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Chipboard handbook

KOSKISEN

Koskisen Chipboard Handbook

1. General

The Koskisen company was founded in 1909. Koskisen is known as a manufacturer of mechanical forest industry products. Koskisen is the only chipboard manufacturer in Finland, with a capacity of around 100,000 m³.

The raw materials of chipboard are by-products of sawn timber and plywood production. The sawdust and birch veneer woodchips come directly from the sawmill and plywood production line on the same property. Logs come from within a radius of approximately 100 km of Järvelä and are certified timber. Recycled materials are not used in the chipboard, as enough by-products are used and the result is a pure, light board.

The chipboard is made by compressing wood shavings and resin. In chipboard made by hot pressing, the chips generally run in the direction of the surface. Both sides of the surface of the board are sprinkled with very fine wood particles, while the coarser chips are on the inside. The chips of the surface layer are smaller and thinner than those in the middle layer, meaning the surface of the chipboard is compacter and denser than the centre of the board. The production line can manufacture several different quality grades that are optimised for the intended application.

2. Chipboard use

In terms of its basic properties, chipboard is comparable to timber. In addition, the manufacturing method gives it certain advantages, such as no grain pattern, homogeneity and constancy of strength in every direction along the plane of the board. In addition, linear dimensional changes are minimal (Puuinfo pages).

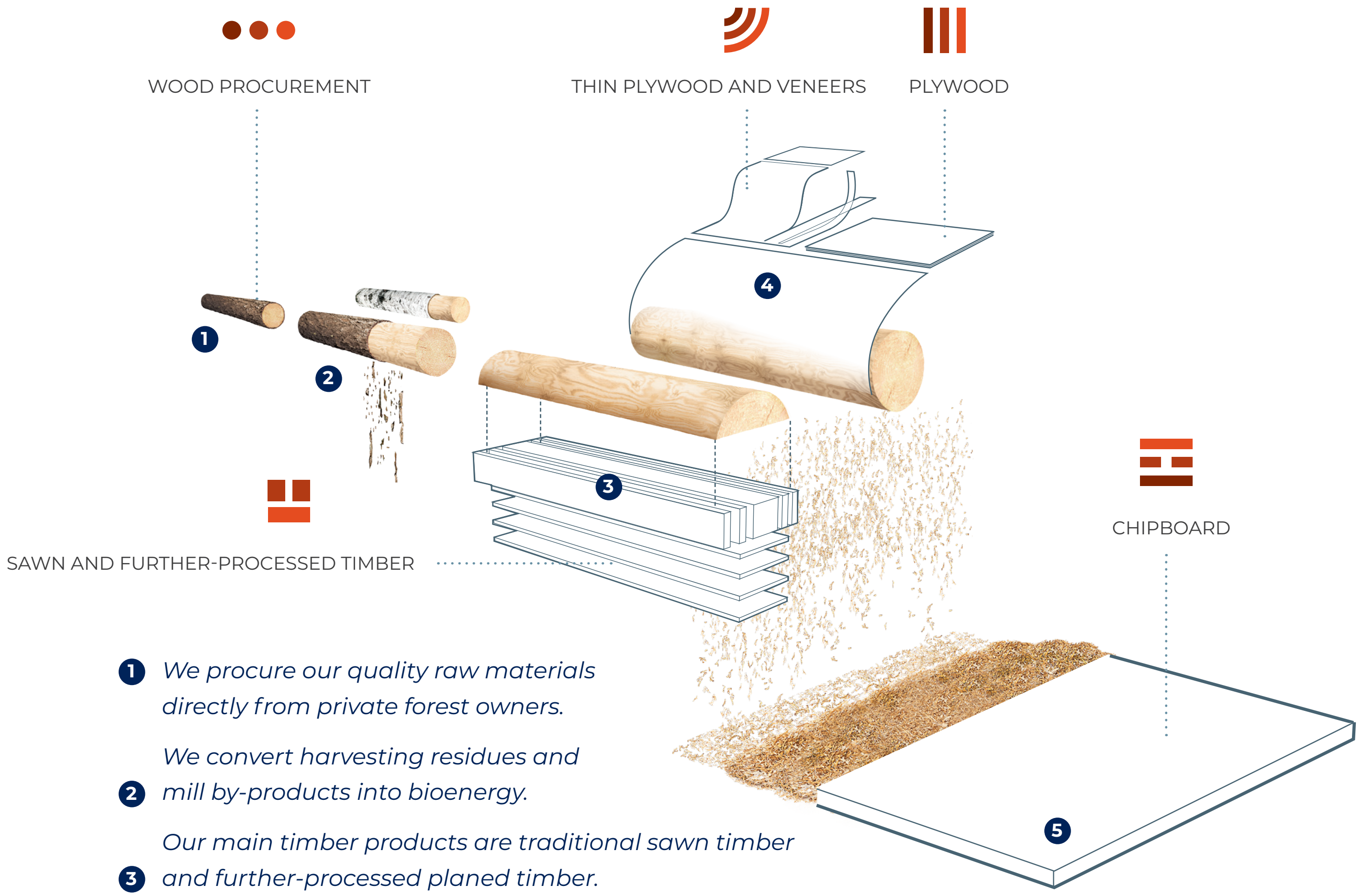
2.1 Chipboard applications

Chipboard is generally used in construction, such as in walls and floors, and in furniture, such as cabinets and kitchen fixtures. Chipboard can be manufactured in an almost continuous range of thicknesses from 3 to 50 mm, with various strengths. The chipboard strength grade is chosen according to the intended application.

It is important to choose the right type of board for the right application. The list below shows examples of suitable strength grades according to application.

> In terms of its basic properties, chipboard is comparable to wood.

We make full use of each log



1. *We procure our quality raw materials directly from private forest owners.*
2. *We convert harvesting residues and mill by-products into bioenergy.*
3. *Our main timber products are traditional sawn timber and further-processed planed timber.*
4. *We manufacture plywood products from a renewable raw material – Finnish birch.*
5. *In the manufacturing process of our quality chipboard, we utilise the raw material side streams generated in our own units' production.*

P1	Basic board grade is suitable for interior walls and door cores, among other uses
P2	Most common basic board grade. Used as a melamine-coated chipboard for applications such as kitchen fixtures and furniture
P2Mr	Kitchen fixtures, bathroom fixtures
P4	Flooring panels
P5	Greenish colour • For damp spaces • Renovation and construction of extensions: basements and attics • Wet room fixtures at home: bathroom, shower room and WC • Holiday homes: floors and ceilings • Agriculture: production buildings, garages, warehouses and shelters • Casting works: as disposable formwork board
P6	Flooring panels
P7	Heavy duty

The applications for chipboard are indoor and covered spaces. P5 chipboard contains resin which makes it slightly more moisture-resistant, but it is not intended for actual outdoor use.

Wet room fixtures may be exposed to a very wide range of moisture conditions depending on the presence of a sauna and the exposure of the fixtures to splashes, for example.
Generally, “wet room” means a room in which the floor surface is exposed to water and in which water may splash or condense on the wall surfaces (e.g., bathroom, shower room, sauna). Chipboard should not be used in the structures of wet rooms in which water is continually used, such as shower rooms. Floors and walls that are exposed to splashing water must always be built strictly watertight to prevent water damaging the structures. (RT card, 2007)

Chipboard with better moisture capacity than standard chipboard is intended for use in RIL 120-compliant moisture class 2. P2Mr and P5-class boards, which are coated with melamine film at the factory, are also suitable as interior wall cladding boards.

It is important to choose the right type of panel for the right application.

2.2 Chipboard use conditions

Chipboard is intended for use in dry spaces. Table 1 presents moisture classes in accordance with RIL 120 (RIL 120 – 2004).

Class	Name	Monthly average of relative humidity RH
1	indoor, dry	RH < 0.6
2	outdoor, dry	0.6 ≤ RH < 0.8
3	protected from wetting	0.8 ≤ RH < 0.95
4	exposed to wetting	0.95 ≤ RH

Table 1. Service moisture classes in accordance with RIL 120.

2.3 Chipboard moisture

Upon delivery, chipboard has a moisture content of 3–7%. Storage moisture conditions affect the moisture content of the chipboard as per table 2:

Relative air humidity (%)	Chipboard moisture content
20	4
30	6
40	7
50	8
60	9
70	11
80	12
90	15

Table 2. Relative air humidity % +20°C.
Chipboard equilibrium moisture content at various air humidity levels.

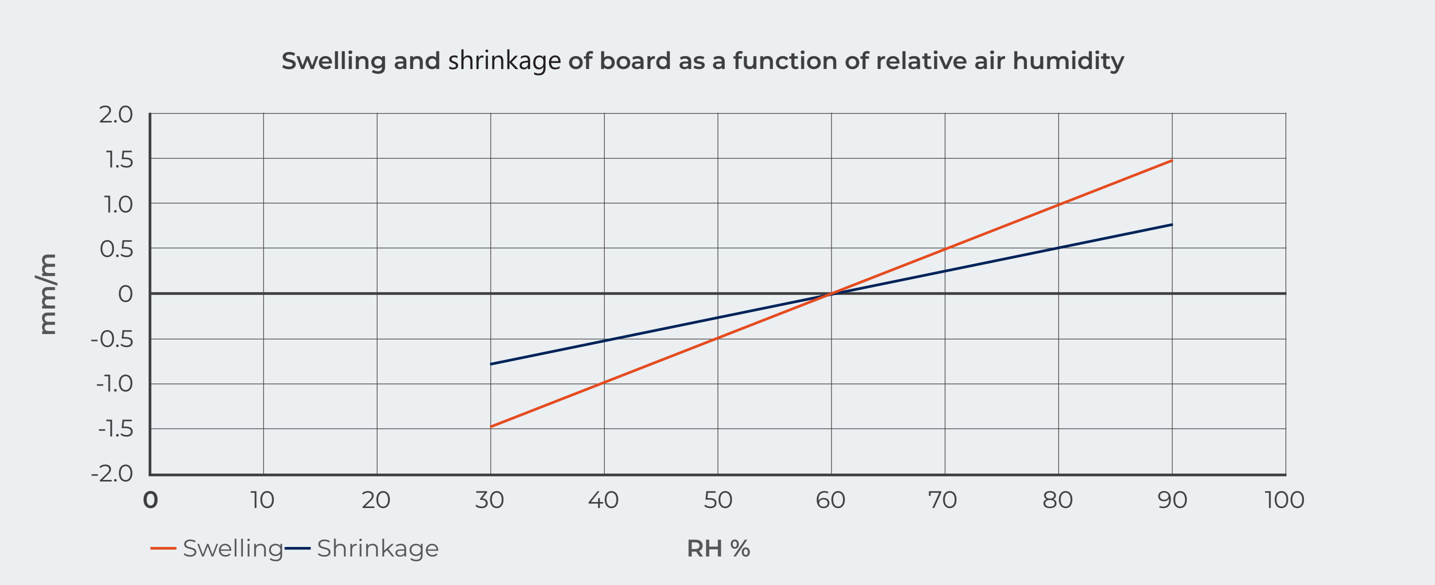


Figure 1. Changes to dimensions of the board as a function of air humidity.

3. Technical properties of Koskisen chipboard

3.1 Board dimensions

The dimensions of the chipboard production line enable the manufacture of specific board dimensions. Table 3 presents standard dimensions.

COATED	
8–32 mm	1830 x 2750 mm
Thicker boards up to 40 mm	1830 x 2630 mm
UNCOATED	
KoskiPan	1220 x 2630 mm 1290 x 3045 mm 1530 / 1830 x 2630 mm
KoskiFloor	600 x 1800 / 2400 mm 1200 x 1800 / 2400 mm
THICKNESS	
3–50 mm	

Table 3. Standard chipboard dimensions.

3.2 Tolerances

The tolerances of chipboard dimensions are presented in tables
4 and 5.

	Standard requirement EN 324-1 (mm)
Basic board	
Length	+/-5
Width	+/-5
Thickness of non-sanded board	-0.3 /+1.7
Thickness of sanded board	+/-0.3
TONGUE-AND-GROOVE	
Length	+/-5
Width	+/-5
CUT-TO-SIZE SAWING (Min. piece size 250x250 mm)	
Length	+/-5
Width	+/-5
EDGE-BANDING *	
Width	+/-5

* Edge-banding sizes: Max. 1200 x 2750 mm edge-banding of two sides.
Max. edge-banding of four sides 1200 x 2500 mm.
Minimum size 220 x 220 mm

Table 4. Chipboard tolerances by factory and standard

	Standard requirement EN 324-1 (mm)
Basic board	
Straightness of edge	1.5
Squareness	2
TONGUE-AND-GROOVE	
Straightness of edge	1.5
Squareness	2
CUT-TO-SIZE SAWINGS	
Straightness of edge	1.5
Squareness	2
Diagonal measure-ment	–

Table 5. Straightness and squareness tolerances of chipboard.

3.3 Chipboard surface qualities

Quality A is generally used as a painted and melami-ne-coated board and quality B is suitable for purposes such as laminating.

Error	Class A	Class B
Sanding mark	Minor line permitted; however, not to the extent it can be felt by hand	Permitted
Sanded through	Not permitted	Not permitted
Centre sha-vings shining through the surface	Core chips may show at edges and sporadically in other places	Permitted in reasonable amounts
Non-sanded area	Not permitted	Permitted to a small degree
Surface roughness	Minor coarseness permitted	Significant coarseness permitted
Edge fault	Minor splits which does not reduce the usage value of the board is permitted on the edges	Minor chipping and deviation in edge density are permitted
Resin and dust spots	Permitted to a small degree when they do not reduce the usage value of the board	Permitted when they do not penetrate the board
Bark spots	Small barks spots permitted	Permitted
Splinters	Some individual splinter-like shavings permitted	Permitted
Foreign objects	Not permitted	Not permitted
Dents	Not permitted	Permitted
Stains	Not permitted	Permitted when they do not reduce the usage value of the board

Table 6. Definitions of Koskisen chipboard surface grades.

4. Chipboard strength grades

Chipboard is classified based on bending strength and humidity swelling requirements. The higher the grade, the higher the strength and the more demanding the application requiring a durable, high-strength board.

Table 8 presents the grades and the requirements set for them in accordance with EN 312. Chipboards which are intended for use in construction: properties and conformity to requirements are defined in standard SFS – EN 13986 + A1.

Table 7 presents the target densities of Koskisen chipboard in various strength classes, and the tolerance is +/- 10%

Thickness / type	P1	P2	P4	P6	P2Mr	P5	P7
4 - 6	810	830	835	850	830	850	890
7 - 13	720	750	755	770	750	770	810
14 – 20	670	700	705	730	700	720	755
21 - 25	650	685	655	700	685	670	770
26 - 32	600	650	645	690	650	660	-
33 - 40	550	620	595	680	620	610	-
41 - 50	490	510	545	600	510	560	-

Table 7. Koskisen chipboard target densities in various strength grades.

Bending strength N/mm2 (EN 310)

Thickness / type	P1	P2	P4	P6	P2Mr	P5	P7
> 4–6	11.5	12.0	16.0	20.0	12.0	19.0	21.0
> 6–13	10.5	11.0	16.0	20.0	11.0	18.0	22.0
> 13–20	10.0	11.0	15.0	18.0	11.0	16.0	20.0
> 20–25	10.0	10.5	13.0	16.0	10.5	14.0	18.5
> 25–32	8.5	9.5	11.0	15.0	9.5	12.0	17.0
> 32–40	7.0	8.5	9.0	14.0	8.5	10.0	16.0
> 40	5.5	7.0	7.0	12.0	7.0	9.0	15.0

Internal bond tensile strength N/mm2 (EN 319)

Thickness / type	P1	P2	P4	P6	P2Mr	P5	P7
> 4–6	0.31	0.45	0.45	0.65	0.45	0.45	0.75
> 6–13	0.28	0.40	0.40	0.60	0.40	0.45	0.75
> 13–20	0.24	0.35	0.35	0.50	0.35	0.45	0.70
> 20–25	0.20	0.30	0.30	0.40	0.30	0.40	0.65
> 25–32	0.17	0.25	0.25	0.35	0.25	0.35	0.60
> 32–40	0.14	0.20	0.20	0.30	0.20	0.30	0.55
> 40	0.14	0.20	0.20	0.25	0.20	0.25	0.50

Modulus of elasticity in bending N/mm2 (EN 310)

Thickness / type	P1	P2	P4	P6	P2Mr	P5	P7
> 4–6	NOT STD	1950	2200	2900	1950	2450	3100
> 6–13	–	1800	2300	3150	1800	2550	3350
> 13–20	–	1600	2300	3000	1600	2400	3100
> 20–25	–	1500	2050	2550	1500	2150	2900
> 25–32	–	1350	1850	2400	1350	1900	2800
> 32–40	–	1200	1500	2200	1200	1700	2600
> 40	–	1050	1200	2050	1050	1550	2400

Swelling in thickness after 24 h immersion in water % (EN 317)

Thickness / type	P1	P2	P4	P6	P2Mr	P5	P7
> 4-6	NOT STD	NOT STD	21	16	14	14	10
> 6-10	–	–	19	16	13	13	10
> 10-13	–	–	16	16	11	11	10
> 13-20	–	–	15	15	10	10	10
> 20-25	–	–	15	15	10	10	10
> 25-32	–	–	15	15	10	10	10
> 32-40	–	–	14	14	9	9	9
> 40	–	–	14	14	9	9	9

Internal bond tensile strength after moisture stress test N/mm2 (EN 321)

Thickness / type	P1	P2	P4	P6	P2Mr	P5	P7
> 4-6	NOT STD	NOT STD	NOT STD	NOT STD	NOT STD	0.30	0.44
> 6-10	–	–	–	–	–	0.25	0.41
> 10-13	–	–	–	–	–	0.25	0.41
> 13-20	–	–	–	–	–	0.22	0.36
> 20-25	–	–	–	–	–	0.20	0.33
> 25-32	–	–	–	–	–	0.17	0.28
> 32-40	–	–	–	–	–	0.15	0.25
> 40	–	–	–	–	–	0.12	0.20

Swelling in thickness after humidity/moisture stress test % (EN 321)

Thickness / type	P1	P2	P4	P6	P2Mr	P5	P7
> 4-6	NOT STD	NOT STD	NOT STD	NOT STD	NOT STD	12	11
> 6-10	–	–	–	–	–	12	11
> 10-13	–	–	–	–	–	12	11
> 13-20	–	–	–	–	–	12	11
> 20-25	–	–	–	–	–	11	10
> 25-32	–	–	–	–	–	10	9
> 32-40	–	–	–	–	–	9	8
> 40	–	–	–	–	–	9	8

Table 8. Summary of chipboard standard requirements EN 312:2010

5. Coatings and specialty products

Chipboard can be coated with several different coatings, including hot pressed melamine or phenol film. A wide range of patterns is available. Laminates and plastic coatings may also be glued to the chipboard surface. The coating is chosen in accordance with the application and customer requirements.

Our website shows standard coatings and colour models. Melamine-coated furniture board is sold under the KoskiMel product name.

Tailored special boards are manufactured under the KoskiPro product name. Its properties, such as weight, are defined by client requirements. KoskiPro can be coated with various coatings such as melamine, phenol coating and glued coatings.

KoskiMel ▸ KoskiLam ▸ KoskiPro ▸

6. Design – Floors

To assist the design of floorboards, mathematical values have been calculated as an aid for chipboard strength grades P5 and P6. The bases for calculation are presented here. The values are simulated and indicative. In addition, local guidelines and building codes must be taken into considertion.

The density and moisture content of the chipboard, as well as the duration of the load, affect its strength values. Thinner boards are generally stronger than thick ones as they have a higher relative proportion of dense surface layer than thick boards. Because the chipboard strength values presented in table 4 are determined on the basis of short-term static trials, they cannot be used as such as a basis for design. The characteristic strengths and moduli of elasticity to be used in measuring load-bearing structures are presented in the SFS EN 12369-1 Wood-based Panels publication. Characteristic structural design values. Part 1.

6.1 Uniformly distributed load

An uniformly distributed load affects the entire support span consistently. The length of the board is taken to be infinite in one direction and as long as support span L in the other. Thus, the case of uniformly distributed load may be simplified to beam theory, from which the infinite side of the board is omitted from the calculations.

6.1.1 Deflection, single-span

The deflection of a single-span beam may be obtained with beam theory. For an evenly loaded beam, the largest deflection is located in the middle of the beam and may be defined according to formula 1:

$$V_{max.\ 1\text{-}span} = \frac{5qL^4}{384EI} = \frac{5q_{surface}bL^4}{384E\,\frac{bt^3}{12}} = \frac{5q_{surface}L^4}{32Et^3}$$

$q_{surface}$ = surfaceload = span
E = average module of elasticity t = thickness

6.1.2 Deflection, double span

For a double span beam with an uniformly distributed load, the maximum value of the deflection for the beam is obtained with formula 2:

$$V_{max.\ 2\text{-}span} = \frac{qL^4}{185EI} = \frac{q_{surface}bL^4}{185E\,\frac{bt^3}{12}} = \frac{12q_{surface}L^4}{185Et^3}$$

Thus, the deflections of a double span case may be obtained from the single-span deflection tables by multiplying them by the number:

$$\frac{V_{max.\ single\ span}}{V_{max.\ double\ span}} = \frac{384}{925}$$

6.2 Capacity

6.2.1 Capacity single-span

The strength of a single-span beam with an uniformly distributed load may also be obtained directly with beam theory. Bending strength is considered a dominant case. The maximum moment for a single-span beam with an uniformly distributed load is obtained with formula 3:

$$M_{max} = \frac{qL^2}{8} = \frac{q_{surface}bL^2}{8}$$

The bending strength is in accordance with formula 4:

$$\sigma_t = \frac{M}{I}y = \frac{\left(\frac{q_{surface}bL^2}{8}\right)}{\left(\frac{bt^3}{12}\right)}\frac{t}{2} = \frac{3q_{surface}L^2}{4t^2}$$

And when the board's bending strength is known, the permitted strength is obtained in accordance with formula 5:

$$q_{surface.capacity.1\text{-}span} = \frac{4f_t t^2}{3L^2}$$

On a single-span beam, the shear strength does not become dominant.

6.2.2 Capacity double span

In a double span case, the maximum moment remains the same as with a single span, meaning the capacity with regard to the bending is the same as on a single-span supported beam. The maximum moment appears at the central support.

In a double span case, with thick material strengths and short support spans, the shear strength may become dominant. In practice, with uniformly distributed load, this occurs in both P5 and P6 boards with the thickest material strength used in the calculations t = 38 mm together with the shortest support span L = 300 mm.

The greatest shear force in an evenly loaded double span beam is on the central support of the beam, and its value is obtained with formula 6:

$$V_{max} = \frac{5}{8}qL$$

Shear strength may be proven through shear stress and bending strength. When shear strength is calculated, the curved shape of the structure is considered, in which case, per standard EN 1995-1-1, the value of 2/3 is used in the way shown in section 6.1.7(2) as the plate's effective width. As a result, formula 7 is obtained:

$$T = \frac{V_{max}}{\frac{2}{3}A} \longrightarrow q_{shear.capacity.2\text{-}span} = \frac{16f_v t}{15L}$$

When determining the capacity of an uniformly loaded double span beam, the smaller of the values obtained from formulas (5) and (7) is used.

6.3. Point load

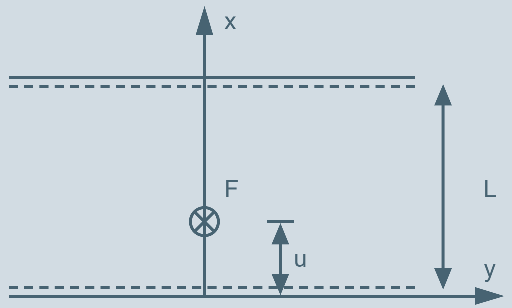
The point load is assumed to affect the centre of the support spans. The length of the board is taken to be infinite in one direction and as long as support span L in the other.

6.3.1 Deflection with point load – single-span

The deflection of a single-span beam can be derived from levykenttä teoria. For a simply supported, on opposing sides, infinite plate strip
the deflection equation (formula 8)
is in valid:

$$v(x,y) = \frac{Fa^2}{2\pi^3 D}\sum_{n=1}^{\infty}\frac{1}{n^3}\sin(\alpha_n u)\sin(\alpha_n x)\left[(1+\alpha_n y)e^{-\alpha_n y}\right]$$

where $D = \frac{Eh^3}{12(1-v^2)}$ *and* $\alpha_n = n\frac{\pi}{L}$



Where in this case x = u = L/2 and y=0. In this case, the deflection caused by the load at the centre of the support span at the site of the load is per formula 9:

$$V_{max} = V\left(\frac{L}{2}, 0\right) = \frac{Fa^2}{2\pi^3 D}\sum_{n=1}^{\infty}\frac{1}{n^3}\sin\left(n\frac{\pi}{2}\right)\sin\left(n\frac{\pi}{2}\right)$$

Depending on parameter n, the value of the product of the sine phrases is either 0 (even n) or 1 (odd n). Thus, an equation may be formed:

$$V_{max} = V\left(\frac{L}{2}, 0\right) = \frac{Fa^2}{2\pi^3 D}\sum_{n=1}^{\infty}\frac{1}{n^3} - \sum_{n=1}^{\infty}\frac{1}{(2n)^3}$$

In other words, the sum of even numbers is subtracted from the sum of all positive integers, as the sine function multiplying the sum by an even n returns the value 0.

The result of the sum $\sum_{n=1}^{\infty}\frac{1}{n^3}$ is an Apéry constant, which is approximately 1.2025. Correspondingly, the result of the sum $\sum_{n=1}^{\infty}\frac{1}{(2n)^3}$ is 1/8 of an Apéry constant, in which case the value of the deflection may be written in its final form with formula 10:

$$V_{max} = V\left(\frac{L}{2}, 0\right) = \frac{Fa^2}{2\pi^3 D}\left(\frac{7}{8}*1.2025\right) = \frac{6FL^2(1-v^2)}{\pi^3 Et^3}\left(\frac{7}{8}*1.2025\right)$$

6.3.2 Deflection, double span

The deflection of a double span plate is not analytically easy to solve. Thus, the calculation makes use of the RFEM element calculation software, which is used to define the double span plate's relative deflection compared to a single-span one. To obtain a valid result, two plates are modelled as both single- and double span:

- Support span 500 mm, long side 10 m, load at the centre of the plate
- Support span 1200 mm, long side 10 m, load at the centre of the plate

In both cases we note that the ratio of the maximum values of the deflection between the single- and two-span plate is 0.599..; that is, it remains stable notwithstanding the support span.

$$V_{max.\ 2\text{-}span} =$$

$$V\left(\frac{L}{2}, 0\right) = 0.6 * \frac{Fa^2}{2\pi^3 D}\left(\frac{7}{8} * 1.2025\right) = \frac{3}{5}\,\frac{6FL^2(1-v^2)}{\pi^3 E t^3}\left(\frac{7}{8} * 1.2025\right)$$

Capacity is defined by beam theory in which the equivalent width, which is defined as the input data on the basis of VTT-provided table data capacity results, serves as the width of the diaphragm. The functionality of the width equivalence, that is, the correspondence of the bending stresses formed by it on point load and the board, are proven with the ANSYS calculation software.

For a single-span beam with a point load at the centre, the maximum moment is calculated using formula 12:

$$M_{max} = \frac{FL}{4}$$

And the bending stress is calculated with formula 13:

$$\sigma_t = \frac{M_{max}}{I}\,y = \frac{\left(\frac{FL}{4}\right)}{\left(\frac{bt^3}{12}\right)}\,\frac{t}{2} = \frac{3FL}{2bt^2}$$

, in which the defined equivalent width beqv must be used as width b. The point load capacity is obtained once the board's bending strength has been defined by solving the strength in formula 12 and replacing bending stress with bending strength, as a result of which formula 14 is obtained:

$$F = \frac{2b_{eqv} f_t t^2}{3L}$$

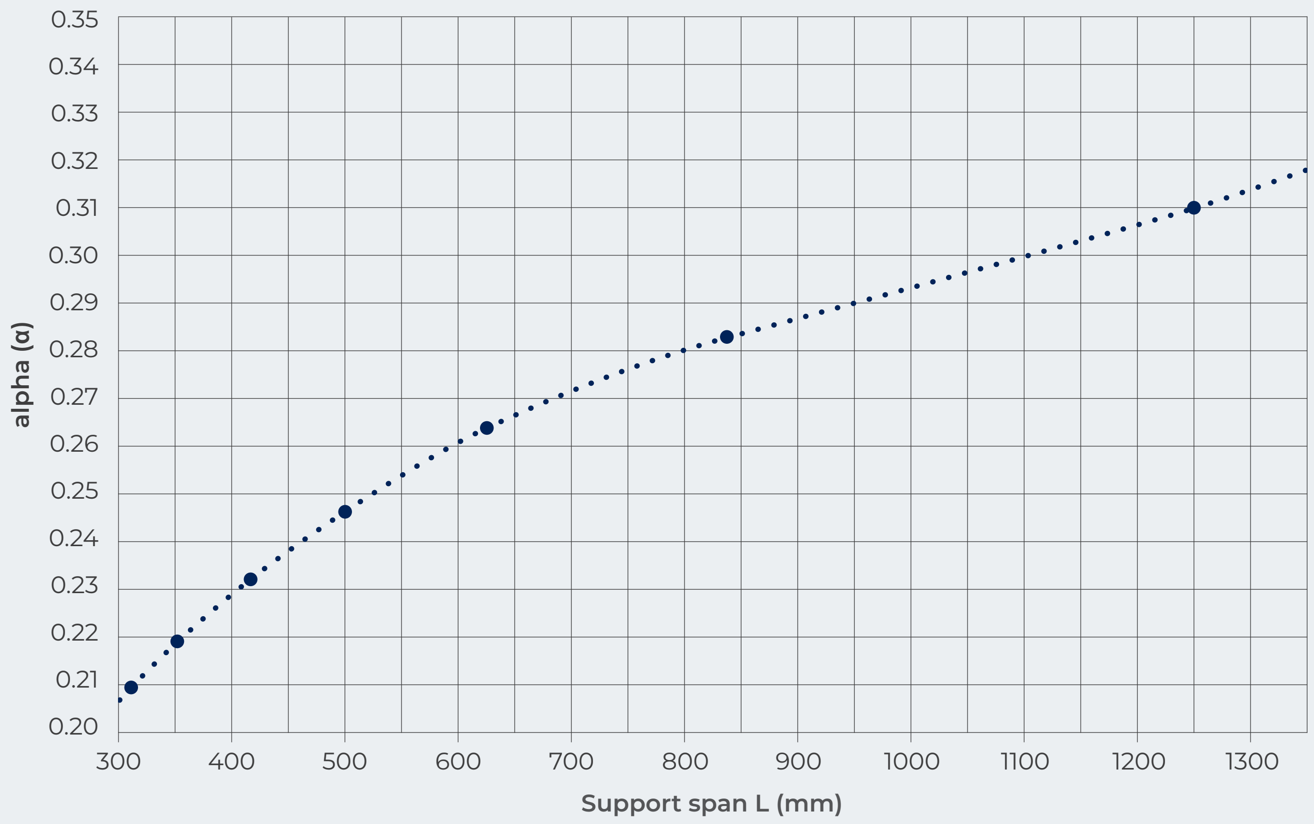
The equivalent width is calculated backwards with input data from the obtained tables so that the support span length L and point load capacity F are known, after which the equivalent width b in formula 15 is solved:

$$b_{eqv} = \frac{3FL}{2 f_t t^2}$$

By tabling b's values for various support span lengths, it is observed that width of the equivalent depends in linear fashion on the length of the support span. Equivalent width may be evaluated with reasonably accuracy using formula 16:

$$b_{eqv} = \frac{16}{25} L + 140 \text{ mm}$$

Now the capacity tables may be formed using the beam-theory-compliant formula 13 by using the defined equivalent width per formula 16.



$\alpha = (-2.6321510719L^4) * 10^{-15} + (1.3947031157L^2) * 10^{-10} - (4.0215980919L^2) * 10^{-7} + 4.5645757185L * 10^{-4} + 0.10183336228$

6.3.3 Capacity – double span

The point load capacity of a multi-span plate may be calculated using formula 17 for bending:

$$F = \frac{f_t t^2}{6\alpha}$$

, in which α may be expressed with sufficient precision for 300 mm – 1200 mm support span using formula 18, when the width of the point load is 50 mm.

In a double span case, with thick material strengths and short support spans, the shear strength may become dominant. In practice, with point load, that occurs in both P5 and P6 boards with the thickest material strength used in the calculations t = 38 mm as well as with the shortest support span L = 300 mm, as well as in P5 board with the thickest material strength and a support span of L = 350 mm.

The greatest shearing force in a locally loaded plate is a local point load F (formula 19)

$$V_{max} = F$$

Shearing durability may be proven through shearing stress and shearing strength. For a locally stressed plate with loading width c (50 mm), formula 20 is obtained for point load durability via shearing stress:

$$T = \frac{F}{4ct} \longrightarrow F_{shear.capacity.2\text{-}span} = 4cf_v t$$

When determining the capacity of a point loaded double span beam, the smaller of the values obtained from formulas (17) and (20) is used.

6.4 Combination factors in accordance with service and duration classes

The conditions of the application must also be taken into account when using design values.

6.4.1 Deflections

The service class (humidity conditions) and load duration class are taken into account by increasing the deflections defined in chapters 1.1 and 1.2 using the factors in standard SFS EN 1995-1-1. In the case of a deflection, the deflection should be increased by the factor in accordance with formula 21:

$$k_{deflection} = (1+k_{def}\Psi_2)$$

, where k_{def} is defined in table 3.2 of standard SFS EN 1995-1-1. Eurocode does not take a position on the load duration classes regarding deflections. Rather, it classifies them in accordance with primary load cases (e.g., snow load, payload, permanent load). Thus, factor $_2$ is defined in reverse with input data from the report provided*, in which case the results remain comparable for added material strengths.

Service class	k_{def}
Service class 1 (heated)	2.25
Service class 2 (unheated)	3.00

Load duration class	Ψ_2
Permanent load	1
Long-term load	2/3
Medium-term load	1/3
Short-term load	2/15

For factor k_{def} the values of P5 chipboard are used, because kmod factors are not defined for P6 board in the standard for all service classes. This is a conservative assumption.

6.4.2. Capacity

The service class (humidity conditions) and load duration class are taken into account by reducing the deflections defined in chapters 1.1 and 1.2 using the k_{mod} factor in standard SFS EN 1995-1-1. In addition, the material's partial safety γ_M = 1.3 and the load's partial safety γ_q = 1.5 are taken into account. In the case of durability, the capacity must be reduced by the factor in formula 22:

$$k_{durability} = \frac{k_{mod}}{\gamma_M \gamma_q}$$

, where k_{mod} is defined in table 3.1 of standard SFS EN 1995-1-1.

Service class → / Load duration class ↓	k_{mod} Service class 1 (heated)	Service class 2 (unheated)
Permanent load	0.30	0.20
Long-term load	0.45	0.30
Medium-term load	0.65	0.45
Short-term load	0.85	0.60

For factor k_{mod} the values of P5 chipboard are used, because kmod factors are not defined for P6 board in the standard for all service classes. This is a conservative assumption. In addition, comparability with the reference tables provided as input data is retained*

The conditions of the end use must also be taken into account when using design values.

7. Design tables

P5 board

Table 8: Deflection, constant load q=1 kN/m2, P5, single span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	0.066	0.122	0.208	0.333	0.507	0.743	1.052	1.449	1.949	2.569	3.325	4.238	5.327	6.613	8.119	9.868	11.887	14.2	16.835
22	0.04	0.073	0.125	0.201	0.306	0.448	0.634	0.873	1.174	1.548	2.004	2.553	3.209	3.984	4.891	5.945	7.161	8.555	10.143
25	0.027	0.05	0.085	0.137	0.208	0.305	0.432	0.595	0.8	1.055	1.365	1.74	2.187	2.715	3.333	4.052	4.88	5.83	6.912
30	0.018	0.033	0.057	0.091	0.139	0.204	0.288	0.397	0.534	0.704	0.912	1.162	1.46	1.813	2.226	2.705	3.259	3.893	4.615
38	0.01	0.018	0.03	0.049	0.074	0.109	0.154	0.212	0.285	0.375	0.486	0.619	0.778	0.966	1.186	1.442	1.737	2.075	2.46

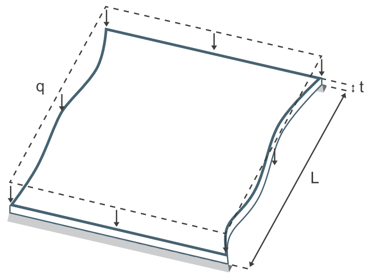
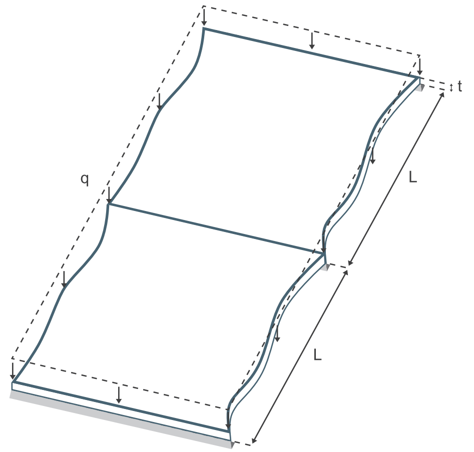


Table 9: Deflection, constant load q=1 kN/m2, P5, double span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	0.027	0.051	0.086	0.138	0.211	0.308	0.437	0.602	0.809	1.066	1.381	1.759	2.211	2.745	3.37	4.097	4.935	5.895	6.989
22	0.016	0.03	0.052	0.083	0.127	0.186	0.263	0.362	0.488	0.642	0.832	1.06	1.332	1.654	2.031	2.468	2.973	3.551	4.211
25	0.011	0.021	0.035	0.057	0.086	0.127	0.179	0.247	0.332	0.438	0.567	0.722	0.908	1.127	1.384	1.682	2.026	2.42	2.869
30	0.007	0.014	0.024	0.038	0.058	0.085	0.12	0.165	0.222	0.292	0.378	0.482	0.606	0.753	0.924	1.123	1.353	1.616	1.916
38	0.004	0.007	0.013	0.02	0.031	0.045	0.064	0.088	0.118	0.156	0.202	0.257	0.323	0.401	0.493	0.599	0.721	0.861	1.021



The deflections needed in various load service and duration classes are obtained by multiplying the values in the table above by the following values:

Load duration class	Permanent	Long term	Medium-term	Short term
Service class 1 (heated)	3.25	2.50	1.75	1.30
Service class 2 (unheated)	4.00	3.00	2.00	1.40

P5 board

Table 10: Specific capacity, constant load kN/m2 single span P5

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	63.84	46.9	35.91	28.37	22.98	18.99	15.96	13.6	11.73	10.21	8.98	7.95	7.09	6.37	5.75	5.21	4.75	4.34	3.99
22	83.89	61.64	47.19	37.29	30.2	24.96	20.97	17.87	15.41	13.42	11.8	10.45	9.32	8.37	7.55	6.85	6.24	5.71	5.24
25	108.33	79.59	60.94	48.15	39	32.23	27.08	23.08	19.9	17.33	15.23	13.49	12.04	10.8	9.75	8.84	8.06	7.37	6.77
30	133.33	97.96	75	59.26	48	39.67	33.33	28.4	24.49	21.33	18.75	16.61	14.81	13.3	12	10.88	9.92	9.07	8.33
38	177.56	130.45	99.88	78.91	63.92	52.83	44.39	37.82	32.61	28.41	24.97	22.12	19.73	17.71	15.98	14.49	13.21	12.08	11.1

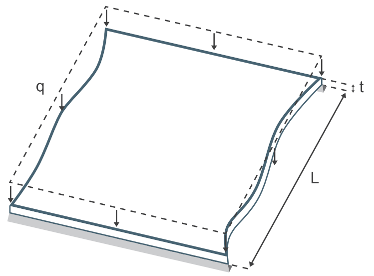
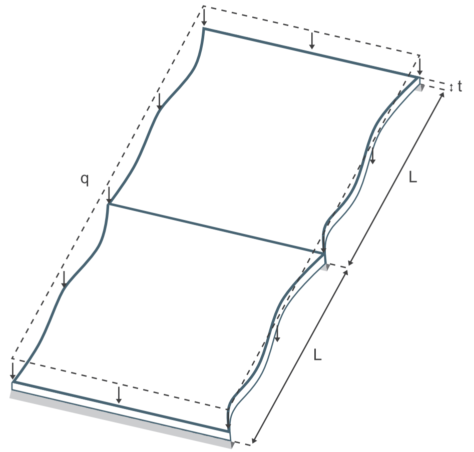


Table 11: Specific capacity, constant load kN/m2 douple span P5

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	63.84	46.9	35.91	28.37	22.98	18.99	15.96	13.6	11.73	10.21	8.98	7.95	7.09	6.37	5.75	5.21	4.75	4.34	3.99
22	83.89	61.64	47.19	37.29	30.2	24.96	20.97	17.87	15.41	13.42	11.8	10.45	9.32	8.37	7.55	6.85	6.24	5.71	5.24
25	108.33	79.59	60.94	48.15	39	32.23	27.08	23.08	19.9	17.33	15.23	13.49	12.04	10.8	9.75	8.84	8.06	7.37	6.77
30	133.33	97.96	75	59.26	48	39.67	33.33	28.4	24.49	21.33	18.75	16.61	14.81	13.3	12	10.88	9.92	9.07	8.33
38	162.13	130.45	99.88	78.91	63.92	52.83	44.39	37.82	32.61	28.41	24.97	22.12	19.73	17.71	15.98	14.49	13.21	12.08	11.1



The capacities needed in various load service and duration classes are obtained by multiplying the values in the table above by the following values of the classes (incl. $\gamma_M = 1.3$ and $\gamma_q = 1.5$):

Load duration class	Permanent	Long term	Medium-term	Short term	Instantaneous
Service class 1 (heated)	0.15	0.23	0.33	0.44	0.56
Service class 2 (unheated)	0.10	0.15	0.23	0.31	0.41

P5 board

Table 12: Deflection, concentrated load in the centre of a support span F=1 kN, P5, c=50 mm, single span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	0.951	1.295	1.691	2.141	2.643	3.198	3.806	4.466	5.18	5.946	6.766	7.638	8.563	9.541	10.571	11.655	12.791	13.98	15.223
22	0.573	0.78	1.019	1.29	1.592	1.927	2.293	2.691	3.121	3.583	4.076	4.602	5.159	5.748	6.369	7.022	7.706	8.423	9.171
25	0.391	0.532	0.694	0.879	1.085	1.313	1.562	1.834	2.127	2.441	2.778	3.136	3.516	3.917	4.34	4.785	5.252	5.74	6.25
30	0.261	0.355	0.464	0.587	0.725	0.877	1.043	1.224	1.42	1.63	1.855	2.094	2.348	2.616	2.898	3.195	3.507	3.833	4.173
38	0.139	0.189	0.247	0.313	0.386	0.467	0.556	0.653	0.757	0.869	0.989	1.116	1.251	1.394	1.545	1.703	1.869	2.043	2.225

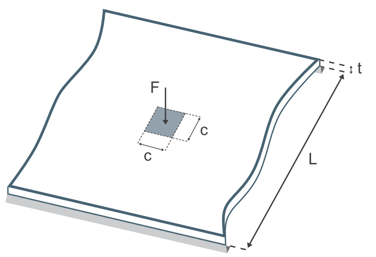
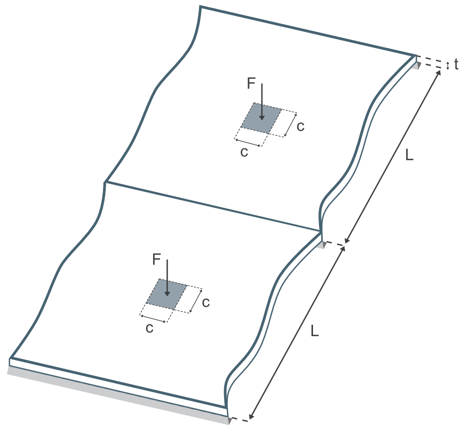


Table 13: Deflection, concentrated load in the centre of a support span F=1 kN, P5, c=50 mm, douple span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	0.571	0.777	1.015	1.284	1.586	1.919	2.283	2.68	3.108	3.568	4.059	4.583	5.138	5.724	6.343	6.993	7.675	8.388	9.134
22	0.344	0.468	0.611	0.774	0.955	1.156	1.376	1.615	1.872	2.15	2.446	2.761	3.095	3.449	3.821	4.213	4.624	5.054	5.503
25	0.234	0.319	0.417	0.527	0.651	0.788	0.937	1.1	1.276	1.465	1.667	1.882	2.109	2.35	2.604	2.871	3.151	3.444	3.75
30	0.157	0.213	0.278	0.352	0.435	0.526	0.626	0.735	0.852	0.978	1.113	1.256	1.409	1.569	1.739	1.917	2.104	2.3	2.504
38	0.083	0.114	0.148	0.188	0.232	0.28	0.334	0.392	0.454	0.521	0.593	0.67	0.751	0.837	0.927	1.022	1.122	1.226	1.335



The deflections needed in various load service and duration classes are obtained by multiplying the values in the table above by the following values:

Load duration class	Permanent	Long term	Medium-term	Short term
Service class 1 (heated)	3.25	2.50	1.75	1.30
Service class 2 (unheated)	4.00	3.00	2.00	1.40

P5 board

Table 14: Specific capacity, concentrated load in the centre of a support span, kN, P5, c=50 mm, single span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	3.18	2.99	2.84	2.73	2.64	2.57	2.51	2.46	2.41	2.37	2.34	2.31	2.29	2.26	2.24	2.22	2.2	2.19	2.17
22	4.18	3.93	3.74	3.59	3.47	3.38	3.3	3.23	3.17	3.12	3.08	3.04	3	2.97	2.94	2.92	2.9	2.88	2.86
25	5.4	5.07	4.83	4.64	4.49	4.36	4.26	4.17	4.1	4.03	3.97	3.92	3.88	3.84	3.8	3.77	3.74	3.71	3.69
30	6.64	6.24	5.94	5.71	5.52	5.37	5.24	5.13	5.04	4.96	4.89	4.83	4.77	4.72	4.68	4.64	4.6	4.57	4.54
38	8.84	8.31	7.91	7.6	7.35	7.15	6.98	6.83	6.71	6.61	6.51	6.43	6.36	6.29	6.23	6.18	6.13	6.09	6.05

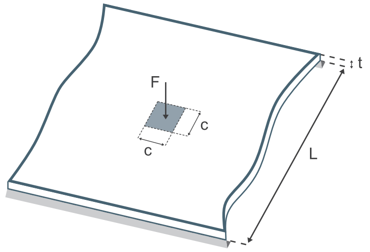
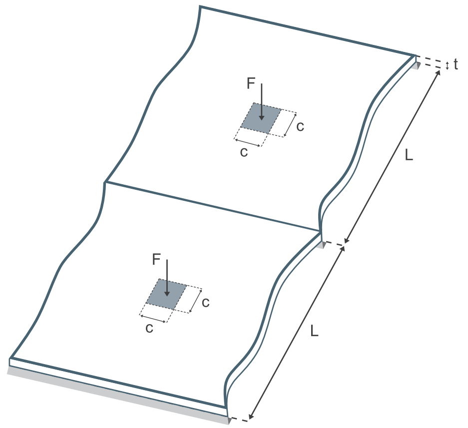


Table 15: Deflection, concentrated load in the centre of a support span F=1 kN P5, c=50 mm, douple span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	3.48	3.29	3.14	3.01	2.91	2.83	2.75	2.7	2.65	2.6	2.57	2.53	2.5	2.48	2.45	2.43	2.4	2.37	2.35
22	4.57	4.32	4.12	3.96	3.82	3.71	3.62	3.54	3.48	3.42	3.37	3.33	3.29	3.26	3.22	3.19	3.16	3.12	3.08
25	5.91	5.58	5.32	5.11	4.94	4.79	4.67	4.57	4.49	4.42	4.35	4.3	4.25	4.2	4.16	4.12	4.07	4.03	3.98
30	7.27	6.87	6.55	6.29	6.08	5.9	5.75	5.63	5.52	5.44	5.36	5.29	5.23	5.17	5.12	5.07	5.01	4.96	4.9
38	9.12	9.12	8.73	8.38	8.09	7.86	7.66	7.5	7.36	7.24	7.14	7.04	6.96	6.89	6.82	6.75	6.68	6.61	6.53



The capacities needed in various load service and duration classes are obtained by multiplying the values in the table above by the following values of the classes (incl. $\gamma_M = 1.3$ and $\gamma_q = 1.5$):

Load duration class	Permanent	Long term	Medium-term	Short term	Instantaneous
Service class 1 (heated)	0.15	0.23	0.33	0.44	0.56
Service class 2 (unheated)	0.10	0.15	0.23	0.31	0.41

P6 board

Table 16: Deflection, constant load 1 kN/m2, single span P6

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	0.053	0.098	0.167	0.268	0.408	0.598	0.847	1.166	1.569	2.068	2.677	3.411	4.287	5.322	6.535	7.943	9.567	11.429	13.55
22	0.034	0.063	0.107	0.172	0.262	0.384	0.543	0.748	1.007	1.327	1.717	2.189	2.751	3.415	4.193	5.096	6.138	7.333	8.694
25	0.023	0.043	0.073	0.117	0.179	0.261	0.37	0.51	0.686	0.904	1.17	1.491	1.875	2.327	2.857	3.473	4.183	4.997	5.925
30	0.014	0.026	0.045	0.072	0.11	0.16	0.227	0.313	0.421	0.555	0.718	0.915	1.151	1.428	1.754	2.132	2.568	3.067	3.636
38	0.007	0.014	0.024	0.038	0.057	0.084	0.119	0.164	0.221	0.291	0.376	0.479	0.603	0.748	0.919	1.117	1.345	1.607	1.905

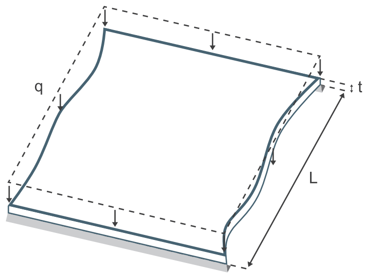
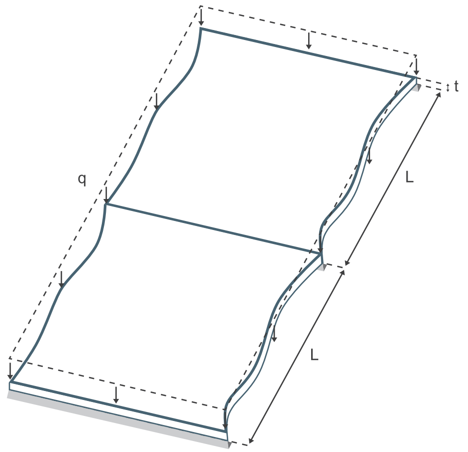


Table 17: Specific capacity, constant load kN/m2 douple span P5

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	0.022	0.041	0.069	0.111	0.17	0.248	0.352	0.484	0.651	0.858	1.111	1.416	1.78	2.21	2.713	3.297	3.972	4.745	5.625
22	0.014	0.026	0.045	0.071	0.109	0.159	0.226	0.311	0.418	0.551	0.713	0.909	1.142	1.418	1.74	2.116	2.548	3.044	3.609
25	0.01	0.018	0.03	0.049	0.074	0.109	0.154	0.212	0.285	0.375	0.486	0.619	0.778	0.966	1.186	1.442	1.737	2.074	2.459
30	0.006	0.011	0.019	0.03	0.046	0.067	0.094	0.13	0.175	0.23	0.298	0.38	0.478	0.593	0.728	0.885	1.066	1.273	1.51
38	0.003	0.006	0.01	0.016	0.024	0.035	0.049	0.068	0.092	0.121	0.156	0.199	0.25	0.311	0.381	0.464	0.558	0.667	0.791



The deflections needed in various load service and duration classes are obtained by multiplying the values in the table above by the following values:

Load duration class	Permanent	Long term	Medium-term	Short term
Service class 1 (heated)	3.25	2.50	1.75	1.30
Service class 2 (unheated)	4.00	3.00	2.00	1.40

P6 board

Table 18: Specific capacity, constant load kN/m2 single span P6

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	72	52.9	40.5	32	25.92	21.42	18	15.34	13.22	11.52	10.13	8.97	8	7.18	6.48	5.88	5.36	4.9	4.5
22	95.37	70.06	53.64	42.38	34.33	28.37	23.84	20.31	17.52	15.26	13.41	11.88	10.6	9.51	8.58	7.78	7.09	6.49	5.96
25	123.15	90.48	69.27	54.73	44.33	36.64	30.79	26.23	22.62	19.7	17.32	15.34	13.68	12.28	11.08	10.05	9.16	8.38	7.7
30	166.67	122.45	93.75	74.07	60	49.59	41.67	35.5	30.61	26.67	23.44	20.76	18.52	16.62	15	13.61	12.4	11.34	10.42
38	250.29	183.89	140.79	111.24	90.11	74.47	62.57	53.32	45.97	40.05	35.2	31.18	27.81	24.96	22.53	20.43	18.62	17.03	15.64

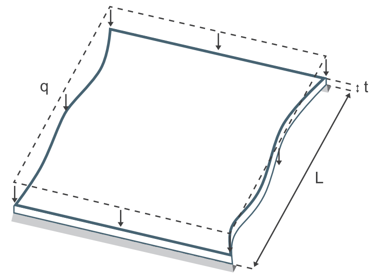
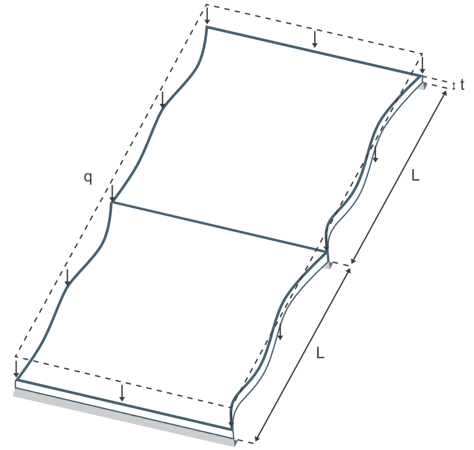


Table 19: Specific capacity, constant load kN/m2 douple span P6

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	72	52.9	40.5	32	25.92	21.42	18	15.34	13.22	11.52	10.13	8.97	8	7.18	6.48	5.88	5.36	4.9	4.5
22	95.37	70.06	53.64	42.38	34.33	28.37	23.84	20.31	17.52	15.26	13.41	11.88	10.6	9.51	8.58	7.78	7.09	6.49	5.96
25	123.15	90.48	69.27	54.73	44.33	36.64	30.79	26.23	22.62	19.7	17.32	15.34	13.68	12.28	11.08	10.05	9.16	8.38	7.7
30	166.67	122.45	93.75	74.07	60	49.59	41.67	35.5	30.61	26.67	23.44	20.76	18.52	16.62	15	13.61	12.4	11.34	10.42
38	229.69	183.89	140.79	111.24	90.11	74.47	62.57	53.32	45.97	40.05	35.2	31.18	27.81	24.96	22.53	20.43	18.62	17.03	15.64



The capacities needed in various load service and duration classes are obtained by multiplying the values in the table above by the following values of the classes (incl. $\gamma_M = 1.3$ and $\gamma_q = 1.5$):

Load duration class	Permanent	Long term	Medium-term	Short term	Instantaneous
Service class 1 (heated)	0.15	0.23	0.33	0.44	0.56
Service class 2 (unheated)	0.10	0.15	0.23	0.31	0.41

P6 board

Table 20: Deflection, concentrated load in the centre of a support span, F= 1 kN, P6, c=50 mm, single span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	0.766	1.042	1.361	1.723	2.127	2.574	3.063	3.595	4.169	4.786	5.445	6.147	6.892	7.679	8.509	9.381	10.295	11.253	12.252
22	0.491	0.669	0.873	1.105	1.365	1.651	1.965	2.306	2.675	3.071	3.494	3.944	4.422	4.927	5.459	6.019	6.606	7.22	7.861
25	0.335	0.456	0.595	0.753	0.93	1.125	1.339	1.572	1.823	2.093	2.381	2.688	3.013	3.358	3.72	4.102	4.501	4.92	5.357
30	0.206	0.28	0.365	0.462	0.571	0.691	0.822	0.965	1.119	1.284	1.461	1.65	1.85	2.061	2.283	2.517	2.763	3.02	3.288
38	0.108	0.147	0.191	0.242	0.299	0.362	0.431	0.505	0.586	0.673	0.765	0.864	0.969	1.079	1.196	1.319	1.447	1.582	1.722

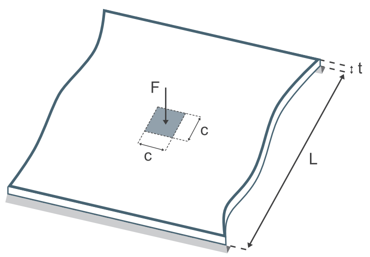
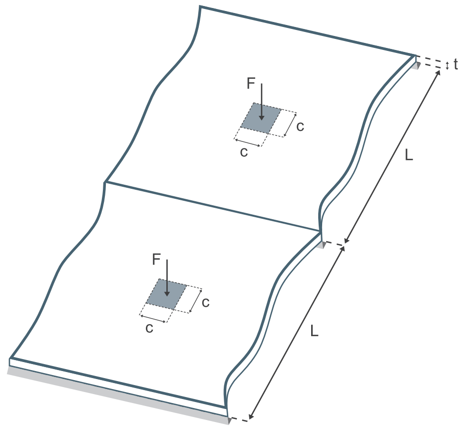


Table 21: Deflection, concentrated load in the centre of a support span, F=1 kN, P6, c=50 mm, douple span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	0.459	0.625	0.817	1.034	1.276	1.544	1.838	2.157	2.502	2.872	3.267	3.688	4.135	4.607	5.105	5.628	6.177	6.752	7.351
22	0.295	0.401	0.524	0.663	0.819	0.991	1.179	1.384	1.605	1.842	2.096	2.367	2.653	2.956	3.275	3.611	3.963	4.332	4.717
25	0.201	0.273	0.357	0.452	0.558	0.675	0.804	0.943	1.094	1.256	1.429	1.613	1.808	2.015	2.232	2.461	2.701	2.952	3.214
30	0.123	0.168	0.219	0.277	0.343	0.414	0.493	0.579	0.671	0.771	0.877	0.99	1.11	1.236	1.37	1.51	1.658	1.812	1.973
38	0.065	0.088	0.115	0.145	0.179	0.217	0.258	0.303	0.352	0.404	0.459	0.518	0.581	0.648	0.718	0.791	0.868	0.949	1.033



The deflections needed in various load service and duration classes are obtained by multiplying the values in the table above by the following values:

Load duration class	Permanent	Long term	Medium-term	Short term
Service class 1 (heated)	3.25	2.50	1.75	1.30
Service class 2 (unheated)	4.00	3.00	2.00	1.40

P6 board

Table 22: Specific capacity, concentrated load in the centre of a support span, kN, P6, c=50 mm, single span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	3.59	3.37	3.21	3.08	2.98	2.9	2.83	2.77	2.72	2.68	2.64	2.61	2.58	2.55	2.53	2.51	2.49	2.47	2.45
22	4.75	4.46	4.25	4.08	3.95	3.84	3.75	3.67	3.6	3.55	3.5	3.45	3.41	3.38	3.35	3.32	3.29	3.27	3.25
25	6.13	5.76	5.49	5.27	5.1	4.96	4.84	4.74	4.66	4.58	4.52	4.46	4.41	4.36	4.32	4.29	4.25	4.22	4.19
30	8.3	7.8	7.43	7.13	6.9	6.71	6.55	6.42	6.3	6.2	6.11	6.04	5.97	5.91	5.85	5.8	5.75	5.71	5.68
38	12.46	11.71	11.15	10.71	10.36	10.08	9.84	9.63	9.46	9.31	9.18	9.06	8.96	8.87	8.79	8.71	8.64	8.58	8.52

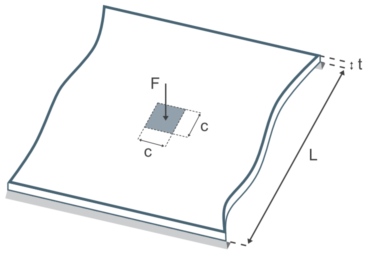
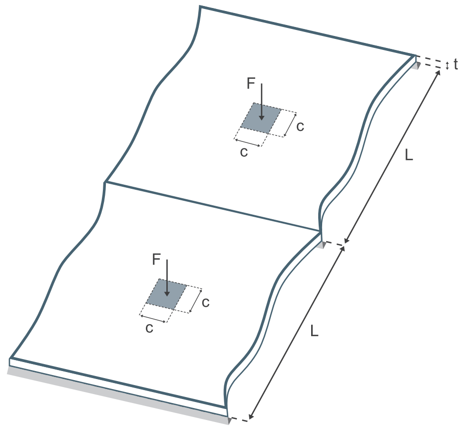


Table 23: Specific capacity, concentrated load in the centre of a support span, kN, P5, c=50 mm, douple span

L (mm) → t (mm) ↓	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
18	3.93	3.71	3.54	3.4	3.28	3.19	3.11	3.04	2.98	2.94	2.89	2.86	2.82	2.79	2.76	2.74	2.71	2.68	2.65
22	5.2	4.92	4.69	4.5	4.35	4.22	4.12	4.03	3.95	3.89	3.83	3.78	3.74	3.7	3.66	3.62	3.59	3.55	3.51
25	6.71	6.35	6.05	5.81	5.61	5.45	5.31	5.2	5.1	5.02	4.95	4.89	4.83	4.78	4.73	4.68	4.63	4.58	4.53
30	9.09	8.59	8.19	7.86	7.6	7.38	7.19	7.04	6.91	6.79	6.7	6.61	6.54	6.47	6.4	6.33	6.27	6.2	6.13
38	12.92	12.9	12.3	11.81	11.41	11.08	10.8	10.57	10.37	10.2	10.06	9.93	9.82	9.71	9.61	9.51	9.41	9.31	9.2



The capacities needed in various load service and duration classes are obtained by multiplying the values in the table above by the following values of the classes (incl. $\gamma_M = 1.3$ and $\gamma_q = 1.5$):

Load duration class	Permanent	Long term	Medium-term	Short term	Instantaneous
Service class 1 (heated)	0.15	0.23	0.33	0.44	0.56
Service class 2 (unheated)	0.10	0.15	0.23	0.31	0.41

8. Emissions

8.1 Gluing of chipboard

Urea formaldehyde resin is primarily used as the glue in standard chipboard. The amount of resin in chipboard at the manufacturing stage is approximately 10%. The formaldehyde contained in the resin is for the most part released during hot pressing, but a portion of it remains in the product and is released over time. The amount of formaldehyde in a wood-based board is an important criteria when choosing boards for various applications, and different markets require products of different emission classes. For example, the US and Japanese markets have traditionally required very low formaldehyde emissions.

8.2 Formaldehyde and emissions

The formaldehyde emission of the finished product is monitored regularly in quality control, for which several test methods and class limits exist. Factory quality control uses an extraction method known was perforation (EN 120; EN 12460-5) by which the amount of formaldehyde is obtained as a unit mg/100 g sample. The amount is reduced to 6.5% constant humidity in a sample piece.

The chipboard is CE marked and conform to the corresponding E1 emissions class whose limit value is 8 mg/100 g sample (SFS-EN 13986 + A1 Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking). In practice, E1-class chipboard has significantly lower values than 8 mg/100 g sample. For comparison, natural wood has been measured and produced corresponding values of 3...10 mg/100 g.

Chipboard formaldehyde emissions may also be reduced by coating or painting the boards.

There are also products in production with lower formaldehyde emissions than the E1 level. So-called E05 means half the E1 limit or 4 mg/100g. This has yet to be standardised, nor has the official CE mark-compliant emission yet been confirmed.

In addition, the product range includes TSCA-certified chipboard, the emission content of which has been certified by the US Environmental Protection Agency (EPA) in accordance with the Toxic Substances Control Act (TSCA) Title VI. ULEF status has been obtained for chipboard of this emission level, in which case the product's formaldehyde emission is below 0.05 ppm. This chipboard has the lowest formaldehyde emissions of all.

Table 24 presents the measurement methods and limit values of emissions.

Gluing emission class	Measurement method	Formaldehyde content limit values
E1 standard gluing	Perforation method EN 120; EN 12460-5	8 mg/100 g sample
E05**	Perforation method EN 120; EN 12460-5	No official limit value exists, but halving of E1 means 4 mg/100 g sample
TSCA/CARB ULEF	Factory quality control EN 120; EN 12460-5	0.05 ppm
**) not in strength grades P5 and P7		

Table 24. Formaldehyde measurement method in wood-based boards.

8.3 M1 indoor air classification

Choice of materials can be used to affect the quality of buildings' indoor air. The M1 emissions classification label of building materials is a sign of low emissions. The M1 classification sets limit values for materials' and fixtures' total volatile organic compounds (TVOC) and formaldehyde and ammoniac emissions. In addition, the product's odour is evaluated.

The KoskiLam product is classified M1.

9. Thermal properties of chipboard

9.1 Thermal properties

9.1.1 Thermal insulation
The thermal insulation of chipboard depends on its humidity

λ10 = 0.13 W/mK
λn = 0.14 W/mK (SRakMK/C4)

9.1.2 Vapour permeance
3...7 x 10^{-12} kg / msPa (Dick Björkholz: Heat and humidity)

9.1.3 Air permeability
10...25 x 10-9 m² / sPa (RT 22-10517)

10. Fire class

In conformity with the CE label, chipboard which is used in walls and ceilings is in fire class D-s2,d0 if its density is above 400 kg/m^3 and thickness is above 9 mm. Koskisen does not use fire retardants which could improve fire properties in chipboard.

Uncoated chipboard with the same criteria (CE label) (density 400 kg/m3 and thickness above 9 mm) floor chipboard conforms to Dfl-s0 class in accordance with EN 13501.

Melamine or phenol-coated chipboard for floors conforms to Bfl-s1 fire class in thicknesses 12–38 mm (EN 13501-1).

Wood-based board chars at a rate of approximately 1 mm/min.

11. Sound insulation

The sound insulation of 12–18 mm chipboards is 24–29 dB. Chipboard can be used as a vibrating surface for the dampening of low noise as well as part of other sound dampening structures. Sound dampening capability can be improved through perforating and grooving. Table 25 presents the measured sound reduction values of chipboard.

KoskiWall, 8 mm	Rw 27 dB
KoskiPro Light, 32 mm	Rw 31 dB

Table 25. Measured sound reduction values, airborne sound reduction figure per Rw ISO 717-1:2013.

Mineral wool between the boards improves the structures sound insulation by 5–8 dB. The best sound insulation is achieved with a double frame structure. If for board cladding
sufficiently thick and heavy chipboard or two boards one on top of the other combined with mineral wool insulation is used, the airborne sound insulation can be improved up to 55...60 dB.

Table 26 presents values for various combined structures' airborne sound insulation. (RT R-3729

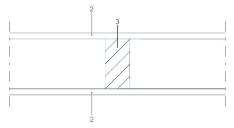
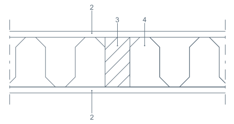
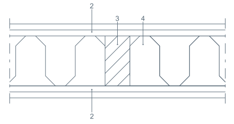
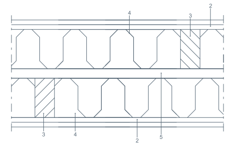
Type Number	Structure	Boards 2 (min)	Frame 3 (min)	Mineral wool 4	Air gap 5	Airborne sound insulation Rw (laboratory value)	Airborne sound insulation Rw (value measured in building)
1		1 x 12 mm	70 mm				32 dB
		1 x 12 mm	100 mm				35 dB
2		1 x 12 mm	70 mm	70 mm			40 dB
		1 x 12 mm	100 mm	100 mm			43 dB
3		2 x 10 mm	70 mm	70 mm			45 dB
		2 x 10 mm	100 mm	100 mm		49 dB	48 dB
4		2 x 10 mm	70 mm	70 mm	20 mm	59 dB	56 dB
		2 x 10 mm	70 mm	70 mm	60 mm	59 dB	58 dB

Table 26. Airborne sound insulation.

12. Installation instructions

12.1 Floors

The links below are to installation instructions for Koski-
sen
floor chipboard.

KoskiFloor installation instructions ▸

KoskiFloor Tandem installation instructions ▸

12.2 Walls

The link below is to installation instructions for Koskisen wall boards.

KoskiWall installation instructions ▸

13. Usage instructions

13.1 Machining

The chipboard can be sawn, drilled and cut using any conventional woodworking tools. Blades become duller somewhat more quickly than when machining wood. For that reason, when machining larger board amounts, carbide-tipped blades are recommended. The best machining results is obtained with well sharpened tools and high cutting speeds.

Chipboard may also be bought ready-machined, for example with tongue and groove. Figure 3 presents common tongue and groove models:

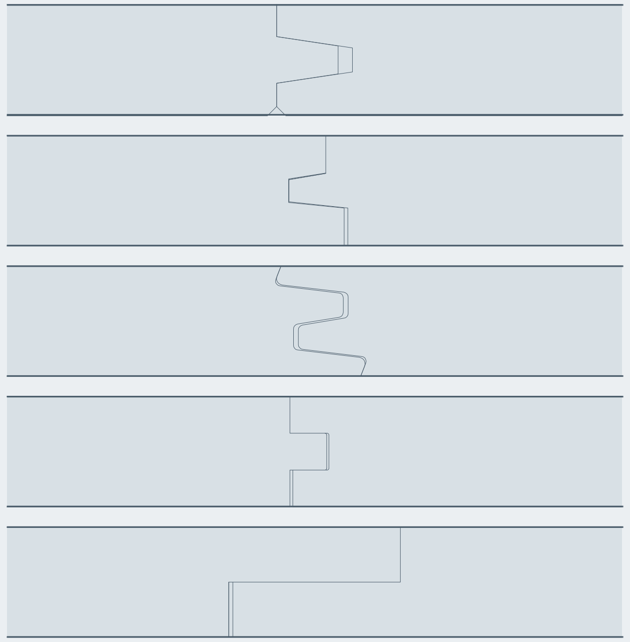
13.2 Gluing properties

Chipboard has good gluing properties. In general, the same resins can be used as in wood. Low-water, dense resins are recommended. The resin may not be thinned with water.

13.3 Surface coating

Chipboard may be painted, wallpapered, veneered or covered with other surface coatings. The dense, homogeneous surface of chipboard forms an even basis for paint and thin surface coatings. Chipboard may be painted with all paints intended for wood surface treatment. Thinning of paint with water should be avoided. To achieve a high-quality paint surface, the boards should first be painted with a primer, or a board to which primer or a painting film has been applied at the factory should be used.

Chipboard standard T&G



Wall board T&G
Thicknesses 11–12 mm

T&G (standard)
Thicknesses 16–30 mm
Most common floor thicknesses 18, 22 and 25 mm.

DTG (double T&G, "tandem")
Thicknesses 22–25 mm
Double tongue enables seams between the framing.

FTG (symmetrical straight T&G)
Thicknesses 30–40 mm

HL (half tongue)
Thicknesses 8–40 mm

Figure 3. Common tongue and groove models.

13.4 Storage, processing and transport

Boards are protected during transport and storage from moisture, dirt, ground contact, chipping and scratching. Boards are stored face down on a level surface. If necessary, bearers 0.5 m apart are used. The board stack is covered with a protective board.

Chipboard should be air conditioned for 5 to 7 days before installation in humidity and temperature conditions that are close as possible to the intended conditions.

13.5 Disposal

If the boards are intact and dry, they may be used again on discretion on a case-by-case basis. Reuse is the most recommended way to "dispose" of chipboard. As chipboard chiefly consists of pure natural timber, it can be disposed of (in compliance with local environmental instructions) by composting, landfill disposal or burning at over 800°C with other wood.

14. Chipboard environmental considerations

Chipboard makes use of the by-products of sawmilling and plywood industry, and it consists of 90% wood. Chipboard is thus a carbon store: the carbon contained in the timber is retained in the board as long as the board is used and until it is disposed of, such as by incineration for energy. Chipboard binds wood carbon for much longer than other wood products such as cardboard and paper.

An average carbon footprint has been calculated for coated melamine chipboard and uncoated chipboard. The carbon contained in chipboard compensates emissions and the chipboard serves as a carbon sink. The carbon footprint calculations are available on the Koskisen website.

EPD KoskiMel ▸

EPD KoskiPan ▸

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