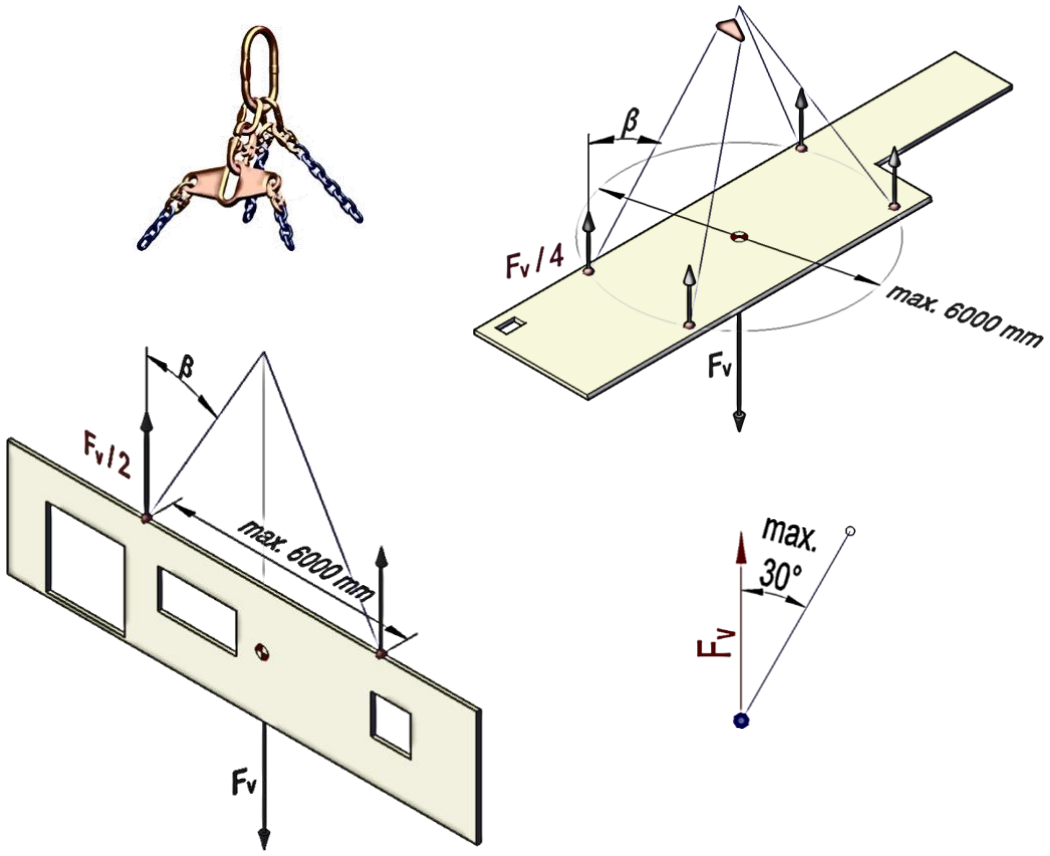
Lifting Guideline
for Cross Laminated Timber



Content

1 Disclaimer

This document is a general guideline and does not substitute technical datasheets provided by lifting device suppliers.

While every effort is made to ensure the accuracy of the advice given, Stora Enso cannot accept liability for loss or damage arising from the information supplied.

Except for the version available on Stora Enso's Website, all printed and electronic copies must be considered uncontrolled copies for reference only. This document is valid until further notice and invalidates all previous 'Lifting Guidelines'.

2 Basics of safe lifting

Lifting Safety relies on the know-how from all stakeholders involved. The selection of lifting devices and the actual lifting operation need to be executed by qualified professionals.

If your lifting environment (national regulations / company guidelines) deviate from the assumptions stated in this guideline, you are obliged to inform Stora Enso in writing about your necessary requirements.
Stora Enso Is reserving the right to refuse installation of lifting equipment if best practices are neglected.

While Stora Enso is enforcing a rigorous safety philosophy buyers are responsible for safe lifting on their own building sites!

Stora Enso assumptions for lifting point design:

1. More than two lifting points on wall elements and more than three lifting points on floor elements, require the use of load distribution equipment!
2. Without the use of load distribution equipment, the load bearing capacity needs to be reduced by 50 %.
3. Lifting angles on-site should be limited to a maximum of 30°. Stora Enso is working with design values for 45° to create additional safety margins.
4. The element weight itself is decisive. No other loads are considered (i.e. safety fence).
5. Hoisting velocity and type of crane used on-site influence the dynamic load coefficient significantly. Load coefficient assumptions vary between manufacturers. Complying with these assumptions is critical for safe lifting and within the operator's responsibility.
6. The panel weight refers to the net panel area excluding cut-outs.
7. Cut-outs may have to be fixed inside the gross panel for loading and transport. These must be removed under all circumstances before lifting the net panel.

Safe Lifting depends on the buyer's responsibility to comply and operate within these assumptions.

Important background knowledge!

To consider the dynamic actions while lifting a dead load from the ground, the **dynamic coefficient $\varphi 2$ must be considered.** This coefficient depends on the used lifting equipment (type of crane and lifting speed). The coefficient should be applied to the action E.

However, to simplify the design process, $\varphi 2$ is sometimes applied directly to the load bearing capacity of the lifting device.

Applying the coefficient to the load will increase the design value of action.
Applying the coefficient to the resistance of a lifting device will decrease the design load-bearing capacity.

In this guideline we are highlighting the supplier's assumption made on their lifting device, **clarifying whether the dynamic coefficient has already been deducted from the load bearing capacity or needs to be considered with the load.**

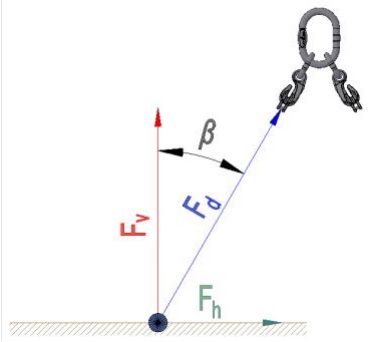
CLT is usually lifted by tower cranes or mobile cranes with lifting speeds of 35m/s or less. In this case, a dynamic coefficient of φ2 = 1.3 should be applied.

Be aware that the type of crane used, and the lifting speed have a significant impact on either the load or the load bearing capacity.

boundary condition	dynamic coefficient
rotating tower crane, portal crane, mobile crane	**1.30**
lifting and moving on flat terrain	2.50
lifting and moving on rough terrain	≥ 4.00

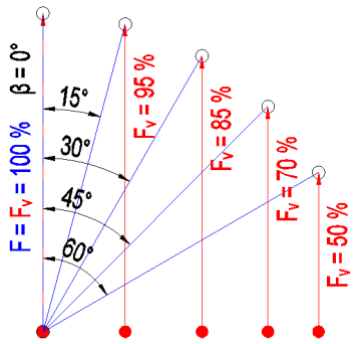
1: Source: VDI/BV-BS 6205 Part 3

The lifting angle (β) has a significant influence on the load-bearing capacity of each lifting system:



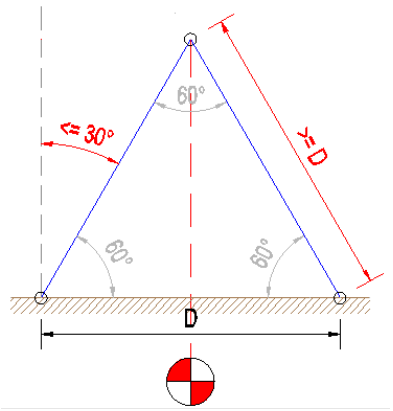
F_v Load > vertical share
F_d Load > diagonal share (chain/anchor/sling)
F_h Load > horizontal share

An increase of the lifting angle as a rule decreases the load-bearing capacity (F_v) of a lifting system significantly.



Stora Enso assumes a lifting angle of 30° or less.

- Higher lifting angles decrease the load-bearing capacity and therefore increase risk.
- There is a simple rough-and-ready rule for 30° or less lifting angles. **Chain length must be equal or longer than the maximum distance between lifting points (D).**
- The lifting points must be aligned symmetrically regarding center of gravity and lifting direction.



Stora Enso assumes **a symmetric system** where all lifting points are equally loaded.

With more than two lifting points on wall elements and more than three lifting points on floor elements, it is mandatory to use load distribution equipment.

Load distribution

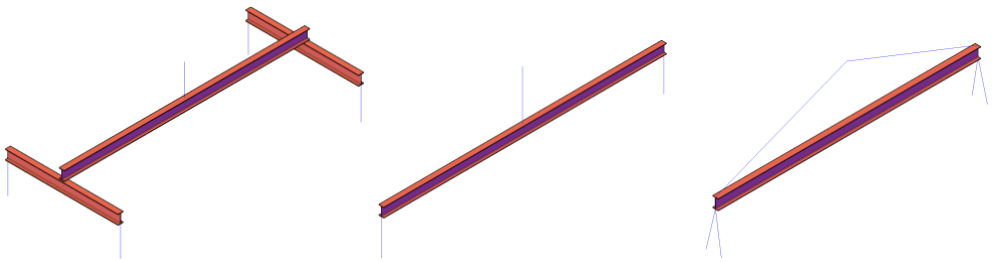
Without load distribution equipment, load-bearing capacity must be reduced by 50 %.

Asymmetry/Eccentricity

In such cases the load-bearing capacity must be reduced by 50 %.

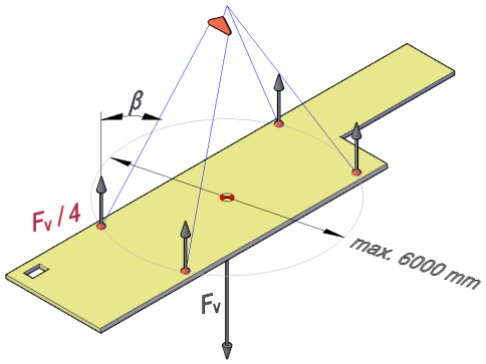
A "**load distributor**" (balancing rocker) is affordable and very effective for 4-leg lifting.

System sketches of equivalent load distribution equipment (lifting beams, spreader beams, etc.).
For professional support please contact your preferred supplier.

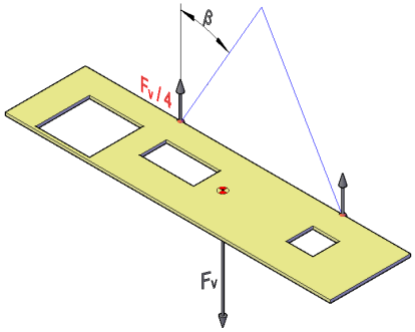


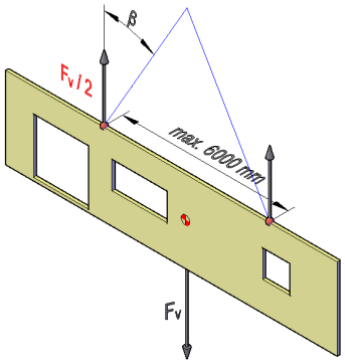
4-leg lifting with load distributor or something equivalent:

Each lifting point is loaded equally with 1/4 of the total load.



Turning of Wall Panels
Wall panels are usually delivered horizontally. To upright such panels the correct load case provided by supplier must be selected.



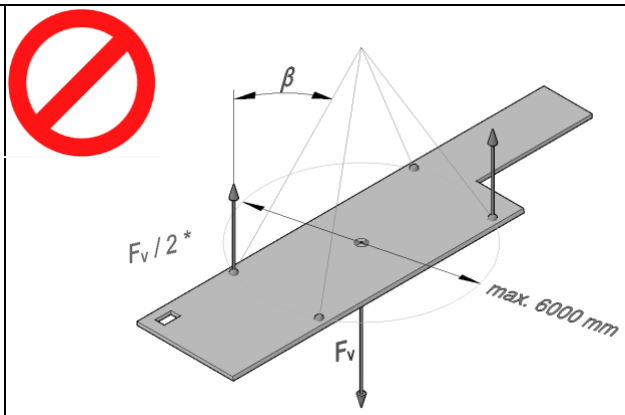


4-leg lifting without load distributor:

© Pewag

***** Despite symmetrical alignment the total load is not distributed equally to all four lifting points.

Not supported by Stora Enso!



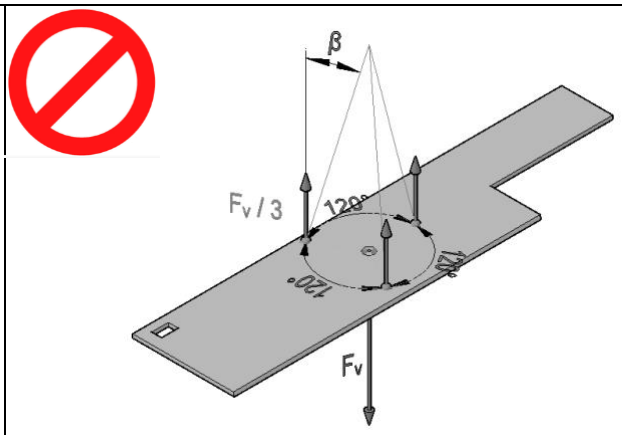
3-leg lifting:

There are two conditions to distribute the total load equally to all three lifting points:

- All lifting points must have the same distance from center of gravity.
- The angle between lifting points must always be 120°.

The lifting points are aligned within a small area. Long panels might deflect and bend.

Not supported by Stora Enso!



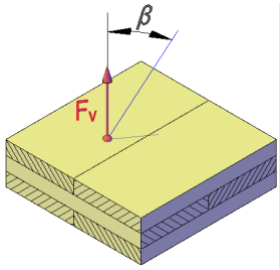
3 Lifting sling

Lifting sling is made of 100 % Polyester (PES). Standard length is one meter at 50 mm width and ~ 3 mm thickness.
Lengths of 2 and 4 meters on request. Technical Datasheet and Operating Instruction.

- **The sling is for single-use only**. 'Single use': maximum six lifting cycles per element.
- It is not allowed to remove slings and re-use them for other elements.
- Slings must always be checked for damages before each lifting cycle.
- Contact with sharp edges (steel beams, concrete edge, etc.) must be avoided.
- Adhere to the information provided on the lifting sling label.

The sling is pre-installed and delivered as 'basket'. It is not allowed to 'choke' afterwards.

3.1 Floor

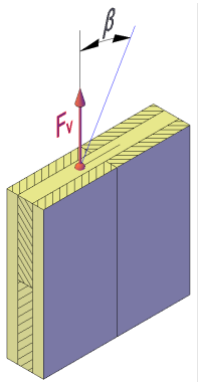
<table>
<tr><td colspan="4">Edge distance: minimum 200 mm
The lifting angle (β) is assumed to be maximum 30°.</td></tr>
<tr><td rowspan="3"> 
</td><td>  </td><td> 

≤ 30°</td></tr>
<tr><td rowspan="2">Lifting Method</td><td>© Pewag
  </td></tr>
<tr><td>F_v (kg) *</td></tr>
<tr><td> 
</td><td>'basket'
(standard)</td><td>1250</td></tr>
<tr><td colspan="4">EC – declaration of conformity: see Appendix</td></tr>
<tr><td colspan="4">* Design values are only valid if correct load distribution equipment is used.</td></tr>
<tr><td colspan="4">The dynamic load coefficient φ_2 = 1.3 can be considered included in the safety factor of 7.</td></tr>
</table>

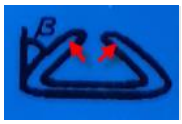
Slings are installed in D35 mm drill holes. Depending on the load, sling can cause localized timber crushing.
The lifting holes can be plugged once lifting is complete.

3.2 Wall

Edge distance: 200 mm
The lifting angle (β) is assumed to be maximum 30°.



≤ 30°

Lifting Method		F_v (kg) *
	**'Basket'** (standard)	**1000**

EC – declaration of conformity: see Appendix

*** Design values are only valid if correct load distribution equipment is used.**

The dynamic load coefficient φ_2 = 1.3 can be considered included in the safety factor of 7.

Slings are installed in D35 mm drill holes. Depending on the load, sling can cause localized timber crushing.
The lifting hole can be plugged once lifting is complete.

Lifting slings and load hooks

According to DIN-EN 1492-1 - Textile slings, one-way lifting slings with a width of less than 75 mm do not necessarily have to lie flat on the lifting equipment. The slings with a width of 50 mm used by Stora Enso fall under this regulation.
The Norm allows for a lifting hook radius of min. 0.75 x the width of the lifting sling.
The radius of the lifting hook must therefore be at least 37.5 mm or the diameter at least 75 mm.

4 Blind hole with dowel and lifting sling

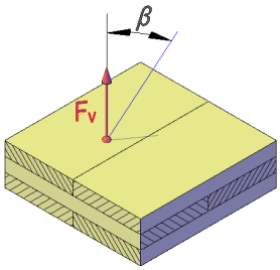
Lifting sling is made of 100 % Polyester (PES). Standard length is one meter at 50 mm width and ~ 3 mm thickness.
Lengths of 2 and 4 meters on request. Blind hole diameter: 68 mm
The sling is fixed by a steel dowel and is stuffed into the blind hole for easy stacking and transport.

- **The sling is for single use only**. 'Single use': maximum six lifting cycles per element.
- It is not allowed to remove slings and re-use them for other elements.
- Slings must always be checked for damages before each lifting cycle.
- Contact with sharp edges (steel beams, concrete edge, etc.) must be avoided.
- Adhere to the information provided on the lifting sling label.

The sling is pre-installed and delivered as 'Basket'. It is not allowed to 'choke' afterwards.

The lifting angle (β) is assumed to be maximum 30°.
Indicated loads are only valid for hoisting velocity up to 36 m/min = 0.6 m/s

≤ 30°



Lifting Method

© Pewag

'Basket'
(standard)

CLT (mm)	F_v (kg) *
80 - 90	**500**
100 - 150	**1000**
> 150	**1250**

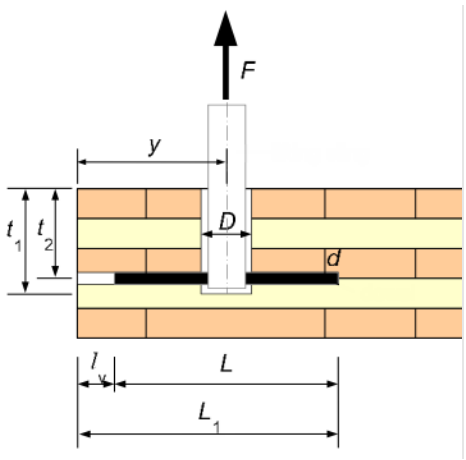
EC – declaration of conformity: see Appendix

*** Design values are only valid if correct load distribution equipment is used.**

Values take into account a dynamic load coefficient of φ2 = 1.3

Below parameters for drillings and load-bearing capacities of standard CLT panels.
Deviating dimensions according to the following principles:

- t_1: The blind hole should be as deep as possible, maximum 160 mm.
- t_2 :The steel dowel has to be 20 mm higher than the bottom of the blind hole ($t_2 = t_1$ -20 mm).



Steel dowel (d):

- diameter: 16 mm
- length: 300 mm
- depth (t2): see table below
- steel grade: S235

Blind hole (D):

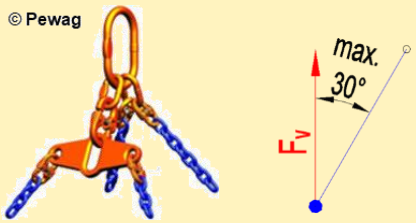
- diameter 68 mm
- depth (t1): see table below; max. 160 mm

Edge distance (y):

- minimum = 200 mm
- maximum = 340 mm

Lifting sling: PEWAG; 50x1000 mm; 1000 kg

The lifting angle (β) is assumed to be maximum 30°.
Indicated loads are only valid for hoisting velocity up to 36 m/min = 0.6 m/s



Product	Thickness	Structure	Blind hole t1	Steel dowel t2	F_v (kg) *
CLT	60	L3s	not possible		
CLT	80	L3s	70	50	**500**
CLT	90	L3s	80	60	**500**
CLT	100	L3s	90	70	**1000**
CLT	120	L3s	110	90	**1000**
CLT	100	L5s	90	70	**1000**
CLT	120	L5s	100	80	**1000**
CLT	140	L5s	110	90	**1000**
CLT	160	L5s	130	110	**1250**
CLT	180	L5s	140	120	**1250**
CLT	200	L5s-2	150	130	**1250**
CLT	160	L5s-2	140	120	**1250**
CLT	180	L7s	160	140	**1250**
CLT	200	L5s	160	140	**1250**
CLT	240	L7s	160	140	**1250**
CLT	220	L7s-2	160	140	**1250**
CLT	240	L7s-2	160	140	**1250**
CLT	260	L7s-2	160	140	**1250**
CLT	280	L7s-2	150	130	**1250**
CLT	300	L8s-2	160	140	**1250**
CLT	320	L8s-2	160	140	**1250**

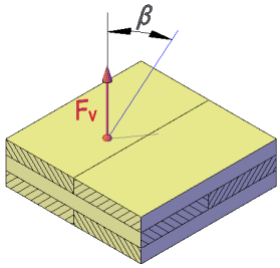
*** Design values are only valid if correct load distribution equipment is used.**

Values take into account a dynamic load coefficient of φ2 = 1.3

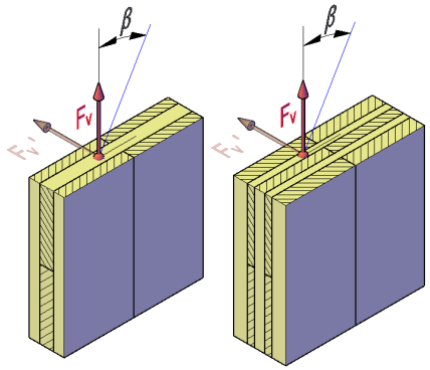
5 SIHGA Pick & Pick Max®

Design values and operating instructions should exclusively be taken from SIHGA Pick technical datasheet.
Technical datasheet Sihga Pick MAX®.

5.1 Floor

The lifting angle (β) is assumed to be maximum 30°.		
 	**SIHGA Pick** • Min. panel thickness: 80 mm • Blind hole: ø 50x75 mm • Tolerance ø: -0.0 / +1.0 mm. • Edge distance: min 250 mm • No manual drilling for VI Qualities at min. thickness (center tip)	**SIHGA Pick Max®** • Min. panel thickness: 160 mm • Blind hole: ø 50x145 mm • Tolerance ø: -0.0 / +1.0 mm. • Edge distance: min 500 mm • No manual drilling for VI Qualities at min. thickness (center tip)
β (°)	**45°**	
kg	**810**	**975**
*** Design values are only valid if correct load distribution equipment is used.**		
Values take into account a dynamic load coefficient of φ2 = 1.3		

5.2 Wall

The lifting angle (β) is assumed to be maximum 30°.		
	**Sihga Pick** • Min panel thickness: 90 mm • Blind hole: D50x75 mm • Tolerance ø: -0.0 / +1.0 mm • Min. edge distances: 20 mm (thickness) and 250 mm • Max. end grain share of the blind hole ≤ 40 mm.	**Sihga Pick Max** • Min. panel thickness: 100 mm • Blind hole: D50x145 mm • Tolerance ø: -0.0 / +1.0 mm • Min. edge distances: 25 mm (thickness) and 500 mm • Max. end grain share of the blind hole ≤ 40 mm.
	According to Sihga Pick technical datasheet **According to Sihga Pick MAX® technical datasheet**	
*** Design values are only valid if correct load distribution equipment is used.**		
Values take into account a dynamic load coefficient of φ2 = 1.3		

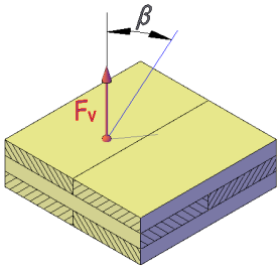
© SIHGA Pick

© SIHGA Pick Max®

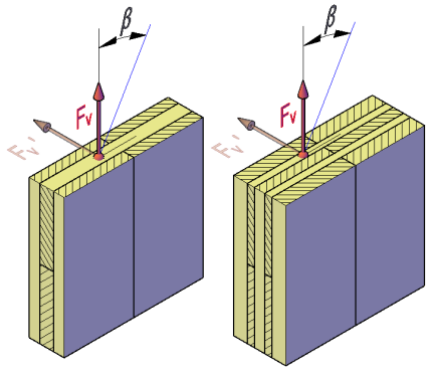
6 Pitzl Power Clamp III

Design values and operating instructions should exclusively be taken from Power Clamp III technical datasheet.
The Power Clamp III is **always yellow** and should not be confused with the black Power Clamp II 40/90 for which other load values apply.

6.1 Floor

The lifting angle (β) is assumed to be maximum 30°.	
 	Minimal panel thickness: • 100 mm – Standard • 80 mm – with spacer ring No manual drilling for VI Qualities (center tip) Blind hole: • D40x95 mm – standard • D40x75 mm – with spacer ring • Tolerance diameter: -0.0 / +1.0 mm • Edge distance: minimum 200 mm
β (°)	**0°- 45°**
F_v (kg) *	**1050**
*** Design values are only valid if correct load distribution equipment is used.**	

6.2 Wall

The lifting angle (β) is assumed to be maximum 30°.	
	Minimal panel thickness: 80 mm Use of spacer ring is not allowed for walls. Blind hole: • D40x95 mm • Tolerance diameter: -0.0 / +1.0 mm • Minimum edge distances: 20 mm (thickness) and 200 mm
F_v (kg) *	**PowerClamp III D40/90**
	According to technical datasheet
*** Design values are only valid if correct load distribution equipment is used.**	

© Pitzl


incl. Spacer Ring

7 Lifting screws

Stora Enso supplies lifting screws from **Rothoblaas** in packaging units of 25 pieces.
The load capacity calculation of the lifting screws and the necessary lifting screws (number and dimension) must be defined by the customer and communicated to Stora Enso. All technical information for the dimensioning of the lifting screws can be found directly from the manufacturer.
Due to the wide variation in load bearing capacities between possible load cases, dimensioning should be done by the end-user for safety reasons to avoid misinterpretations.
Blind holes (55 x 30 mm) or positioning drills (8 x 10 mm) are considered as a CNC service and can be produced if required.
The number and position of these services must be defined by the customer.

The following screw diameters are in stock:

- VGS Ø 11 x 100 mm
- VGS Ø 11 x 150 mm
- VGS Ø 11 x 200 mm
- VGS Ø 11 x 250 mm

The WASP anchor (for VGS Ø11MM) can be purchased from Stora Enso.

8 Lifting Devices for LVL

The information provided in this Lifting Guideline is valid for CLT only.
For lifting laminated veneer lumber (LVL) the lifting device must be specifically approved.
We recommend the following two devices and encourage you to contact us about your detailed needs.

- Lifting Slings
- SIHGA Pick (characteristic values for LVL available in their technical datasheet)

9 Annex

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EC - declaration of conformity

acc.to Machinery Directive 2006/42/EC

Manufacturer: Stora Enso Oyj
Salmisaarenaukio 2
00180 Helsinki, Finland

CLT Mills: Ybbs, Bad St. Leonhard, Gruvön, Ždírec

Machine: Lifting systems
- Lifting sling
- Dowel and lifting sling

Year of manufacture: 2023

This is to confirm that the lifting system construed as load handling attachment in both variants is compliant with the health and safety requirements of the Machinery Directive 2006/42/EC, that the technical material was created in accordance with Annex VII A and that the appropriate harmonized standards were applied:

This declaration of conformity confirms the implementation of the following directives:

- Directive 2006/42/EC – Machinery directive

This declaration of conformity confirms the consideration of the following technical standards:

- ÖNORM EN ISO 12100:2013-10-15 – Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12199:2010)
- EN ISO 13854:2019 – Safety of machinery - Minimum gaps to avoid crushing of parts of the human body (ISO 13854:2017)
- ÖNORM EN ISO 13857:2008-08-01 – Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)
- ÖNORM EN 614-1:2009-05-01 – Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
- ÖNORM EN 614-2:2008-12-01 – Safety of machinery - Ergonomic design principles - Part 2: Interactions between the design of machinery and work tasks
- ÖNORM EN 1005-2: 2009-01-01 – Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and component parts of machinery
- ÖNORM EN 1005-3: 2014-12-01 – Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation
- EN 82079-1:2012 – Preparation of instructions for use - Structuring, content and presentation - Part 1: General principles and detailed requirements

Signed for and on behalf of the manufacturer by:

Herbert Jöbstl – SVP Head of Operations

DocuSigned by:
Herbert Jöbstl
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Bad. St. Leonhard, 02-Feb-23 | 15:28 MEZ

UKCA DECLARATION OF CONFORMITY
for machinery

Manufacturer: Stora Enso Oyj
Salmisaarenaukio 2
00180 Helsinki, Finland

CLT Mills: Ybbs, Bad St. Leonhard, Gruvön, Ždírec

Machine: Lifting systems
- Lifting sling
- Dowel and Lifting Sling

Year of manufacture: 2023

is a complete machine that complies with the requirements of following regulations:

- **Supply of Machinery (Safety) Regulations 2008**
  In accordance with the provisions of the Supply of Machinery (Safety) Regulations, the safety objectives set out in Electrical Equipment (Safety) Regulations 2016 relating to electrical equipment designed for use within certain voltage limits are covered.

- the technical documents were prepared in accordance with Annex VII A
- the following harmonised standards were applied:

BS EN ISO 12100:2010	(Safety of machinery – Risk assessment and risk reduction)
BS EN 1492-1:2000	*(Textile slings. Safety Flat woven webbing slings made of man-made fibres for general purpose use)*
BS EN 26891:1991	*Timber structures. Joints made with mechanical fasteners General principles for the determination of strength and deformation characteristics*
BS EN ISO 20607:2019	*Safety of machinery. Instruction handbook. General drafting principles*

Signed for and on behalf of the manufacturer by:

Herbert Jöbstl – SVP Head of Operations

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Herbert Jöbstl
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