stora Enso LVL consists of multiple layers of 3 mm veneers from spruce that are bonded together (fig. 1). The rotary-peeled veneers are scarf jointed. The glue is a water-resistant phenol formaldehyde resin applied between all layers.

##### 2.2 Product types

Stora Enso LVL is produced in the following grades:

- Stora Enso LVL S-grade, with all veneers having the fiber direction parallel to the beam's longitudinal direction.
- Stora Enso LVL X-grade, with veneers alternately placed crosswise and parallel to the beam's longitudinal direction (fig. 2).
- Stora Enso LVL T-grade, with all veneers running in the same direction as for S-grade, but with a lighter veneer quality.

##### 2.3 Dimensions

Stora Enso LVL S-grade and X-grade comes as beams with the following standard dimensions:

- Thicknesses from 27 mm to 75 mm
- Widths from 200 mm to 600 mm
- Maximum length 24,5 m

Stora Enso LVL X-grade are also available as panels and boards with widths 1200 mm and 2500 mm.

Stora Enso LVL T-grade is specially designed for use as wall studs, and are available with standard dimensions 39 x 66 mm and length 2550 - 6000 mm, and 39 x 92 mm with length 6000 mm.

Dimension tolerances measured at moisture content of  $10 \pm 2\%$ :

- Thickness:  $\pm 1$  mm for beam thickness 27 mm  
 $\pm 2$  mm for beam thickness  $> 27$  mm and  $\leq 57$  mm  
 $\pm 3$  mm for beam thickness  $> 57$  mm
- Height/width:  $\pm 2$  mm for height/width  $\leq 400$  mm  
 $\pm 0,5\%$  for height/width  $> 400$  mm
- Length:  $\pm 5$  mm

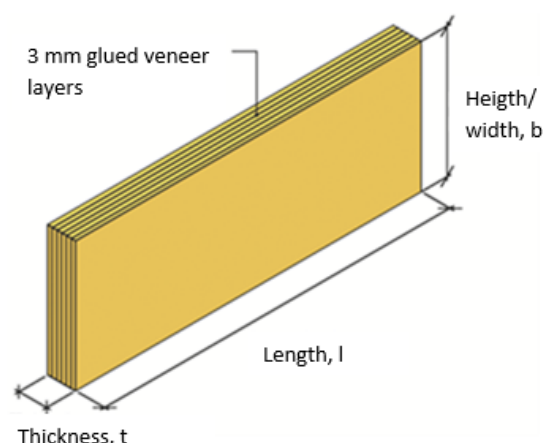


Fig. 1

Stora Enso LVL. In S-grade and T-grade all veneers has the fiber direction running parallel to the longitudinal direction. In X-grade the veneers are regularly placed crosswise and parallel to the beam's longitudinal direction

Nominal thickness mm	Number of piles	Veneer lay-up <sup>1)</sup>
22	8	-  -
27	9	-  -
30	10	-  -
33	11	-  -  -
39	13	-  -  -
45	15	-  -  -
51	17	-  -  -  -
57	19	-  -  -  -  -
63	21	-  -  -  -  -
69	23	-  -  -  -  -  -
75	25	-  -  -  -  -  -

<sup>1)</sup> | denotes veneers with fiber direction parallel to the longitudinal direction of the beam/panel

— denotes veneers with fiber direction crosswise to the longitudinal direction of the beam/panel

Fig. 2

Veneer lay-up in Stora Enso LVL X-grade

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## 2.4 Weight and moisture content

Stora Enso LVL S-grade and X-grade have a density of approx. 510 kg/m<sup>3</sup> measured according to EN 323. T-grade has a density of approx. 440 kg/m<sup>3</sup>.

Stora Enso LVL is delivered with a moisture content of 8 - 10 % measured according to EN 322.

## 3. Fields of application

Stora Enso LVL can be used in load bearing structures in service class 1 and 2 according to NS-EN 1995-1-1. The area of use applies to both types of glue.

Stora Enso LVL type X grade, S grade and T grade, can be used in buildings with hazard class 1 - 6 in fire class 1 and 2. Use of the product in a higher fire class is not covered by the approval and

must be documented specially by the responsible undertaker in each individual project. See chap. 6 special conditions for use and installation.

## 4. Properties

### 4.1 General

Stora Enso LVL fulfils the requirements for laminated veneer lumber as given in EN 14374.

### 4.2 Load-carrying capacity

Tabell 1 shows the characteristic strength, stiffness modules and density values to be used when calculating structures with Stora Enso LVL.

Table 1

Characteristic strength and stiffness modules in N/mm<sup>2</sup> plus density values for Stora Enso LVL. <sup>1)</sup>

Properties		Product		
		S-grade 24-75 mm	X-grade 24- 75 mm	T-grade 24-75 mm
Strength (5 % fractile)				
Bending strength, - edgewise <sup>2)</sup> - size effect parameter - flatwise parallel to grain - flatwise perpendicular to grain	$f_{m,0,edge,k}$ $S$ $f_{m,0,flat,k}$ $f_{m,90,flat,k}$	44 0,12 50 -	32 0,12 36 8	27 0,15 32 -
Tensile strength, - parallel to grain <sup>3)</sup> - edgewise, perpendicular to grain	$f_{t,0,k}$ $f_{t,90,edge,k}$	35 0,8	26 6	24 -
Compressive strength, -parallel to grain - edgewise, perpendicular to grain - flatwise, perpendicular to grain	$f_{c,0,k}$ $f_{c,90,edge,k}$ $f_{c,90,flat,k}$	35 6 2,2	26 <sup>4)</sup> 9 2,2	26 - -
Shear strength, - Edgewise - flatwise parallel to grain - flatwise, perpendicular to grain	$f_{v,0/90,edge,k}$ $f_{v,0,flat,k}$ $f_{v,90,flat,k}$	4,2 2,3 -	4,5 1,3 0,6	3,6 - -
Stiffness for stability calculations (5 % fractile)				
Modulus of elasticity, - bending and axial load, parallel to grains -bending, perpendicular to face veneer grain - edgewise, compression perpendicular to grain	$E_{0,k}$ $E_{m,90,k}$ $E_{c,90,edge,k}$	11 600 - -	8800 1700 2000	8 800 - -
Shear modulus, - edgewise - flatwise parallel to grain - flatwise, perpendicular to grain	$G_{0/90,edge,k}$ $G_{0,flat,k}$ $G_{90,flat,k}$	400 250 -	400 100 16	- - -
Stiffness for calculation of deformations (mean values)				
Modulus of elasticity, - bending and axial load, parallel to grains - bending, perpendicular to face veneer grain -edgewise, compression perpendicular to grain	$E_{0,mean}$ $E_{m,90,mean}$ $E_{c,90,edge,mean}$	13800 - -	10500 2000 2400	10 000 - -
Shear modulus, - edgewise - flatwise, parallel to grain - flatwise, perpendicular to grain	$G_{0/90,edge, mean}$ $G_{0,flat,mean}$ $G_{90,flat,mean}$	600 460 -	600 120 22	- - -
Density, kg/m <sup>3</sup>				
- 5 % fractile - mean	$\rho_k$ $\rho_{mean}$	480 510	480 510	410 440

<sup>1)</sup> Declared value according to the manufacturer's Declaration of Performance (DoP)

<sup>2)</sup> For beams with heights (b) other than the reference height 300 mm, the bending strength edgewise  $f_{m,k}$  must be multiplied with the correction factor  $k_h$ , as given for LVL in NS-EN 1995-1-1, where s is the declared size effect parameter

<sup>3)</sup> For beams with lengths (l) other than the reference length 3000 mm, the tensile strength  $f_{t,0,k}$  must be multiplied with the correction factor  $k_l$  as given for LVL in NS-EN 1995-1-1, where s is the declared size effect parameter

<sup>4)</sup> In service class 2 the compressive strength parallel to grain should be divided with 1,2

#### 4.3 Reaction to fire

Stora Enso LVL X grade, S grade and T grade with untreated surface is classified as class D-s1,d0 according to EN 13501-1.

#### 4.4 Fire resistance

The fire resistance of structures with Stora Enso LVL is calculated according to EN 1995-1-2 for each individual building project.

#### 4.5 Properties related to moisture

Table 2 shows the dimensional changes that may be expected when the moisture content in the material changes. Table 3 shows the water vapour resistance factor  $\mu$ .

Table 2

Declared dimensional moisture change for Stora Enso LVL

Product	Swelling and shrinkage in % per 1 % change in moisture content		
	Thickness	width	Length <sup>1</sup>
S-grade	0,30	0,31	0,006
X-grade	0,44	0,033	0,009

Table 3

Water vapor resistance factor  $\mu$  perpendicular to thickness of Stora Enso LVL, based on EN ISO 10456

Product	Water vapor resistance factor $\mu$	
	Dry climate <sup>1)</sup>	Wet climate <sup>2)</sup>
S-grade and X-grade	200	70
T-grade	180	65

<sup>1)</sup> At moisture content 0 / 50 % RH and 23 °C ("dry cup")

<sup>2)</sup> At moisture content 50 / 93 % RH and 23 °C ("wet cup")

Standard Stora Enso LVL is not impregnated against fungi or rot.

#### 4.6 Sound insulation

When calculating sound insulation performance of constructions with Stora Enso LVL, the same properties as for solid wood constructions with same weight may be applied.

#### 4.7 Thermal insulation

The design thermal conductivity is  $\lambda_d = 0,13 \text{ W/(m}\cdot\text{K)}$  for beams, panels and studs according to EN ISO 10456.

### 5. Environmental aspects

#### 5.1 Substances hazardous to health and environment

Stora Enso LVL contains no hazardous substances with priority in quantities that pose any increased risk for human health and environment. Chemicals with priority include CMR, PBT or vPvB substances.

#### 5.2 Effect on indoor environment

Stora Enso LVL is not regarded as emitting any particles, gases or radiation that have a perceptible impact on the indoor climate, or to have any significant impact on health.

#### 5.3 Waste treatment/recycling

For disposal the product shall be sorted as wood material, and delivered to an authorized waste treatment plant for energy recovery.

#### 5.4 Environmental declaration

Environmental product declaration (EPD) according to EN 15804 has been issued for Stora ENSO LVL. The declaration number is S-P-01730 [www.environdec.com](http://www.environdec.com).

### 6. Special conditions for use and installation

#### 6.1 Calculation of load-bearing capacity

The load-bearing capacity of Stora Enso LVL shall be calculated according to NS-EN 1995-1-1 with the characteristic values given in table 1.

#### 6.2 Design of fasteners

Fasteners should be designed according to the rules for laminated veneer lumber given in NS-EN 1995-1-1.

#### 6.3 Joists in residential buildings, offices etc.

The stiffness of floor joists in order to avoid annoying vibrations in normal use must be considered. Table 4 shows recommended maximum spans for joists in residential buildings, offices etc. The table are based on calculations according to SINTEF's recommended comfort criterium. In addition the load-bearing capacity has been controlled according to NS-EN 1991-1-1 and NS-EN 1995-1-1 with national annexes.

Table 4

Recommended maximum spans for floors with max 3,0 kN/m<sup>2</sup> imposed loads and added loads from light partition walls (residential buildings, offices etc.) <sup>1)</sup>

Joist dimension mm x mm	Maximum span in meters		
	Joist spacing c/c in mm		
	300	400	600
39 x 200	3,65	3,45	3,15
39 x 225	4,05	3,80	3,50
39 x 260	4,55	4,30	3,95
45 x 200	3,80	3,55	3,25
45 x 225	4,15	3,95	3,60
45 x 260	4,70	4,45	4,05
51 x 200	3,90	3,65	3,35
51 x 225	4,25	4,05	3,70
51 x 260	4,80	4,55	4,15

<sup>1)</sup> The values also applies for joists with 5 cm reinforced casting and max. self-weight incl. cast of 2,6 kN/m<sup>2</sup>, assuming maximum imposed loads of 2,0 kN/m<sup>2</sup> (single occupancy residential buildings) without added loads from partition walls. If the casting is used across large areas special considerations must be made.

Corrections of table values must be done according to SINTEF Building Research Design Guide 522.351 *Trebjelkelag. Dimensjonering og utførelse*.

For sound insulated floors, where the self weight is increased by 0,4 kN/m<sup>2</sup>, the span values must be multiplied with 0,89.

#### 6.4 Holes in beams

Holes in beams can be performed according to SINTEF Building Research Design Guide 522.351 *Trebjelkelag. Dimensjonering og utførelse*.

#### 6.5 Safety in case of fire

When used in buildings with requirements for fire resistance the fire resistance of the finished structures must be designed, and any need for additional cladding or protection of the LVL members must be determined.

#### 6.6 Transport and storage

During transport and storage Stora Enso LVL shall be protected against precipitation and contact with water.

**7. Factory production control**

Stora Enso LVL is produced in Varkaus, Finland.

The holder of the approval is responsible for the factory production control to ensure that the product is produced in accordance with the preconditions applying to this approval.

The manufacturing of Stora Enso LVL is subject to continuous surveillance of the factory production control in accordance with the contract regarding SINTEF Technical Approval.

Stora Enso LVL is certified by Eurofins Expert Services Oy in Finland as basis for CE-marking in accordance with EN 14374:2004 with affiliated factory production control, certificate no. 0809 – CPR – 1196, 1203, 1214. (EUF129-20001032-T1).

**8. Basis for the approval**

The evaluation of Stora Enso LVL is based on reports owned by the holder of the approval.

**9. Marking**

Stora Enso LVL shall be CE-marked in accordance with EN 14374. The marking shall include product type and production number.

The approval mark for SINTEF Technical Approval, TG 20766, may also be used.

**10. Liability**

The holder/manufacturer has sole product responsibility according to existing law. Claims resulting from the use of the product cannot be brought against SINTEF beyond the provisions of Norwegian Standard NS 8402.

for SINTEF



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