Building site
Indoor spaces
Furniture and interior decoration
Construction

# Handbook of Koskisen Plywood

KOSKISEN

# 1. Koskisen plywood

Koskisen's Finnish plywood products are globally known for their tailored solutions, high quality and customer orientation. Plywood is manufactured from a renewable raw material – Finnish birch. Finnish birch plywood is a durable and strong material for applications such as vehicle floors and all types of construction. The light-coloured birch surface is ideal for interior decoration such as wall and ceiling panels as well as for furniture.

## 1.1 WOOD, THE MOST IMPORTANT RAW MATERIAL

The most important raw material for plywood is a renewable natural resource – wood. Finnish birch (Betula pendula) and spruce (Picea abies) are the most important raw materials in the plywood process. Trees grow slowly in Finland's climate, which makes the wood close-grained and of a consistent quality.

Birch is of a uniform consistency and it has excellent strength, peeling and gluing properties. Spruce is a less dense wood raw material than birch, and is used in conifer plywood or combi structures together with birch veneers.

## 1.2 GLUE

The majority of Koskisen's cross-banded plywood products are manufactured using phenol formaldehyde glue. This gluing method allows products to be used in wet outdoor conditions (service class 3). The panels must be overlaid or coated and edge sealed. A small part of Finnish plywood production is bonded with urea formaldehyde glue. These products are suitable for use in dry (service class 1) or humid (service class 2) conditions.

The phenol formaldehyde glued plywood meets the requirements of the European standard EN 314-2 class 3 (exterior).

Phenol formaldehyde and urea formaldehyde glued plywood exhibit very low levels of formaldehyde emissions. Koskisen plywood products meet the Ultra Low Emission Formaldehyde (ULEF) requirements.

## 1.3 QUALITY AND SAFETY

Koskisen complies with quality management systems in its operations. The quality of the product is monitored at all stages of the manufacturing process. The controlled characteristics are veneer thickness, glue spread, plywood thickness, bonding strength and other requirements. Koskisen plywood products and manufacturing processes meet European EN standards.

Whilst manufacturing technology and efficiency have been improved continuously, the safety of products and processes has not been neglected. Basic regulations for mill safety are set and monitored by authorities. Management systems, which include quality, safety and environmental management systems, ensure that the development of production is continuous, safe, high-quality and effective.

Koskisen has quality and environmental management systems certified according to the ISO 9001, ISO 45001 and ISO 14001 standards.

## 1.4 FORESTS AND THE ENVIRONMENT

Wood is the main raw material used by Koskisen. In 2021, Koskisen procured 1.6 million cubic metres of wood, of which 52% was spruce, 20% pine, 27% birch and 1% aspen.

In 2021, Koskisen used approximately 1 million m³ of wood. The share of certified roundwood was 78%.

Koskisen's Wood Procurement is in charge of the mills' raw material supply and also delivers wood to other operators in southern Finland. The majority of the wood is procured from private forests through Koskisen's procurement operations and a small proportion arrives as deliveries from Finnish mills. Procurement is centred on the Häme, Uusimaa and Etelä-Savo areas. Koskisen procures only Finnish wood.

In addition to the production units' operations, Koskisen's wood CoC systems and the ISO 14001 environmental standard ensure the level of control of the origin of wood in all of the countries in which the Group procures wood.

Koskisen's Wood Procurement is responsible for the Group's forests and manages forests for private forest owners. Wood procurement subcontractors have also committed to following the management system requirements.

Comprehensive utilisation of raw material is in the interest of both our mills and the wood sellers.

Koskisen uses the whole tree. Logs are turned into plywood and sawn timber products. Pulp wood is delivered to paper and pulp manufacturers and logging residues are utilised as biofuel whenever possible. Side streams from the production processes are used as fuel in heating plants. Koskisen's products are recyclable, as are most of the packaging materials.

Woodchip and sawdust from the other operations are used in chipboard production. In addition to wood, Koskisen uses various adhesives and coatings in its chipboard and plywood production.

### FOREST CERTIFICATION

Sustainable forest management ensures that there is enough wood raw material for future generations. Koskisen knows the origin of the wood and ensures that our forest management practices enable the forest to regenerate and protect natural diversity.

Koskisen Wood Procurement complies with the requirements of the PEFC™ CoC and FSC® CoC chain of custody certificates. The certificates ensure that the wood is harvested from sustainably managed forests where felling is carried out in accordance with the law and certification criteria. The origin of the raw material is inspected based on Koskisen's procurement policy to ensure forests in protected areas are safeguarded and that wood is not procured from controversial sources.

Forest management measures take into account the valuable habitats described in the Nature Conservation Act and Forest Act. Business relies directly on forests, which Koskisen wishes to take care of.

# 2. Koskisen plywood products

## 2.1 COMPOSITION OF STANDARD PLYWOODS

Koskisen plywood is made of thin cross-banded veneers. In addition to standard cross-banded construction, a range of orientated special constructions, aimed at specific end uses, are available. The nominal thickness of birch and spruce veneer is 1.4–2.0 mm.

**KOSKISEN'S STANDARD PLYWOODS ARE:**
**Birch**: Birch veneers are used throughout the construction.

**Combi plywood**: Face veneer and the first inner veneer are birch and the alternate inner veneers are conifer and birch.

Table 2-1. Face grade combinations of birch-faced plywoods.

| | | | |
|---|---|---|---|
| S/S | BB/BB | WG+/WG+ | WG/WG |
| S/BB | BB/WG | | |
| S/WG | | | |

### FACE VENEER GRADES

**S** Irregular grain permitted. Pin knots permitted. Sound intergrown knots permitted up to a diameter of 6 mm and limited to 2/m². Other repaired knots and holes permitted up to a diameter of 6 mm and limited to 2/m². Open splits and checks, repaired, permitted up to 2 mm wide and 200 mm long, not exceeding one per metre of panel width. Closed splits and checks permitted up to 200 mm length and two per metre of panel width. Very mild discoloration and streaks are permitted on a maximum of 10% of the surface area. No wooden patches.

**BB+** Irregular grain permitted. Pin knots permitted. Sound knots permitted up to 25 mm diameter, limited to 2/m². Other repaired knots and holes permitted up to a diameter of 6mm and limited to 5/m². Open splits and checks, repaired, permitted up to 2mm wide and 200mm length not exceeding two per metre of panel width. Mild discoloration and coarseness, repaired, permitted. No wooden patches.

**BB** Irregular grain permitted. Pin knots permitted. Sound knots permitted up to 25 mm diameter, limited to 2/m². Other repaired knots and holes permitted up to a diameter of 6 mm and limited to 5/m². Open splits and checks, repaired, permitted up to 4 mm wide and 1/3 of the panel length not exceeding two per metre of panel width. Mild discoloration and coarseness, repaired, permitted. Wooden patches permitted and repaired missing patches not exceeding three per panel permitted. Glue penetration permitted up to 10% of the surface area.

**WG+** Irregular grain permitted. Pin knots permitted. Sound knots and intergrown decayed knots permitted up to 10 mm diameter and 7/m². Other repaired knots and holes permitted up to a diameter of 10 mm and limited to 7/m². Open splits and checks, repaired, permitted up to 8 mm wide and 1/3 of the panel length not exceeding two per metre of panel width. Wooden patches permitted and repaired missing patches not exceeding three per panel permitted. Discoloration, streaks, roughness, glue penetration, slight sanding through and insufficient sanding are permitted.

**WG** Irregular grain permitted. Pin knots permitted. Sound knots and intergrown decayed knots permitted up to 20 mm diameter and 10 per m². Other knots and holes permitted up to 20 mm diameter, larger ones repaired. Open splits and checks, repaired, permitted 5–20 mm wide and 1/3 of the panel length. Wooden patches and repaired missing patches permitted. Discoloration, streaks, roughness, glue penetration, slight sanding through and insufficient sanding are permitted.

Table 2-2. Standard plywood

| Plywood<br>Face<br>Core<br>Nominal thickness*<br>mm | Thickness tolerance in line with EN 315, mm | | Finnish plywood thickness tolerance**, mm | | Birch<br>Birch<br>Birch<br>No. of plies | <br><br><br>Weight*** kg/m² | Combi<br>Birch<br>Birch&Conifer<br>No. of plies | <br><br><br>Weight*** kg/m² |
|---|---|---|---|---|---|---|---|---|
| | min | max | min | max | | | | |
| 4 | 3.5 | 4.3 | 3.5 | 4.1 | 3 | 2.7 | | |
| 6.5 | 5.9 | 6.9 | 6.1 | 6.9 | 5 | 4.4 | 5 | 4.0 |
| 9 | 8.3 | 9.5 | 8.8 | 9.5 | 7 | 6.1 | 7 | 5.6 |
| 12 | 11.2 | 12.6 | 11.5 | 12.5 | 9 | 8.2 | 9 | 7.4 |
| 15 | 14.2 | 15.7 | 14.3 | 15.3 | 11 | 10.2 | 11 | 9.3 |
| 18 | 17.1 | 18.7 | 17.1 | 18.1 | 13 | 12.2 | 13 | 11.2 |
| 21 | 20.0 | 21.8 | 20.0 | 20.9 | 15 | 14.3 | 15 | 13.0 |
| 24 | 22.9 | 24.9 | 22.9 | 23.7 | 17 | 16.3 | 17 | 14.9 |
| 27 | 25.2 | 28.4 | 25.2 | 26.8 | 19 | 18.4 | 19 | 16.7 |
| 30 | 28.1 | 31.5 | 28.1 | 29.9 | 21 | 20.4 | 21 | 18.6 |
| 35 | 33.5 | 36.1 | 33.5 | 35.5 | 25 | 23.8 | | |
| 40 | 38.4 | 41.2 | 38.8 | 41.2 | 29 | 27.2 | | |
| 45 | 43.3 | 46.4 | 43.6 | 46.4 | 32 | 30.6 | | |
| 50 | 48.1 | 51.5 | 48.5 | 51.5 | 35 | 34.0 | | |

* Other thicknesses on request.
** These tolerances fulfil the ISO and EN requirements and are in part more strict.
*** Approximate weights are based on max number of plies. Birch 680 and combi 620 kg/m³.

Table 2-3. Panel tolerances

| Length/width******, mm | Tolerance, mm |
|---|---|
| < 1000 | ±1 |
| 1000...2000 | ±2 |
| > 2000 | ±3 |
| EN 315 Squareness of panels | 1 mm/m |
| EN 315 Straightness of edges | 1 mm/m |

****** Length and width of panel is within tolerance at 95% probability level.

Table 2-4. Panel sizes *****

| Standard sizes******, mm x mm |
|---|
| 1200 x 2400 / 2500 / 3000 / 3600 / 4000 |
| 1220 x 2440 / 2500 / 3050 / 3600 / 4000 |
| 1250 x 2400 / 2500 / 3000 / 3600 / 4000 |
| 1500 x 2400 / 2500 / 3000 / 3600 / 4000 |
| 1525 x 1525 / 2440 / 2500 / 3050 / 3600 / 4000 |
| 1880 x 3000 / 3300 / 3600 / 4000 |

**** For plywood, the grain of the face veneer runs parallel to the first dimension stated. For Finnish plywood this is generally the shorter dimension of standard panels. Conifer plywood can have the face grain in either direction.
***** Other sizes on request up to 1900 mm x 4000 mm. See also chapter 2.3 for scarf jointed maxi sizes.

## 2.2 APPEARANCE OF STANDARD PLYWOODS

Uncoated standard Finnish plywood is classified according to standard EN 635 on the basis of its face veneer grade. These grade categories are based on the recommendations of the ISO 2426 standard. Full descriptions of the face grades of the above-mentioned plywoods are given in Finnish standard SFS 2413 which is in some respects more demanding than EN 635 and is formulated for Finnish birch plywood. The plywood's grade does not have any significant effect on the structural performance of a panel.

## 2.3 OVERLAID AND COATED PLYWOOD

Plywood panels can all be supplied overlaid or coated to improve technical properties.

### PHENOLIC FILM FACED, SMOOTH

A phenolic resin impregnated film is pressed on both surfaces of the panel under high pressure and temperature. Film faced plywood panels have improved resistance to abrasion, moisture penetration, chemicals, insects and fungi. They have a smooth, hygienic, easy to clean surface. The colour is normally dark brown but panels are also available in light brown, green, grey or black. Panels can also be supplied with heavier films than the usual 120 g/m² film, e.g. 220 g/m², 440 g/m² or even 660 g/m², which have better technical properties. All panels are edge sealed with a specialised paint to minimise moisture penetration.

### PHENOLIC FILM FACED, TEXTURED

Plywood panels overlaid with phenol resin impregnated film. An additional textured pattern is hot pressed onto one or both surfaces. The textured pattern improves slip resistance characteristics. In addition to the traditional wire-mesh surface, a wide variety of embossed surface patterns to provide slip resistance is available. Koskisen's selection includes carat, crown, diamond and ruby textured patterns. A wide variety of coatings is also available.

### PAINTING FILM FACED

The plywood is overlaid with phenol resin impregnated film suitable for painting. The film reduces the required volume of paint and effectively prevents the splits and checks that are typical for painted wooden surfaces. The result is a smooth and durable paint finish. The panel is recommended for all interior and exterior applications.

### MELAMINE FILM FACED

Plywood panels with a variety of melamine resin film surfaces which are ideal for applications requiring a neat finish and hygiene, such as the furniture and joinery industries. The alternatives are white and transparent melamine film.

### SPECIALTY PRODUCTS

In addition to the most common coated plywoods, Koskisen manufactures numerous specialty products. These products include painted and stained plywood, veneered plywood, laminate faced plywood, polypropylene plastic foil coated plywood, glass fibre reinforced surfaces, metal faced plywood and plywood provided with sound insulation.

### SCARF JOINTED MAXI SIZE PANELS

Both uncoated and coated panels are available in maxi sizes. Panels are scarf jointed in the face grain direction and then bonded together with a special glue. The maximum panel size varies according to the plywood type. The largest panel available is about 13500 mm x 2900 mm.

### MACHINED PANELS

Panels can be machined according to the customer's wishes. Panels can be drilled, profiled and machined to order using CNC technology.

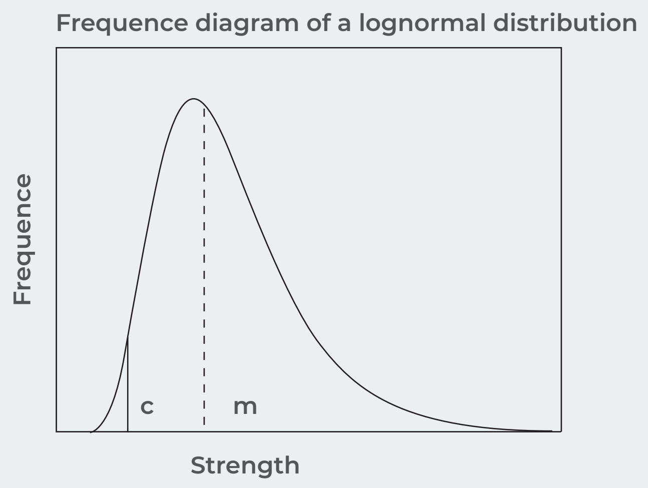
# 3. Technical properties of plywood

## 3.1 MECHANICAL PROPERTIES

In addition to strength, modulus of elasticity and shear modulus, the density and section properties are needed as input values in the design process. These properties have been determined for Finnish plywood by VTT (Technical Research Centre of Finland) in co-operation with Finnish plywood producers.

Plywood was representatively sampled from all Finnish plywood mills. Prior to testing, the panels were conditioned in a climate controlled room held at a steady relative humidity of 65% and temperature of 20°C. Tests were carried out in accordance with EN 789. In testing, the duration of load was 5 minutes. Based on the test results, the mean and characteristic values were determined in accordance with EN 1058. The characteristic value is related to the lower 5-percentile value obtained from the test results.

Figure 3-1. Frequence diagram of a lognormal distribution




**Strength values**
m = mean value
c = characteristic value

Bending tests were carried out on the same panels in accordance with EN 310. The acquired bending strength values are higher than the EN 789 values and lower for modulus of elasticity. The EN 310 method is only suitable for quality control purposes and is therefore not to be used as a basis for design data.

The plywood's mean and characteristic values of density to be used in design calculations are given in Table 3-1.

For other purposes, e.g. the transportation of plywood, other values may be used.

The lay-ups as well as thickness, area, section modulus and second moment of area of the cross sections of sanded plywood are given in Table 3-2 to Table 3-4. For unsanded plywood these values are conservative.

The mean modulus of elasticity as well as characteristic strength values in bending, tension and compression are given in Table 3-2 to Table 3-4. These values are given both along and across the grain direction of the face veneers. The mean shear modulus and characteristic strength values in panel and planar (rolling) shear are given in Table 3-5 to Table 3-7.

Table 3-1. Density to be used in design.
The values are given at a relative humidity of 65%.

| Plywood | Mean density kg/m³ | Characteristic density kg/m³ |
|---|---|---|
| Birch, 1.4 mm veneers | 680 | 630 |
| Combi, 1.4 mm veneers | 620 | 560 |

Symbols used in Table 3-2 to Table 3-7.

| | | |
|---|---|---|
| $t$ | = | thickness |
| $A$ | = | cross-sectional area |
| $W$ | = | section modulus |
| $I$ | = | second moment of area |
| $\parallel$ | = | grain direction of surface veneers |
| $\perp$ | = | perpendicular to the face grain |
| $f_m$ | = | bending strength |
| $f_t$ | = | tensile strength |
| $f_c$ | = | compression strength |
| $f_v$ | = | panel shear strength |
| $f_r$ | = | planar shear strength |
| $E_m$ | = | modulus of elasticity in bending |
| $E_t$ | = | modulus of elasticity in tension |
| $E_c$ | = | modulus of elasticity in compression |
| $G_v$ | = | modulus of rigidity in panel shear |
| $G_r$ | = | modulus of rigidity in planar shear |
| $\vert$ | = | birch veneer cross grained |
| — | = | birch veneer long grained |
| $\vert$ | = | spruce veneer cross grained |
| — | = | spruce veneer long grained |

Table 3-2. Birch plywood

| Lay-up | Section properties | | | | | | Characteristic strength | | | | | | Mean modulus of elasticity | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bending | | Compression | | Tension | | Bending | | Tension and compression | |
| | Nominal thickness | No of plies | t average mm | A mm²/mm | W mm³/mm | I mm⁴/mm | $f_m$ II N/mm² | $f_m$ ⊥ N/mm² | $f_c$ II N/mm² | $f_c$ ⊥ N/mm² | $f_t$ II N/mm² | $f_t$ ⊥ N/mm² | $E_m$ II N/mm² | $E_m$ ⊥ N/mm² | $E_{t/c}$ II N/mm² | $E_{t/c}$ ⊥ N/mm² |
| \|—\| | 4 | 3 | 3.6 | 3.6 | 2.16 | 3.89 | 65.9 | 10.6 | 31.8 | 20.2 | 45.8 | 29.2 | 16471 | 1029 | 10694 | 6806 |
| \|—\|—\| | 6.5 | 5 | 6.4 | 6.4 | 6.83 | 21.8 | 50.9 | 29.0 | 29.3 | 22.8 | 42.2 | 32.8 | 12737 | 4763 | 9844 | 7656 |
| \|—\|—\|—\| | 9 | 7 | 9.2 | 9.2 | 14.1 | 64.9 | 45.6 | 32.1 | 28.3 | 23.7 | 40.8 | 34.2 | 11395 | 6105 | 9511 | 7989 |
| \|—\|...\|—\| | 12 | 9 | 12.0 | 12.0 | 24.0 | 144 | 42.9 | 33.2 | 27.7 | 24.3 | 40.0 | 35.0 | 10719 | 6781 | 9333 | 8167 |
| \|—\|...\|—\| | 15 | 11 | 14.8 | 14.8 | 36.5 | 270 | 41.3 | 33.8 | 27.4 | 24.6 | 39.5 | 35.5 | 10316 | 7184 | 9223 | 8277 |
| \|—\|...\|—\| | 18 | 13 | 17.6 | 17.6 | 51.6 | 454 | 40.2 | 34.1 | 27.2 | 24.8 | 39.2 | 35.8 | 10048 | 7452 | 9148 | 8352 |
| \|—\|...\|—\| | 21 | 15 | 20.4 | 20.4 | 69.4 | 707 | 39.4 | 34.3 | 27.0 | 25.0 | 39.0 | 36.0 | 9858 | 7642 | 9093 | 8407 |
| \|—\|...\|—\| | 24 | 17 | 23.2 | 23.2 | 89.7 | 1041 | 38.9 | 34.4 | 26.9 | 25.1 | 38.8 | 36.2 | 9717 | 7783 | 9052 | 8448 |
| \|—\|...\|—\| | 27 | 19 | 26.0 | 26.0 | 113 | 1465 | 38.4 | 34.5 | 26.8 | 25.2 | 38.7 | 36.3 | 9607 | 7893 | 9019 | 8481 |
| \|—\|...\|—\| | 30 | 21 | 28.8 | 28.8 | 138 | 1991 | 38.1 | 34.6 | 26.7 | 25.3 | 38.5 | 36.5 | 9519 | 7981 | 8993 | 8507 |
| \|—\|...\|—\| | 35 | 25 | 34.4 | 34.4 | 197 | 3392 | 37.6 | 34.7 | 26.6 | 25.4 | 38.4 | 36.6 | 9389 | 8111 | 8953 | 8547 |
| \|—\|...\|—\| | 40 | 29 | 40.0 | 40.0 | 267 | 5333 | 37.2 | 34.7 | 26.5 | 25.5 | 38.3 | 36.8 | 9296 | 8204 | 8925 | 8575 |
| \|—\|...\|—\| | 45 | 32 | 44.2 | 44.2 | 326 | 7196 | 37.0 | 34.7 | 26.5 | 25.5 | 38.2 | 36.8 | 9259 | 8241 | 8914 | 8586 |
| \|—\|...\|—\| | 50 | 35 | 48.4 | 48.4 | 390 | 9448 | 36.8 | 34.8 | 26.4 | 25.6 | 38.1 | 36.9 | 9198 | 8302 | 8895 | 8605 |

Table 3-3. Combi plywood

<table>
<tr><th rowspan="3">Lay-up</th><th colspan="6">Section properties</th><th colspan="6">Characteristic strength</th><th colspan="4">Mean modulus of elasticity</th></tr>
<tr><th rowspan="2">Nominal thickness</th><th rowspan="2">No of plies</th><th rowspan="2">t average mm</th><th rowspan="2">A mm²/mm</th><th rowspan="2">W mm³/mm</th><th rowspan="2">I mm⁴/mm</th><th colspan="2">Bending</th><th colspan="2">Compression</th><th colspan="2">Tension</th><th colspan="2">Bending</th><th colspan="2">Tension and compression</th></tr>
<tr><th>$f_m$ II N/mm²</th><th>$f_m \perp$ N/mm²</th><th>$f_c$ II N/mm²</th><th>$f_c \perp$ N/mm²</th><th>$f_t$ II N/mm²</th><th>$f_t \perp$ N/mm²</th><th>$E_m$ II N/mm²</th><th>$E_m \perp$ N/mm²</th><th>$E_{t/c}$ II N/mm²</th><th>$E_{t/c} \perp$ N/mm²</th></tr>
<tr><td>|—|—|</td><td>6.5</td><td>5</td><td>6.4</td><td>6.4</td><td>6.83</td><td>21.8</td><td>50.8</td><td>29.0</td><td>24.5</td><td>22.8</td><td>19.1</td><td>32.8</td><td>12690</td><td>4763</td><td>8859</td><td>7656</td></tr>
<tr><td>|—|—|—|</td><td>9</td><td>7</td><td>9.2</td><td>9.2</td><td>14.1</td><td>64.9</td><td>43.9</td><td>32.1</td><td>22.5</td><td>23.7</td><td>17.5</td><td>34.2</td><td>10983</td><td>6105</td><td>8141</td><td>7989</td></tr>
<tr><td>|—|...|—|</td><td>12</td><td>9</td><td>12.0</td><td>12.0</td><td>24.0</td><td>144</td><td>40.0</td><td>33.2</td><td>21.5</td><td>24.3</td><td>16.7</td><td>35.0</td><td>10012</td><td>6781</td><td>7758</td><td>8167</td></tr>
<tr><td>|—|...|—|</td><td>15</td><td>11</td><td>14.8</td><td>14.8</td><td>36.5</td><td>270</td><td>37.5</td><td>33.8</td><td>20.8</td><td>24.6</td><td>16.2</td><td>35.5</td><td>9386</td><td>7184</td><td>7520</td><td>8277</td></tr>
<tr><td>|—|...|—|</td><td>18</td><td>13</td><td>17.6</td><td>17.6</td><td>51.6</td><td>454</td><td>35.8</td><td>34.1</td><td>20.4</td><td>24.8</td><td>15.8</td><td>35.8</td><td>8950</td><td>7452</td><td>7358</td><td>8352</td></tr>
<tr><td>|—|...|—|</td><td>21</td><td>15</td><td>20.4</td><td>20.4</td><td>69.4</td><td>707</td><td>34.5</td><td>34.3</td><td>20.0</td><td>25.0</td><td>15.6</td><td>36.0</td><td>8628</td><td>7642</td><td>7240</td><td>8407</td></tr>
<tr><td>|—|...|—|</td><td>24</td><td>17</td><td>23.2</td><td>23.2</td><td>89.7</td><td>1041</td><td>32.9</td><td>34.4</td><td>19.8</td><td>25.1</td><td>15.4</td><td>36.2</td><td>8381</td><td>7783</td><td>7151</td><td>8448</td></tr>
<tr><td>|—|...|—|</td><td>27</td><td>19</td><td>26.0</td><td>26.0</td><td>113</td><td>1465</td><td>31.2</td><td>34.5</td><td>19.6</td><td>25.2</td><td>15.3</td><td>36.3</td><td>8185</td><td>7893</td><td>7081</td><td>8481</td></tr>
<tr><td>|—|...|—|</td><td>30</td><td>21</td><td>28.8</td><td>28.8</td><td>138</td><td>1991</td><td>29.9</td><td>34.6</td><td>19.5</td><td>25.3</td><td>15.1</td><td>36.5</td><td>8026</td><td>7981</td><td>7024</td><td>8507</td></tr>
</table>

Table 3-4. Combi Mirror plywood

<table>
<tr><th rowspan="3">Lay-up</th><th colspan="6">Section properties</th><th colspan="6">Characteristic strength</th><th colspan="4">Mean modulus of elasticity</th></tr>
<tr><th rowspan="2">Nominal thickness</th><th rowspan="2">No of plies</th><th rowspan="2">t average mm</th><th rowspan="2">A mm²/mm</th><th rowspan="2">W mm³/mm</th><th rowspan="2">I mm⁴/mm</th><th colspan="2">Bending</th><th colspan="2">Compression</th><th colspan="2">Tension</th><th colspan="2">Bending</th><th colspan="2">Tension and compression</th></tr>
<tr><th>$f_m$ II N/mm²</th><th>$f_m \perp$ N/mm²</th><th>$f_c$ II N/mm²</th><th>$f_c \perp$ N/mm²</th><th>$f_t$ II N/mm²</th><th>$f_t \perp$ N/mm²</th><th>$E_m$ II N/mm²</th><th>$E_m \perp$ N/mm²</th><th>$E_{t/c}$ II N/mm²</th><th>$E_{t/c} \perp$ N/mm²</th></tr>
<tr><td>|—|—|</td><td>6.5</td><td>5</td><td>6.4</td><td>6.4</td><td>6.83</td><td>21.8</td><td>50.9</td><td>16.6</td><td>29.3</td><td>15.8</td><td>42.2</td><td>12.3</td><td>12737</td><td>3538</td><td>9844</td><td>5688</td></tr>
<tr><td>|—|—|—|</td><td>9</td><td>7</td><td>9.2</td><td>9.2</td><td>14.1</td><td>64.9</td><td>45.6</td><td>18.3</td><td>28.3</td><td>16.4</td><td>40.8</td><td>12.8</td><td>11395</td><td>4535</td><td>9511</td><td>5935</td></tr>
<tr><td>|—|...|—|</td><td>12</td><td>9</td><td>12.0</td><td>12.0</td><td>24.0</td><td>144</td><td>42.9</td><td>19.0</td><td>27.7</td><td>16.8</td><td>40.0</td><td>13.1</td><td>10719</td><td>5037</td><td>9333</td><td>6067</td></tr>
<tr><td>|—|...|—|</td><td>15</td><td>11</td><td>14.8</td><td>14.8</td><td>36.5</td><td>270</td><td>41.3</td><td>19.3</td><td>27.4</td><td>17.0</td><td>39.5</td><td>13.2</td><td>10316</td><td>5337</td><td>9223</td><td>6149</td></tr>
<tr><td>|—|...|—|</td><td>18</td><td>13</td><td>17.6</td><td>17.6</td><td>51.6</td><td>454</td><td>40.2</td><td>19.5</td><td>27.2</td><td>17.2</td><td>39.2</td><td>13.4</td><td>10048</td><td>5536</td><td>9148</td><td>6205</td></tr>
<tr><td>|—|...|—|</td><td>21</td><td>15</td><td>20.4</td><td>20.4</td><td>69.4</td><td>707</td><td>39.4</td><td>19.6</td><td>27.0</td><td>17.3</td><td>39.0</td><td>13.5</td><td>9858</td><td>5677</td><td>9093</td><td>6245</td></tr>
<tr><td>|—|...|—|</td><td>24</td><td>17</td><td>23.2</td><td>23.2</td><td>89.7</td><td>1041</td><td>38.9</td><td>19.7</td><td>26.9</td><td>17.4</td><td>38.8</td><td>13.5</td><td>9717</td><td>5782</td><td>9052</td><td>6276</td></tr>
<tr><td>|—|...|—|</td><td>27</td><td>19</td><td>26.0</td><td>26.0</td><td>113</td><td>1465</td><td>38.4</td><td>19.7</td><td>26.8</td><td>17.4</td><td>38.7</td><td>13.6</td><td>9607</td><td>5863</td><td>9019</td><td>6300</td></tr>
<tr><td>|—|...|—|</td><td>30</td><td>21</td><td>28.8</td><td>28.8</td><td>138</td><td>1991</td><td>38.1</td><td>19.8</td><td>26.7</td><td>17.5</td><td>38.5</td><td>13.6</td><td>9519</td><td>5928</td><td>8993</td><td>6319</td></tr>
</table>

Table 3-5. Birch plywood

| Nominal thickness | Characteristic strength | | | | Average modulus of rigidity | | | |
|---|---|---|---|---|---|---|---|---|
| | Panel shear | | Planar shear | | Panel shear | | Planar shear | |
| mm | $f_v$ II N/mm² | $f_v \perp$ N/mm² | $f_r$ II N/mm² | $f_r \perp$ N/mm² | $G_v$ II N/mm² | $G_v \perp$ N/mm² | $G_r$ II N/mm² | $G_r \perp$ N/mm² |
| 4 | 9.5 | 9.5 | 2.77 | – | 620 | 620 | 169 | – |
| 6.5 | 9.5 | 9.5 | 3.20 | 1.78 | 620 | 620 | 169 | 123 |
| 9 | 9.5 | 9.5 | 2.68 | 2.35 | 620 | 620 | 206 | 155 |
| 12 | 9.5 | 9.5 | 2.78 | 2.22 | 620 | 620 | 207 | 170 |
| 15 | 9.5 | 9.5 | 2.62 | 2.39 | 620 | 620 | 207 | 178 |
| 18 | 9.5 | 9.5 | 2.67 | 2.34 | 620 | 620 | 206 | 183 |
| 21 | 9.5 | 9.5 | 2.59 | 2.41 | 620 | 620 | 206 | 186 |
| 24 | 9.5 | 9.5 | 2.62 | 2.39 | 620 | 620 | 206 | 189 |
| 27 | 9.5 | 9.5 | 2.57 | 2.43 | 620 | 620 | 205 | 190 |
| 30 | 9.5 | 9.5 | 2.59 | 2.41 | 620 | 620 | 205 | 192 |
| 35 | 9.5 | 9.5 | 2.57 | 2.43 | 620 | 620 | 204 | 193 |
| 40 | 9.5 | 9.5 | 2.56 | 2.44 | 620 | 620 | 204 | 195 |
| 45 | 9.5 | 9.5 | 2.55 | 2.46 | 620 | 620 | 203 | 195 |
| 50 | 9.5 | 9.5 | 2.54 | 2.46 | 620 | 620 | 203 | 196 |

Table 3-6. Combi plywood

| Nominal thickness | Characteristic strength | | | | Average modulus of rigidity | | | |
|---|---|---|---|---|---|---|---|---|
| | Panel shear | | Planar shear | | Panel shear | | Planar shear | |
| mm | $f_v$ II N/mm² | $f_v \perp$ N/mm² | $f_r$ II N/mm² | $f_r \perp$ N/mm² | $G_v$ II N/mm² | $G_v \perp$ N/mm² | $G_r$ II N/mm² | $G_r \perp$ N/mm² |
| 6.5 | 7.0 | 7.0 | 3.20 | 1.14 | 600 | 600 | 169 | 41 |
| 9 | 7.0 | 7.0 | 2.68 | 1.51 | 593 | 593 | 206 | 52 |
| 12 | 7.0 | 7.0 | 2.78 | 1.42 | 589 | 589 | 207 | 57 |
| 15 | 7.0 | 7.0 | 2.62 | 1.53 | 586 | 586 | 207 | 59 |
| 18 | 7.0 | 7.0 | 2.67 | 1.50 | 584 | 584 | 206 | 61 |
| 21 | 7.0 | 7.0 | 2.59 | 1.55 | 583 | 583 | 206 | 62 |
| 24 | 7.0 | 7.0 | 2.62 | 1.53 | 582 | 582 | 206 | 63 |
| 27 | 7.0 | 7.0 | 2.57 | 1.56 | 581 | 581 | 205 | 63 |
| 30 | 7.0 | 7.0 | 2.59 | 1.54 | 581 | 581 | 205 | 64 |

Table 3-7. Combi Mirror plywood

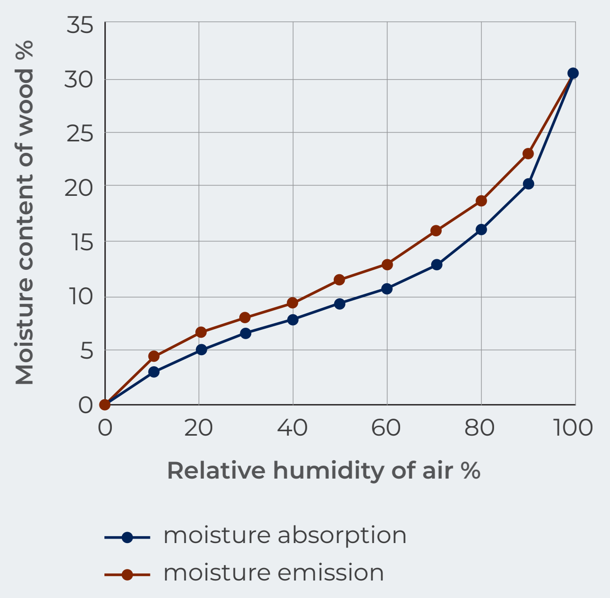
| Nominal thickness | Characteristic strength | | | | Average modulus of rigidity | | | |
|---|---|---|---|---|---|---|---|---|
| | Panel shear | | Planar shear | | Panel shear | | Planar shear | |
| mm | $f_v$ II N/mm² | $f_v \perp$ N/mm² | $f_r$ II N/mm² | $f_r \perp$ N/mm² | $G_v$ II N/mm² | $G_v \perp$ N/mm² | $G_r$ II N/mm² | $G_r \perp$ N/mm² |
| 6.5 | 7.0 | 7.0 | 2.05 | 1.78 | 581 | 581 | 66 | 123 |
| 9 | 7.0 | 7.0 | 1.72 | 2.35 | 579 | 579 | 69 | 155 |
| 12 | 7.0 | 7.0 | 1.78 | 2.22 | 578 | 578 | 69 | 170 |
| 15 | 7.0 | 7.0 | 1.68 | 2.39 | 577 | 577 | 69 | 178 |
| 18 | 7.0 | 7.0 | 1.71 | 2.34 | 577 | 577 | 69 | 183 |
| 21 | 7.0 | 7.0 | 1.66 | 2.41 | 577 | 577 | 69 | 186 |
| 24 | 7.0 | 7.0 | 1.68 | 2.39 | 577 | 577 | 69 | 189 |
| 27 | 7.0 | 7.0 | 1.65 | 2.43 | 576 | 576 | 68 | 190 |
| 30 | 7.0 | 7.0 | 1.66 | 2.41 | 576 | 576 | 68 | 192 |

## 3.2 MOISTURE PROPERTIES

### MOISTURE PROPERTIES

The absorption of moisture into wood depends on the moisture level and temperature of the surrounding air. The absorption of moisture depends on the initial moisture content and temperature of the wood. Figure 3-2 illustrates the wood's equilibrium moisture content at a temperature of 20°C.

Figure 3-2. Wood's equilibrium moisture content at 20°C




The size, shape and species of the wood affects the absorption of moisture. The moisture in the wood moves mainly along the pores that are perpendicular to the fibres. In plywood, the glue seam and film coating prevent the transfer of moisture. For the most part, the absorption and evaporation of the plywood's moisture takes place through the edges even if the panels are edge sealed.

The moisture absorbed through the plywood's edges results in uneven moisture content in the panel. Areas with higher moisture content begin to swell and the tension causes warping and twisting.

Table 3-8. Modification factors for mechanical properties when the plywood moisture content is 20%

| Property | Modification factor |
|---|---|
| Bending strength | 0.75 |
| Planar shear strength | 0.80 |
| Modulus of elasticity in bending | 0.85 |
| Modulus of rigidity | 0.65 |

### TYPICAL PLYWOOD MOISTURE CONTENTS

- Average moisture content of plywood at the mill 8–10%
- Delivery to Central Europe UK 10–12%

**Average equilibrium moisture content in different applications:**

- Laser cutting panels 8–10%
- Transport vehicles 15–18%
- Scaffolding plywood 16–20%
- System formwork panels 20–27%

### RELATION BETWEEN PLYWOOD DIMENSIONS AND MOISTURE CONTENT

The dimensional changes in and across the face grain direction of Finnish exterior plywood average an 0.015% increase per 1% increase of the moisture level of plywood. The formula works when the plywood's moisture content changes within the 10–27% range. Changes in board thickness over the same range of moisture content will average an 0.3–0.4% increase per 1% increase of moisture level.

### MOISTURE PERMEABILITY

The vapour permeability of panel products must be known when designing, for example, structures for external walls and roofs of buildings. The coefficient of vapour permeability of plywood expresses the amount of vapour diffused through the plywood panel per unit of time when there is a different relative humidity of air and a vapour pressure difference on either side of the panel. The values in Table 3-9 have been determined in accordance with the standard /Handbook of Finnish Plywood/ using the coefficient of moisture permeability of plywood.

Table 3-9. Moisture permeability of Finnish plywood/Handbook of Finnish Plywood/

| Plywood | Thickness, mm | Transmission rate g/(m²*24 h) |
|---|---|---|
| Combi | 6.5 | 16.4 |
| | 9 | 15.7 |
| | 15 | 9.1 |
| | 21 | 7.0 |
| Combi with phenolic film overlay | 6.5 | 3.5 |
| | 9 | 3.3 |
| | 15 | 2.9 |
| | 21 | 2.9 |

The moisture permeability of plywood is dependent on its moisture content. When the moisture content of plywood increases, the moisture permeability is also greater. Table 3-10 shows the vapour permeability of plywood at different plywood moisture contents /Handbook of Finnish Plywood/.

Table 3-10. Vapour permeability coefficient of plywood/Handbook of Finnish Plywood/

| | Thickness, mm | Moisture content of plywood, % (RH 53%) | Vapour permeability coefficient $k_d$ kg/(Pa*s*m$^2$*10$^{12}$) | Moisture content of plywood, % (RH 90%) | Vapour permeability coefficient $k_d$ kg/(Pa*s*m$^2$*10$^{12}$) |
|---|---|---|---|---|---|
| Birch | 12 | 5.7 | 53 | 27 | 500 |
| Combi | 12 | 6.5 | 50 | 27 | 460 |
| Film-faced plywood: Combi | 12 | | | 16 | 88 |

## 3.3 BIOLOGICAL DURABILITY

### PLYWOOD IN EXTERIOR CONDITIONS

In general, the biological durability of plywood is as good as the wood species that the panel is made from. Although Koskisen plywood is bonded with exterior phenol formaldehyde glue, the moisture resistance of uncoated plywoods where edges have not been sealed is limited. For this reason, in permanent exterior structures, plywood must be properly coated, edge sealed, installed and maintained to provide extra protection against the adverse effects of moisture and weather. Overlaid and edge sealed Koskisen plywood also meet the requirements of standard EN 636-3.

Decay in wood is caused by fungal attack. Fungi will only grow if there is sufficient moisture, oxygen and a temperature range of +3...+40°C. Decay will begin if the moisture content of plywood is higher than 20% (RH is over 85%) and oxygen is available.

The risk of fungal attack to plywood can be avoided by using the correct construction methods to eliminate some of the above conditions required for fungi to grow.

### BLUE-STAIN, MOULD AND INSECTS

Both blue-stain fungi and mould cause discoloration of plywood. Mould grows only on the surface of wood. Blue-stain lives on the soluble substances in the wood cells, so it does not significantly weaken the strength of plywood.

### UV LIGHT

The use of unprotected standard plywoods in exterior applications leads to their prolonged exposure to strong sunlight which includes ultraviolet radiation. Prolonged exposure to radiation can lead to the breakdown of the wood fibres. Appropriately coated and painted Koskisen plywood gives excellent protection against UV radiation and other adverse weather effects.

## 3.4 THERMAL PROPERTIES

### THERMAL CONDUCTIVITY

The thermal conductivity of plywood is dependent on its moisture content. When the plywood moisture content grows, its thermal conductivity increases, which weakens the thermal insulation ability of the plywood. Table 3-11 shows the thermal conductivities of Koskisen's birch and combi plywood in two different moisture content ranges.

Table 3-11. Thermal conductivities of Koskisen's birch and combi plywood /Handbook of Finnish Plywood/

| Plywood | Thickness, mm | Moisture content of plywood, % (RH 47%) | Thermal conductivity λ W/(m*K) | Moisture content of plywood, % (RH 93%) | Thermal conductivity λ W/(m*K) |
|---|---|---|---|---|---|
| Birch | 40 | 9.3 | 0.147 | 26 | 0.175 |
| Combi | 40 | 8.8 | 0.188 | 25 | 0.145 |

### THERMAL DEFORMATION

Plywood has excellent dimensional stability under heat, far superior to that of metals and plastics, for example. The thermal deformation of plywood is so small that it can generally be disregarded.

### USEABLE TEMPERATURE RANGE FOR PLYWOODS

Koskisen's standard plywood and most coated plywood products are suitable for use at sustained temperatures of 100°C and instantaneous temperatures of 120°C. The plywood supplier should be consulted for applications at high temperatures, especially if the plywood is load carrying. Plywood tolerates cold temperatures better than heat. Plywood can be used at sustained temperatures as low as -200°C.

## 3.5 FIRE PERFORMANCE

Although plywood burns it can have better fire resistance than many materials which do not burn. Plywood has an optimal dimensional stability under heat and a low rate of combustion, better than solid wood, for example.

The temperature at which plywood will ignite when exposed to a naked flame is about 270°C whilst a temperature of over 400°C is needed to cause spontaneous combustion. When it burns, plywood chars at a slow and predictable linear rate (about 0.6 mm per minute), which enables it to be used in certain fire resisting constructions. This property can be improved by impregnating or coating the plywood with fire retardant chemicals or by facing with non-combustible foils.

## 3.6 SOUND INSULATION

Sound is transmitted through air and through structures. Airborne sound insulation is dependent on the density of the insulating material. Plywood is a good insulating material in relation to its weight. For these reasons, plywood is a good material for acoustic improvement solutions. The average measured sound reduction index (for the frequency range 100–3200 Hz) for Koskisen plywood is given in table 3-12.

Table 3-12. Sound insulation of Koskisen plywood
Calculated values based on EN 13986 (R=13*lg(mA)+14); 680kg/m$^3$

| Nominal thickness, mm | Sound insulation, dB |
|---|---|
| 9 | 24 |
| 12 | 26 |
| 15 | 27 |
| 18 | 28 |
| 21 | 29 |
| 24 | 30 |
| 27 | 30 |
| 30 | 31 |

The sound insulation of plywood can be improved by using sandwich construction (air gap or insulation material between two panels). For improved sound insultation, it is important to avoid gaps between structures or elements.

Furthermore, a special plywood structure is available with sound insulating cork-rubber composite material in the middle. Higher sound insulation at different frequencies can be achieved through a layered structure. This is utilised in transport vehicles, for example. The sound insulation and weight per square metre are presented in Table 3-13 and a diagram in Figure 3-3.

KoskiSound ▶

Figure 3-3. Sound insulation of Koskisen plywoods

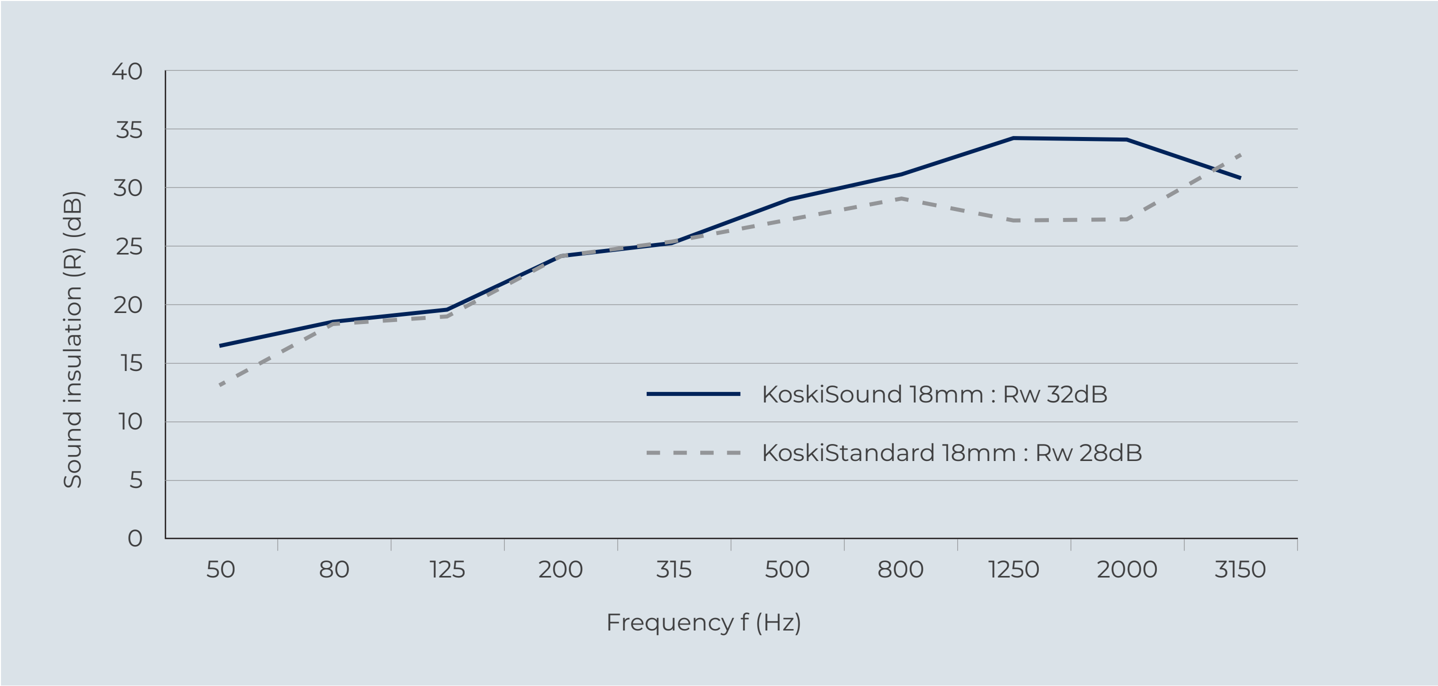



Table 3-13. Sound insulation of special plywoods by thickness. Measured according to standards EN ISO 10140-1:2016 / EN ISO 10140-2:2010. The weighted sound insulation index Rw is defined according to the standard ISO 717-1:2013.

| Product | Nominal thickness, mm | Weight, kg/m$^2$ | Sound insulation Rw, dB |
|---|---|---|---|
| KoskiSound | 16 | 9.9 - 11.4 | 31 |
| KoskiSound | 18 | 11.1 - 12.8 | 32 |
| KoskiSound | 22 | 13.7 - 15.7 | 32 |

## 3.7 EMISSION OF FORMALDEHYDE

Formaldehyde emissions from phenol formaldehyde resin adhesive bonded plywood are very low and the emissions are below even the tightest international requirements. When determined according to EN 717-2, the formaldehyde emission from uncoated birch plywood is 0.4 mg HCHO/(h*m$^2$), which is significantly lower than the requirements of class E1.

Both phenol formaldehyde and urea formaldehyde resin meet the Ultra Low Emission Formaldehyde (ULEF) limit as specified by the California Air Resources Board (CARB). The ULEF emission limit is 0.04 ppm.

Koskisen plywood also meets the requirements of the formaldehyde emission limits of the standard EN 1084, release class A.

### CHEMICAL RESISTANCE

Koskisen plywood has good resistance to many dilute acids and acid salt solutions. Alkalis tend to cause softening. Direct contact with oxidising agents such as chlorine, hypochlorites and nitrates should be avoided. Alcohols and some other organic solvents have an effect similar to water, producing swelling and slight loss of strength. Apart from discoloration, petroleum oils have no effect. The chemical resistance of plywood can be improved by overlaying it with different coatings whose chemical resistance must be determined first.

# 4. Design

## 4.1 GENERAL

The design guidance given is based on the limit state design principles of Eurocode 5 (EN 1995). The partial safety factors as well as factors taking into account the load duration and the moisture content on the strength and stiffness properties of plywood given in Eurocode 5 are used when tabulated load resistance values are given. Furthermore, formulas for correcting the tabulated resistances for other assumptions are also given. The formulas make it possible to extend the use of this Handbook to cover a wide range of design calculations not directly covered by the tabulated values.

The limit state design approach ensures safety and functionality in the ultimate limit state and the serviceability limit state. Ultimate limit state refers to the maximum load carrying capacity of the construction while serviceability limit state refers to the normal useability of the construction.

In ultimate limit state design it shall be verified that the design stress σ is less than the design strength $f_d$:

$$\sigma < f_d$$

Formula 4-1

The design stress σ is calculated using the design value of the load $F_d$. For design situations with only one variable load, for example snow or imposed load, the design load is given by the formula 4-2:

$$F_d = 1.35F_{k,perm} + 1.5F_{k,var}$$

Formula 4-2

where $F_{k,perm}$ is the characteristic value of the permanent load and $F_{k,var}$ is the characteristic value of the variable load. For design situations with two or more variable loads, the design load is given by the formula 4-3:

$$F_d = 1.35F_{k,perm} + \sum 1.35F_{k,var}$$

Formula 4-3

The most unfavourable design load shall be used.

The partial safety factors for loads $\gamma_q$ given in Equations (4-2) and (4-3) may be reduced from 1.35 to 1.20 and from 1.50 to 1.35 for one-storey constructions with moderate spans that are only occasionally occupied.

The design strength $f_d$ is given by the formula 4-4:

$$f_d = k_{mod} \frac{f_k}{\gamma m}$$

Formula 4-4

where $f_k$ is the characteristic value of strength and $\gamma_m$ is the partial safety factor for the material. For plywood as for other wood and wood based materials the value of $\gamma_m$ is 1.3. $k_{mod}$ is a factor taking into account the effect of duration of load and moisture content. The $k_{mod}$ factors are presented in Table 4-1.

**Load duration classes**

| | |
|---|---|
| Permanent | in which the duration of load is more than 10 years |
| Long-term | in which the duration of load is between 6 months and 10 years |
| Medium-term | in which the duration of load is between 1 week and 6 months |
| Short-term | in which the duration of load is less than 1 week |
| Instantaneous | in which the duration of load is a few minutes |

**Service classes**

**Service class 1** is characterised by a moisture content in the materials corresponding to a temperature of 20°C and a relative humidity of the surrounding air only exceeding 65% for a few weeks per year. Service class 1 corresponds to a plywood equilibrium moisture content ≤ 12%.

**Service class 2** is characterised by a moisture content in the materials corresponding to a temperature of 20°C and a relative humidity of the surrounding air only exceeding 85% for a few weeks per year. Service class 2 corresponds to a plywood equilibrium moisture content ≤ 18%.

**Service class 3** is characterised by climatic conditions leading to higher moisture contents than service class 2. Service class 3 corresponds to a plywood equilibrium moisture content > 18%.

Table 4-1 $k_{mod}$ factors

| Load duration class | Service class | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Permanent | 0.60 | 0.60 | 0.50 |
| Long-term | 0.70 | 0.70 | 0.55 |
| Medium-term | 0.80 | 0.80 | 0.65 |
| Short-term | 0.90 | 0.90 | 0.70 |
| Instantaneous | 1.10 | 1.10 | 0.90 |

Table 4-2 $k_{def}$ factors

| Load duration class | Service class | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Permanent | 0.80 | 1.00 | 2.50 |
| Long-term | 0.50 | 0.60 | 1.80 |
| Medium-term | 0.25 | 0.30 | 0.90 |
| Short-term | 0.00 | 0.00 | 0.40 |
| Instantaneous | - | - | - |

## 4.2 ROOFS OF BUILDINGS

Roofs are usually designed to service class 2 and load duration class medium-term. Consequently, the same load resistance values given for floors in Tables 4-3 to 4-32 can be used for roof panels. Furthermore, the deflection values given in Tables 4-3 to 4-32 shall be multiplied by the factor $k_{def,\,corr}$, given by the formula 4-8:

$$k_{def,\,corr} = \frac{1+0.30}{1+0.25} \cdot 1 = 1.04$$

Formula 4-8

## 4.3 FLOORS OF BUILDINGS

Below are presented, based on the general design principles, tabulated load resistance values for floors and the deflection values for different spans and thicknesses. Also, the tables show whether the bending or shear strength is design governing. Finally, the deflection under the load is given. The tables include the following support and load cases:

- A uniformly distributed load on a continuous plate strip with one and two equal span lengths (Tables 4-3, 4-4, 4-9, 4-10, 4-15 and 4-16).
- A concentrated load over an area of 50 x 50 mm on a continuous plate strip with one and two equal span lengths (Tables 4-6, 4-7, 4-12, 4-13, 4-18 and 4-19).
- A uniformly distributed load on a simply supported plate (Tables 4-5, 4-11 and 4-17).
- A concentrated load over an area of 50 x 50 mm on a simply supported plate (Tables 4-8, 4-14 and 4-20).

The load resistances and deflections were calculated according to the following assumptions:

$\gamma_q$ = 1.5, the partial safety factor for load

$\gamma_m$ = 1.3, the partial safety factor for the material

$k_{mod}$ = 0.80, the factor taking into account the effect of duration of load and moisture content

$k_{def}$ = 0.25, the factor taking into account the effect of duration of load and moisture content

The design and deflection values are valid for service class 1 and load duration class medium-term. For other assumptions the tabulated load resistance values shall be multiplied by a correction factor $k_{load,\,corr}$ given by the formula 4-9:

$$k_{load,\,corr} = \frac{k_{mod}}{\gamma\, m\, \gamma\, q} \cdot \frac{1.3 \cdot 1.5}{0.80}$$

Formula 4-9

The tabulated deflection values shall be multiplied by a correction factor $k_{def,\,corr}$ given by the formula 4-10:

$$k_{def,\,corr} = \frac{1 + k_{def}}{1 + 0.25} \cdot k_{load,\,corr} =$$

Formula 4-10

**NB**

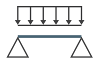
If there are high loads over a small contact area, compressive stress perpendicular to the face of the plywood could become critical. In most practical cases the following mean values can be used in service class 1.

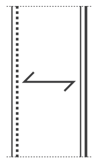
| | |
|---|---|
| Bearing on face | |
| Birch plywood | 9 N/mm² |
| Combi plywood | 5 N/mm² |
| Spruce plywood | 4 N/mm² |

## Load resistance q [kN/m²] or F [kN] and corresponding deflection u [mm] values for Finnish plywood to be used in the design of floors

Table 4-3. Birch plywood | A uniformly distributed load on a single span plate strip | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 | 23 | b | 4.4 | 38 | b | 3.5 | 55 | b | 2.9 | 76 | b | 2.5 | 96 | s | 2.2 | 111 | s | 1.8 | 122 | s | 1.5 | 136 | s | 1.3 | 161 | s | 1.1 | 187 | s | 0.9 | 199 | s | 0.8 | 224 | s | 0.7 |
| 400 | 13 | b | 7.6 | 21 | b | 6.0 | 31 | b | 4.9 | 43 | b | 4.2 | 56 | b | 3.7 | 72 | b | 3.4 | 89 | b | 3.1 | 102 | s | 2.8 | 121 | s | 2.1 | 140 | s | 1.7 | 149 | s | 1.5 | 168 | s | 1.3 |
| 500 | 8 | b | 11.8 | 14 | b | 9.2 | 20 | b | 7.5 | 27 | b | 6.4 | 36 | b | 5.6 | 46 | b | 5.1 | 57 | b | 4.6 | 69 | b | 4.3 | 97 | s | 3.7 | 112 | s | 2.9 | 119 | s | 2.7 | 134 | s | 2.2 |
| 600 | 6 | b | 16.9 | 9 | b | 13.1 | 14 | b | 10.7 | 19 | b | 9.1 | 25 | b | 7.9 | 32 | b | 7.1 | 39 | b | 6.4 | 48 | b | 5.9 | 68 | b | 5.1 | 90 | b | 4.6 | 100 | s | 4.2 | 112 | s | 3.5 |
| 750 | 4 | b | 26.3 | 6 | b | 20.3 | 9 | b | 16.6 | 12 | b | 14.0 | 16 | b | 12.2 | 20 | b | 10.8 | 25 | b | 9.7 | 31 | b | 8.9 | 43 | b | 7.6 | 58 | b | 6.8 | 66 | b | 6.4 | 84 | b | 5.9 |
| 1000 | 2 | b | 46.7 | 3 | b | 35.9 | 5 | b | 29.2 | 7 | b | 24.6 | 9 | b | 21.3 | 11 | b | 18.9 | 14 | b | 16.9 | 17 | b | 15.4 | 24 | b | 13.1 | 33 | b | 11.4 | 37 | b | 10.8 | 47 | b | 9.7 |
| 1200 | 1 | b | 67.1 | 2 | b | 51.6 | 3 | b | 41.9 | 5 | b | 35.3 | 6 | b | 30.5 | 8 | b | 27.0 | 10 | b | 24.2 | 12 | b | 21.9 | 17 | b | 18.6 | 23 | b | 16.1 | 26 | b | 15.2 | 33 | b | 13.6 |
| 1500 | 1 | b | 104.8 | 2 | b | 80.4 | 2 | b | 65.3 | 3 | b | 55.0 | 4 | b | 47.5 | 5 | b | 41.9 | 6 | b | 37.5 | 8 | b | 34.0 | 11 | b | 28.6 | 14 | b | 24.8 | 16 | b | 23.2 | 21 | b | 20.8 |

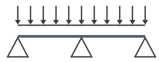


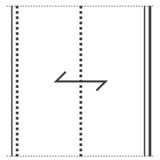


Medium-term loading
Service class 1
$k_{mod}$ = 0.80
$k_{def}$ = 0.25
$\gamma_q$ = 1.5
$\gamma_m$ = 1.3
q given in kN/m²
u given in mm
⟵ grain direction of surface veneers

Table 4-4. Birch plywood | A uniformly distributed load on a double span plate strip | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 | 23 | b | 2.0 | 38 | b | 1.6 | 55 | b | 1.4 | 69 | s | 1.2 | 77 | s | 1.0 | 89 | s | 0.9 | 97 | s | 0.7 | 109 | s | 0.7 | 129 | s | 0.6 | 149 | s | 0.5 | 159 | s | 0.5 | 179 | s | 0.5 |
| 400 | 13 | b | 3.3 | 21 | b | 2.7 | 31 | b | 2.3 | 43 | b | 2.0 | 56 | b | 1.9 | 66 | s | 1.6 | 73 | s | 1.4 | 82 | s | 1.2 | 97 | s | 1.0 | 112 | s | 0.9 | 119 | s | 0.8 | 134 | s | 0.8 |
| 500 | 8 | b | 5.1 | 14 | b | 4.0 | 20 | b | 3.4 | 27 | b | 2.9 | 36 | b | 2.6 | 46 | b | 2.4 | 57 | b | 2.3 | 65 | s | 2.1 | 77 | s | 1.6 | 90 | s | 1.4 | 96 | s | 1.3 | 108 | s | 1.1 |
| 600 | 6 | b | 7.2 | 9 | b | 5.6 | 14 | b | 4.7 | 19 | b | 4.0 | 25 | b | 3.6 | 32 | b | 3.3 | 39 | b | 3.0 | 48 | b | 2.9 | 64 | s | 2.5 | 75 | s | 2.1 | 80 | s | 1.9 | 90 | s | 1.6 |
| 750 | 4 | b | 11.1 | 6 | b | 8.6 | 9 | b | 7.1 | 12 | b | 6.1 | 16 | b | 5.4 | 20 | b | 4.8 | 25 | b | 4.4 | 31 | b | 4.1 | 43 | b | 3.7 | 58 | b | 3.4 | 64 | s | 3.2 | 72 | s | 2.7 |
| 1000 | 2 | b | 19.5 | 3 | b | 15.1 | 5 | b | 12.3 | 7 | b | 10.5 | 9 | b | 9.2 | 11 | b | 8.2 | 14 | b | 7.4 | 17 | b | 6.8 | 24 | b | 5.9 | 33 | b | 5.3 | 37 | b | 5.1 | 47 | b | 4.7 |
| 1200 | 1 | b | 28.0 | 2 | b | 21.6 | 3 | b | 17.6 | 5 | b | 14.9 | 6 | b | 13.0 | 8 | b | 11.5 | 10 | b | 10.4 | 12 | b | 9.5 | 17 | b | 8.2 | 23 | b | 7.3 | 26 | b | 6.9 | 33 | b | 6.3 |
| 1500 | 1 | b | 43.6 | 2 | b | 33.6 | 2 | b | 27.3 | 3 | b | 23.1 | 4 | b | 20.0 | 5 | b | 17.7 | 6 | b | 15.9 | 8 | b | 14.5 | 11 | b | 12.4 | 14 | b | 10.9 | 16 | b | 10.3 | 21 | b | 9.3 |





Medium-term loading

Service class 1

$k_{mod} = 0.80$

$k_{def} = 0.25$

$\gamma_q = 1.5$

$\gamma_m = 1.3$

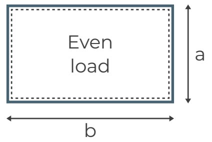
q given in $kN/m^2$

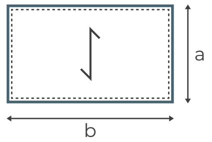
u given in mm

⟵ grain direction of surface veneers

Table 4-5. Birch plywood | A uniformly distributed load on a simply supported plate | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| a x b | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 x 300 | 57 | b | 4.2 | 98 | b | 3.2 | 145 | s | 2.5 | 179 | s | 1.9 | 204 | s | 1.4 | 236 | s | 1.1 | 262 | s | 0.8 | 294 | s | 0.7 | 352 | s | 0.5 | 410 | s | 0.4 | 438 | s | 0.4 | 495 | s | 0.2 |
| 300 x 600 | 27 | b | 4.2 | 45 | b | 3.2 | 67 | b | 2.6 | 93 | b | 2.2 | 114 | s | 1.7 | 131 | s | 1.4 | 145 | s | 1.1 | 162 | s | 0.9 | 193 | s | 0.6 | 224 | s | 0.5 | 239 | s | 0.5 | 269 | s | 0.3 |
| 300 x ∞ | 23 | b | 4.2 | 38 | b | 3.2 | 55 | b | 2.6 | 76 | b | 2.2 | 96 | s | 1.8 | 111 | s | 1.4 | 122 | s | 1.1 | 136 | s | 0.9 | 161 | s | 0.7 | 187 | s | 0.5 | 199 | s | 0.5 | 224 | s | 0.3 |
| 400 x 400 | 32 | b | 7.5 | 55 | b | 5.8 | 84 | b | 4.7 | 119 | b | 3.9 | 153 | s | 3.2 | 177 | s | 2.5 | 196 | s | 2.0 | 220 | s | 1.7 | 264 | s | 1.2 | 307 | s | 0.9 | 328 | s | 0.9 | 371 | s | 0.6 |
| 400 x 800 | 15 | b | 7.4 | 25 | b | 5.7 | 37 | b | 4.6 | 52 | b | 3.9 | 69 | b | 3.3 | 89 | b | 2.9 | 108 | s | 2.6 | 121 | s | 2.1 | 144 | s | 1.5 | 168 | s | 1.1 | 179 | s | 1.2 | 202 | s | 0.8 |
| 400 x ∞ | 13 | b | 7.4 | 21 | b | 5.7 | 31 | b | 4.6 | 43 | b | 3.9 | 56 | b | 3.3 | 72 | b | 2.9 | 89 | b | 2.6 | 102 | s | 2.2 | 121 | s | 1.6 | 140 | s | 1.2 | 149 | s | 1.3 | 168 | s | 0.8 |
| 500 x 500 | 21 | b | 11.8 | 35 | b | 9.0 | 54 | b | 7.3 | 76 | b | 6.1 | 103 | b | 5.3 | 133 | b | 4.7 | 157 | s | 3.9 | 176 | s | 3.2 | 211 | s | 2.3 | 246 | s | 1.7 | 263 | s | 1.8 | 297 | s | 1.1 |
| 500 x 1000 | 10 | b | 11.6 | 16 | b | 8.9 | 24 | b | 7.2 | 33 | b | 6.1 | 44 | b | 5.2 | 57 | b | 4.6 | 71 | b | 4.1 | 86 | b | 3.7 | 116 | s | 2.9 | 134 | s | 2.2 | 143 | s | 2.4 | 162 | s | 1.5 |
| 500 x ∞ | 8 | b | 11.6 | 14 | b | 8.9 | 20 | b | 7.2 | 27 | b | 6.1 | 36 | b | 5.2 | 46 | b | 4.6 | 57 | b | 4.1 | 69 | b | 3.7 | 97 | s | 3.1 | 112 | s | 2.3 | 119 | s | 2.5 | 134 | s | 1.6 |
| 600 x 600 | 14 | b | 16.9 | 25 | b | 13.0 | 37 | b | 10.5 | 53 | b | 8.8 | 71 | b | 7.6 | 92 | b | 6.7 | 116 | b | 6.0 | 143 | b | 5.4 | 176 | s | 3.9 | 205 | s | 2.9 | 219 | s | 3.2 | 248 | s | 2.0 |
| 600 x 1200 | 7 | b | 16.7 | 11 | b | 12.8 | 17 | b | 10.4 | 23 | b | 8.7 | 31 | b | 7.5 | 39 | b | 6.6 | 49 | b | 5.9 | 60 | b | 5.3 | 85 | b | 4.5 | 112 | s | 3.8 | 119 | s | 4.1 | 135 | s | 2.6 |
| 600 x ∞ | 6 | b | 16.7 | 9 | b | 12.8 | 14 | b | 10.4 | 19 | b | 8.7 | 25 | b | 7.5 | 32 | b | 6.6 | 39 | b | 5.9 | 48 | b | 5.3 | 68 | b | 4.5 | 90 | b | 3.8 | 100 | s | 4.3 | 112 | s | 2.7 |
| 750 x 750 | 9 | b | 26.5 | 16 | b | 20.3 | 24 | b | 16.4 | 34 | b | 13.8 | 46 | b | 11.9 | 59 | b | 10.5 | 74 | b | 9.3 | 91 | b | 8.4 | 130 | b | 7.1 | 164 | s | 5.7 | 175 | s | 6.2 | 198 | s | 3.9 |
| 750 x 1500 | 4 | b | 26.2 | 7 | b | 20.1 | 11 | b | 16.3 | 15 | b | 13.7 | 20 | b | 11.8 | 25 | b | 10.4 | 31 | b | 9.2 | 38 | b | 8.3 | 54 | b | 7.0 | 73 | b | 6.0 | 83 | b | 7.0 | 106 | b | 5.0 |
| 750 x ∞ | 4 | b | 26.1 | 6 | b | 20.0 | 9 | b | 16.3 | 12 | b | 13.7 | 16 | b | 11.8 | 20 | b | 10.4 | 25 | b | 9.2 | 31 | b | 8.4 | 43 | b | 7.0 | 58 | b | 6.0 | 66 | b | 7.0 | 84 | b | 5.0 |
| 1000 x 1000 | 5 | b | 47.1 | 9 | b | 36.1 | 13 | b | 29.2 | 19 | b | 24.6 | 26 | b | 21.2 | 33 | b | 18.6 | 42 | b | 16.6 | 51 | b | 15.0 | 73 | b | 12.6 | 99 | b | 10.8 | 113 | b | 12.6 | 145 | b | 8.9 |
| 1000 x 2000 | 2 | b | 46.5 | 4 | b | 35.6 | 6 | b | 28.9 | 8 | b | 24.3 | 11 | b | 20.9 | 14 | b | 18.4 | 18 | b | 16.4 | 22 | b | 14.8 | 30 | b | 12.4 | 41 | b | 10.7 | 47 | b | 12.5 | 59 | b | 8.8 |
| 1000 x ∞ | 2 | b | 46.5 | 3 | b | 35.6 | 5 | b | 28.9 | 7 | b | 24.3 | 9 | b | 20.9 | 11 | b | 18.4 | 14 | b | 16.4 | 17 | b | 14.8 | 24 | b | 12.4 | 33 | b | 10.7 | 37 | b | 12.5 | 47 | b | 8.8 |
| 1200 x 1200 | 4 | b | 67.8 | 6 | b | 51.9 | 9 | b | 42.1 | 13 | b | 35.4 | 18 | b | 30.5 | 23 | b | 26.8 | 29 | b | 23.9 | 36 | b | 21.6 | 51 | b | 18.1 | 69 | b | 15.5 | 79 | b | 18.1 | 101 | b | 12.8 |
| 1200 x 2400 | 2 | b | 67.0 | 3 | b | 51.3 | 4 | b | 41.6 | 6 | b | 35.0 | 8 | b | 30.1 | 10 | b | 26.5 | 12 | b | 23.6 | 15 | b | 21.4 | 21 | b | 17.9 | 28 | b | 15.4 | 32 | b | 17.9 | 41 | b | 12.7 |
| 1500 x 1500 | 2 | b | 105.9 | 4 | b | 81.1 | 6 | b | 65.8 | 8 | b | 55.3 | 11 | b | 47.6 | 15 | b | 41.9 | 19 | b | 37.3 | 23 | b | 33.8 | 33 | b | 28.3 | 44 | b | 24.3 | 50 | b | 28.3 | 64 | b | 20.1 |
| 1500 x 3000 | 1 | b | 104.6 | 2 | b | 80.2 | 3 | b | 65.0 | 4 | b | 54.6 | 5 | b | 47.1 | 6 | b | 41.5 | 8 | b | 36.9 | 10 | b | 33.4 | 14 | b | 28.0 | 18 | b | 24.0 | 21 | b | 28.0 | 26 | b | 19.9 |



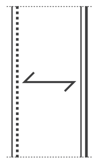

Medium-term loading
Service class 1

$k_{mod} = 0.80$
$k_{def} = 0.25$
$\gamma_q = 1.5$
$\gamma_m = 1.3$

q given in kN/m$^2$
u given in mm
grain direction of surface veneers

Table 4-6. Birch plywood | A concentrated central load over an area of 50 x 50 mm on a single span plate strip | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 1.0 | b | 2.8 | 1.6 | b | 2.1 | 2.4 | b | 1.7 | 3.4 | b | 1.5 | 4.5 | b | 1.3 | 5.3 | s | 1.0 | 5.8 | s | 0.8 | 6.5 | s | 0.7 | 7.8 | s | 0.5 | 9.0 | s | 0.3 | 9.6 | s | 0.3 | 10.9 | s | 0.2 |
| 400 | 0.9 | b | 4.6 | 1.5 | b | 3.5 | 2.2 | b | 2.8 | 3.0 | b | 2.4 | 4.0 | b | 2.1 | 5.2 | b | 1.8 | 5.8 | s | 1.4 | 6.5 | s | 1.2 | 7.8 | s | 0.8 | 9.0 | s | 0.6 | 9.6 | s | 0.5 | 10.9 | s | 0.4 |
| 500 | 0.8 | b | 6.8 | 1.4 | b | 5.2 | 2.0 | b | 4.2 | 2.8 | b | 3.5 | 3.8 | b | 3.0 | 4.9 | b | 2.7 | 5.9 | s | 2.3 | 6.6 | s | 1.9 | 7.8 | s | 1.3 | 9.1 | s | 1.0 | 9.7 | s | 0.9 | 10.9 | s | 0.7 |
| 600 | 0.8 | b | 9.3 | 1.3 | b | 7.1 | 1.9 | b | 5.7 | 2.7 | b | 4.8 | 3.6 | b | 4.1 | 4.6 | b | 3.6 | 5.7 | b | 3.2 | 6.6 | s | 2.7 | 7.8 | s | 1.9 | 9.1 | s | 1.4 | 9.7 | s | 1.2 | 10.9 | s | 1.0 |
| 750 | 0.7 | b | 13.7 | 1.2 | b | 10.4 | 1.8 | b | 8.4 | 2.5 | b | 7.1 | 3.4 | b | 6.1 | 4.3 | b | 5.4 | 5.4 | b | 4.8 | 6.6 | s | 4.3 | 7.8 | s | 3.0 | 9.1 | s | 2.2 | 9.7 | s | 1.9 | 10.9 | s | 1.5 |
| 1000 | 0.7 | b | 22.7 | 1.1 | b | 17.3 | 1.7 | b | 14.0 | 2.4 | b | 11.7 | 3.1 | b | 10.1 | 4.0 | b | 8.9 | 5.0 | b | 7.9 | 6.1 | b | 7.1 | 7.8 | s | 5.4 | 9.1 | s | 4.0 | 9.7 | s | 3.5 | 10.9 | s | 2.7 |
| 1200 | 0.6 | b | 31.3 | 1.1 | b | 23.8 | 1.6 | b | 19.3 | 2.3 | b | 16.2 | 3.0 | b | 13.9 | 3.8 | b | 12.2 | 4.8 | b | 10.9 | 5.9 | b | 9.9 | 7.8 | s | 7.8 | 9.1 | s | 5.8 | 9.7 | s | 5.0 | 11.0 | s | 3.9 |
| 1500 | 0.6 | b | 46.4 | 1.0 | b | 35.4 | 1.5 | b | 28.7 | 2.1 | b | 24.0 | 2.8 | b | 20.7 | 3.7 | b | 18.2 | 4.6 | b | 16.2 | 5.6 | b | 14.6 | 7.8 | s | 12.1 | 9.1 | s | 9.0 | 9.7 | s | 7.8 | 10.9 | s | 6.1 |



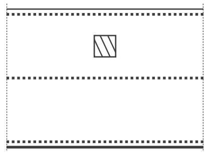
Medium-term loading
Service class 1

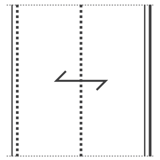
$k_{mod} = 0.80$
$k_{def} = 0.25$
$\gamma_q = 1.5$
$\gamma_m = 1.3$

F given in kN
u given in mm
grain direction of surface veneers

Table 4-7. Birch plywood | A concentrated load over an area of 50 x 50 mm on a double span plate strip at the centre of one span | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 1.1 | b | 2.5 | 1.8 | b | 1.9 | 2.7 | b | 1.5 | 3.6 | s | 1.2 | 4.0 | s | 0.9 | 4.7 | s | 0.7 | 5.2 | s | 0.6 | 5.8 | s | 0.5 | 6.9 | s | 0.3 | 8.0 | s | 0.2 | 8.5 | s | 0.2 | 9.6 | s | 0.2 |
| 400 | 1.0 | b | 4.0 | 1.6 | b | 3.1 | 2.4 | b | 2.5 | 3.3 | b | 2.1 | 4.2 | s | 1.7 | 4.8 | s | 1.3 | 5.3 | s | 1.1 | 6.0 | s | 0.9 | 7.1 | s | 0.6 | 8.3 | s | 0.5 | 8.8 | s | 0.4 | 10.0 | s | 0.3 |
| 500 | 0.9 | b | 5.9 | 1.5 | b | 4.5 | 2.2 | b | 3.6 | 3.1 | b | 3.1 | 4.1 | b | 2.6 | 5.0 | s | 2.2 | 5.5 | s | 1.7 | 6.1 | s | 1.4 | 7.3 | s | 1.0 | 8.5 | s | 0.7 | 9.0 | s | 0.6 | 10.2 | s | 0.5 |
| 600 | 0.8 | b | 8.1 | 1.4 | b | 6.1 | 2.1 | b | 5.0 | 2.9 | b | 4.2 | 3.9 | b | 3.6 | 5.0 | s | 3.1 | 5.5 | s | 2.5 | 6.2 | s | 2.1 | 7.4 | s | 1.4 | 8.5 | s | 1.1 | 9.1 | s | 0.9 | 10.3 | s | 0.7 |
| 750 | 0.8 | b | 11.8 | 1.3 | b | 9.0 | 2.0 | b | 7.3 | 2.7 | b | 6.1 | 3.6 | b | 5.3 | 4.7 | b | 4.6 | 5.6 | s | 4.0 | 6.3 | s | 3.3 | 7.5 | s | 2.3 | 8.7 | s | 1.7 | 9.3 | s | 1.5 | 10.5 | s | 1.2 |
| 1000 | 0.7 | b | 19.5 | 1.2 | b | 14.9 | 1.8 | b | 12.0 | 2.5 | b | 10.1 | 3.4 | b | 8.7 | 4.3 | b | 7.6 | 5.4 | b | 6.8 | 6.4 | s | 6.0 | 7.6 | s | 4.2 | 8.9 | s | 3.1 | 9.4 | s | 2.7 | 10.7 | s | 2.1 |
| 1200 | 0.7 | b | 26.8 | 1.2 | b | 20.4 | 1.7 | b | 16.5 | 2.4 | b | 13.9 | 3.2 | b | 11.9 | 4.1 | b | 10.5 | 5.1 | b | 9.3 | 6.3 | b | 8.4 | 7.6 | s | 6.0 | 8.8 | s | 4.5 | 9.4 | s | 3.9 | 10.6 | s | 3.1 |
| 1500 | 0.7 | b | 39.7 | 1.1 | b | 30.3 | 1.6 | b | 24.5 | 2.3 | b | 20.5 | 3.0 | b | 17.7 | 3.9 | b | 15.5 | 4.9 | b | 13.8 | 6.0 | b | 12.5 | 7.5 | s | 9.3 | 8.7 | s | 6.9 | 9.3 | s | 6.0 | 10.5 | s | 4.7 |





Medium-term loading
Service class 1

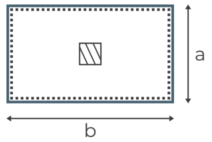
$k_{mod} = 0.80$
$k_{def} = 0.25$
$\gamma_q = 1.5$
$\gamma_m = 1.3$

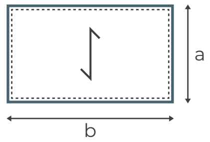
F given in kN
u given in mm
⟵⟶ grain direction of surface veneers

Table 4-8. Birch plywood | A concentrated central load over an area of 50 x 50 mm on a simply supported plate | b = bending strength limitation s = shear strength limitation

| Span c/c | Nominal thickness (mm) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | |
| a x b | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 x 300 | 1.1 | b | 2.6 | 1.9 | b | 1.9 | 2.9 | b | 1.6 | 4.1 | s | 1.3 | 4.7 | s | 1.0 | 5.4 | s | 0.7 |
| 300 x 600 | 1.0 | b | 2.8 | 1.6 | b | 2.1 | 2.4 | b | 1.7 | 3.4 | b | 1.4 | 4.5 | b | 1.2 | 5.3 | s | 1.0 |
| 300 x ∞ | 1.0 | b | 2.8 | 1.6 | b | 2.1 | 2.4 | b | 1.7 | 3.4 | b | 1.5 | 4.5 | b | 1.3 | 5.3 | s | 1.0 |
| 400 x 400 | 1.0 | b | 4.2 | 1.7 | b | 3.1 | 2.6 | b | 2.5 | 3.7 | b | 2.1 | 4.7 | s | 1.7 | 5.4 | s | 1.3 |
| 400 x 800 | 0.9 | b | 4.6 | 1.5 | b | 3.5 | 2.2 | b | 2.8 | 3.1 | b | 2.4 | 4.1 | b | 2.0 | 5.3 | b | 1.8 |
| 400 x ∞ | 0.9 | b | 4.6 | 1.5 | b | 3.5 | 2.2 | b | 2.8 | 3.0 | b | 2.4 | 4.0 | b | 2.1 | 5.2 | b | 1.8 |
| 500 x 500 | 0.9 | b | 6.0 | 1.6 | b | 4.5 | 2.4 | b | 3.6 | 3.4 | b | 3.0 | 4.5 | b | 2.6 | 5.3 | s | 2.1 |
| 500 x 1000 | 0.8 | b | 6.7 | 1.4 | b | 5.1 | 2.1 | b | 4.1 | 2.9 | b | 3.5 | 3.8 | b | 3.0 | 4.9 | b | 2.6 |
| 500 x ∞ | 0.8 | b | 6.8 | 1.4 | b | 5.2 | 2.0 | b | 4.2 | 2.8 | b | 3.5 | 3.8 | b | 3.0 | 4.9 | b | 2.7 |
| 600 x 600 | 0.9 | b | 8.1 | 1.5 | b | 6.2 | 2.3 | b | 5.0 | 3.2 | b | 4.1 | 4.2 | b | 3.5 | 5.3 | s | 3.0 |
| 600 x 1200 | 0.8 | b | 9.2 | 1.3 | b | 7.0 | 1.9 | b | 5.7 | 2.7 | b | 4.8 | 3.6 | b | 4.1 | 4.7 | b | 3.6 |
| 600 x ∞ | 0.8 | b | 9.3 | 1.3 | b | 7.1 | 1.9 | b | 5.7 | 2.7 | b | 4.8 | 3.6 | b | 4.1 | 4.6 | b | 3.6 |
| 750 x 750 | 0.8 | b | 11.8 | 1.4 | b | 9.0 | 2.1 | b | 7.2 | 2.9 | b | 6.0 | 3.9 | b | 5.2 | 5.1 | b | 4.5 |
| 750 x 1500 | 0.7 | b | 13.6 | 1.2 | b | 10.4 | 1.8 | b | 8.4 | 2.6 | b | 7.0 | 3.4 | b | 6.0 | 4.4 | b | 5.3 |
| 750 x ∞ | 0.7 | b | 13.7 | 1.2 | b | 10.4 | 1.8 | b | 8.4 | 2.5 | b | 7.1 | 3.4 | b | 6.1 | 4.3 | b | 5.4 |
| 1000 x 1000 | 0.7 | b | 19.3 | 1.3 | b | 14.7 | 1.9 | b | 11.8 | 2.7 | b | 9.9 | 3.6 | b | 8.4 | 4.7 | b | 7.4 |
| 1000 x 2000 | 0.7 | b | 22.5 | 1.1 | b | 17.2 | 1.7 | b | 13.9 | 2.4 | b | 11.6 | 3.2 | b | 10.0 | 4.1 | b | 8.8 |
| 1000 x ∞ | 0.7 | b | 22.7 | 1.1 | b | 17.3 | 1.7 | b | 14.0 | 2.4 | b | 11.7 | 3.1 | b | 10.1 | 4.0 | b | 8.9 |
| 1200 x 1200 | 0.7 | b | 26.3 | 1.2 | b | 20.1 | 1.8 | b | 16.2 | 2.6 | b | 13.5 | 3.4 | b | 11.6 | 4.4 | b | 10.1 |
| 1200 x 2400 | 0.7 | b | 31.1 | 1.1 | b | 23.7 | 1.6 | b | 19.1 | 2.3 | b | 16.0 | 3.0 | b | 13.8 | 3.9 | b | 12.1 |
| 1500 x 1500 | 0.7 | b | 38.7 | 1.1 | b | 29.5 | 1.7 | b | 23.8 | 2.4 | b | 19.9 | 3.2 | b | 17.0 | 4.2 | b | 14.9 |
| 1500 x 3000 | 0.6 | b | 46.2 | 1.0 | b | 35.2 | 1.5 | b | 28.4 | 2.2 | b | 23.8 | 2.9 | b | 20.5 | 3.7 | b | 18.0 |

| Span c/c | Nominal thickness (mm) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| a x b | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 x 300 | 6.0 | s | 0.6 | 6.7 | s | 0.5 | 8.0 | s | 0.3 | 9.3 | s | 0.2 | 9.9 | s | 0.2 | 11.2 | s | 0.2 |
| 300 x 600 | 5.8 | s | 0.8 | 6.5 | s | 0.6 | 7.8 | s | 0.5 | 9.0 | s | 0.3 | 9.6 | s | 0.3 | 10.9 | s | 0.2 |
| 300 x ∞ | 5.8 | s | 0.8 | 6.5 | s | 0.7 | 7.8 | s | 0.5 | 9.0 | s | 0.3 | 9.6 | s | 0.3 | 10.9 | s | 0.2 |
| 400 x 400 | 6.0 | s | 1.1 | 6.7 | s | 0.9 | 7.9 | s | 0.6 | 9.2 | s | 0.4 | 9.8 | s | 0.4 | 11.1 | s | 0.3 |
| 400 x 800 | 5.9 | s | 1.4 | 6.5 | s | 1.2 | 7.8 | s | 0.8 | 9.1 | s | 0.6 | 9.6 | s | 0.5 | 10.9 | s | 0.4 |
| 400 x ∞ | 5.8 | s | 1.4 | 6.5 | s | 1.2 | 7.8 | s | 0.8 | 9.0 | s | 0.6 | 9.6 | s | 0.5 | 10.9 | s | 0.4 |
| 500 x 500 | 5.9 | s | 1.6 | 6.6 | s | 1.4 | 7.9 | s | 0.9 | 9.2 | s | 0.7 | 9.8 | s | 0.6 | 11.0 | s | 0.5 |
| 500 x 1000 | 5.9 | s | 2.2 | 6.6 | s | 1.9 | 7.8 | s | 1.3 | 9.1 | s | 1.0 | 9.7 | s | 0.8 | 10.9 | s | 0.7 |
| 500 x ∞ | 5.9 | s | 2.3 | 6.6 | s | 1.9 | 7.8 | s | 1.3 | 9.1 | s | 1.0 | 9.7 | s | 0.9 | 10.9 | s | 0.7 |
| 600 x 600 | 5.9 | s | 2.4 | 6.6 | s | 2.0 | 7.9 | s | 1.4 | 9.1 | s | 1.0 | 9.7 | s | 0.9 | 11.0 | s | 0.7 |
| 600 x 1200 | 5.8 | b | 3.2 | 6.6 | s | 2.7 | 7.8 | s | 1.9 | 9.1 | s | 1.4 | 9.7 | s | 1.2 | 10.9 | s | 1.0 |
| 600 x ∞ | 5.7 | b | 3.2 | 6.6 | s | 2.7 | 7.8 | s | 1.9 | 9.1 | s | 1.4 | 9.7 | s | 1.2 | 10.9 | s | 1.0 |
| 750 x 750 | 5.9 | s | 3.7 | 6.6 | s | 3.1 | 7.9 | s | 2.1 | 9.1 | s | 1.6 | 9.7 | s | 1.4 | 11.0 | s | 1.1 |
| 750 x 1500 | 5.5 | b | 4.7 | 6.6 | s | 4.2 | 7.8 | s | 3.0 | 9.1 | s | 2.2 | 9.7 | s | 1.9 | 10.9 | s | 1.5 |
| 750 x ∞ | 5.4 | b | 4.8 | 6.6 | s | 4.3 | 7.8 | s | 3.0 | 9.1 | s | 2.2 | 9.7 | s | 1.9 | 10.9 | s | 1.5 |
| 1000 x 1000 | 5.8 | b | 6.6 | 6.6 | s | 5.5 | 7.9 | s | 3.8 | 9.1 | s | 2.8 | 9.7 | s | 2.5 | 11.0 | s | 1.9 |
| 1000 x 2000 | 5.1 | b | 7.8 | 6.2 | b | 7.1 | 7.8 | s | 5.3 | 9.1 | s | 3.9 | 9.7 | s | 3.4 | 11.0 | s | 2.7 |
| 1000 x ∞ | 5.0 | b | 7.9 | 6.1 | b | 7.1 | 7.8 | s | 5.4 | 9.1 | s | 4.0 | 9.7 | s | 3.5 | 10.9 | s | 2.7 |
| 1200 x 1200 | 5.5 | b | 9.0 | 6.6 | s | 7.9 | 7.8 | s | 5.5 | 9.1 | s | 4.1 | 9.7 | s | 3.5 | 11.0 | s | 2.8 |
| 1200 x 2400 | 4.8 | b | 10.8 | 5.9 | b | 9.7 | 7.8 | s | 7.6 | 9.1 | s | 5.6 | 9.7 | s | 4.9 | 10.9 | s | 3.8 |
| 1500 x 1500 | 5.2 | b | 13.3 | 6.4 | b | 11.9 | 7.9 | s | 8.6 | 9.1 | s | 6.4 | 9.7 | s | 5.5 | 11.0 | s | 4.3 |
| 1500 x 3000 | 4.6 | b | 16.0 | 5.6 | b | 14.5 | 7.8 | s | 11.9 | 9.1 | s | 8.8 | 9.7 | s | 7.7 | 11.0 | s | 6.0 |



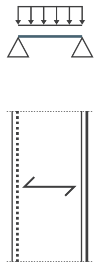

Medium-term loading
Service class 1

$k_{mod} = 0.80$
$k_{def} = 0.25$
$\gamma_q = 1.5$
$\gamma_m = 1.3$

F given in kN
u given in mm
⟵⟶ grain direction of surface veneers

Table 4-9. Combi plywood | A uniformly distributed load on a single span plate strip | b = bending strength limitation s = shear strength limitation

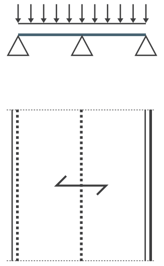
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 | 23 | b | 4.4 | 35 | b | 3.4 | 50 | b | 2.9 | 67 | b | 2.5 | 87 | b | 2.2 | 108 | b | 2.0 | 122 | s | 1.8 | 136 | s | 1.6 |
| 400 | 13 | b | 7.6 | 20 | b | 5.9 | 28 | b | 4.9 | 38 | b | 4.2 | 49 | b | 3.7 | 61 | b | 3.3 | 72 | b | 2.9 | 85 | b | 2.6 |
| 500 | 8 | b | 11.8 | 13 | b | 9.1 | 18 | b | 7.5 | 24 | b | 6.4 | 31 | b | 5.6 | 39 | b | 4.9 | 46 | b | 4.3 | 54 | b | 3.9 |
| 600 | 6 | b | 16.9 | 9 | b | 13.0 | 12 | b | 10.7 | 17 | b | 9.0 | 22 | b | 7.9 | 27 | b | 6.9 | 32 | b | 6.0 | 38 | b | 5.4 |
| 750 | 4 | b | 26.3 | 6 | b | 20.2 | 8 | b | 16.5 | 11 | b | 14.0 | 14 | b | 12.1 | 17 | b | 10.5 | 21 | b | 9.2 | 24 | b | 8.2 |
| 1000 | 2 | b | 46.6 | 3 | b | 35.8 | 4 | b | 29.1 | 6 | b | 24.6 | 8 | b | 21.3 | 10 | b | 18.4 | 12 | b | 16.1 | 14 | b | 14.2 |
| 1200 | 1 | b | 67.0 | 2 | b | 51.5 | 3 | b | 41.8 | 4 | b | 35.3 | 5 | b | 30.5 | 7 | b | 26.4 | 8 | b | 23.0 | 9 | b | 20.3 |
| 1500 | 1 | b | 104.6 | 1 | b | 80.3 | 2 | b | 65.2 | 3 | b | 54.9 | 3 | b | 47.5 | 4 | b | 41.0 | 5 | b | 35.6 | 6 | b | 31.5 |



Medium-term loading
Service class 1
$k_{mod}$ = 0.80
$k_{def}$ = 0.25
$\gamma_q$ = 1.5
$\gamma_m$ = 1.3
q given in kN/m²
u given in mm
grain direction of surface veneers

Table 4-10. Combi plywood | A uniformly distributed load on a double span plate strip | b = bending strength limitation s = shear strength limitation

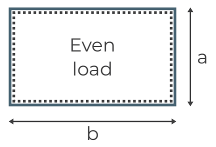
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 | 23 | b | 2.0 | 35 | b | 1.6 | 50 | b | 1.4 | 67 | b | 1.3 | 77 | s | 1.1 | 89 | s | 1.0 | 97 | s | 0.8 | 109 | s | 0.8 |
| 400 | 13 | b | 3.3 | 20 | b | 2.6 | 28 | b | 2.2 | 38 | b | 2.0 | 49 | b | 1.8 | 61 | b | 1.6 | 72 | b | 1.5 | 84 | s | 1.4 |
| 500 | 8 | b | 5.1 | 13 | b | 4.0 | 18 | b | 3.3 | 24 | b | 2.9 | 31 | b | 2.6 | 39 | b | 2.3 | 46 | b | 2.1 | 54 | b | 1.9 |
| 600 | 6 | b | 7.2 | 9 | b | 5.6 | 12 | b | 4.6 | 17 | b | 4.0 | 22 | b | 3.5 | 27 | b | 3.1 | 32 | b | 2.8 | 38 | b | 2.6 |
| 750 | 4 | b | 11.1 | 6 | b | 8.6 | 8 | b | 7.0 | 11 | b | 6.0 | 14 | b | 5.3 | 17 | b | 4.7 | 21 | b | 4.1 | 24 | b | 3.7 |
| 1000 | 2 | b | 19.5 | 3 | b | 15.0 | 4 | b | 12.3 | 6 | b | 10.4 | 8 | b | 9.1 | 10 | b | 7.9 | 12 | b | 7.0 | 14 | b | 6.2 |
| 1200 | 1 | b | 28.0 | 2 | b | 21.5 | 3 | b | 17.5 | 4 | b | 14.9 | 5 | b | 12.9 | 7 | b | 11.2 | 8 | b | 9.8 | 9 | b | 8.8 |
| 1500 | 1 | b | 43.6 | 1 | b | 33.5 | 2 | b | 27.2 | 3 | b | 23.0 | 3 | b | 19.9 | 4 | b | 17.3 | 5 | b | 15.1 | 6 | b | 13.4 |

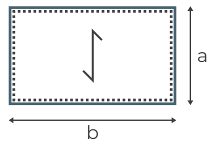


Medium-term loading
Service class 1
$k_{mod}$ = 0.80
$k_{def}$ = 0.25
$\gamma_q$ = 1.5
$\gamma_m$ = 1.3
q given in kN/m²
u given in mm
grain direction of surface veneers

Table 4-11. Combi plywood | Table A3. A uniformly distributed load on a simply supported plate | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| a x b | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 x 300 | 56 | b | 4.2 | 80 | s | 2.8 | 102 | s | 1.9 | 116 | s | 1.3 | 137 | s | 1.0 | 151 | s | 0.7 | 171 | s | 0.6 | 187 | s | 0.5 |
| 300 x 600 | 27 | b | 4.2 | 42 | b | 3.2 | 61 | b | 2.6 | 84 | b | 2.2 | 110 | b | 1.9 | 136 | b | 1.6 | 145 | s | 1.3 | 162 | s | 1.1 |
| 300 x ∞ | 23 | b | 4.2 | 35 | b | 3.2 | 50 | b | 2.6 | 67 | b | 2.2 | 87 | b | 1.9 | 108 | b | 1.6 | 122 | s | 1.4 | 136 | s | 1.2 |
| 400 x 400 | 31 | b | 7.5 | 53 | b | 5.8 | 77 | s | 4.5 | 87 | s | 3.1 | 103 | s | 2.3 | 114 | s | 1.8 | 128 | s | 1.4 | 140 | s | 1.2 |
| 400 x 800 | 15 | b | 7.4 | 24 | b | 5.7 | 34 | b | 4.6 | 47 | b | 3.9 | 62 | b | 3.3 | 77 | b | 2.9 | 92 | b | 2.5 | 108 | b | 2.2 |
| 400 x ∞ | 13 | b | 7.4 | 20 | b | 5.7 | 28 | b | 4.6 | 38 | b | 3.9 | 49 | b | 3.4 | 61 | b | 2.9 | 72 | b | 2.5 | 85 | b | 2.2 |
| 500 x 500 | 20 | b | 11.7 | 34 | b | 9.0 | 51 | b | 7.3 | 70 | s | 6.0 | 82 | s | 4.5 | 91 | s | 3.4 | 103 | s | 2.8 | 112 | s | 2.3 |
| 500 x 1000 | 10 | b | 11.6 | 15 | b | 8.9 | 22 | b | 7.2 | 30 | b | 6.1 | 39 | b | 5.2 | 49 | b | 4.5 | 59 | b | 3.9 | 69 | b | 3.5 |
| 500 x ∞ | 8 | b | 11.6 | 13 | b | 8.9 | 18 | b | 7.2 | 24 | b | 6.1 | 31 | b | 5.2 | 39 | b | 4.5 | 46 | b | 3.9 | 54 | b | 3.5 |
| 600 x 600 | 14 | b | 16.9 | 24 | b | 13.0 | 36 | b | 10.5 | 50 | b | 8.8 | 66 | b | 7.6 | 76 | s | 5.9 | 86 | s | 4.8 | 94 | s | 3.9 |
| 600 x 1200 | 7 | b | 16.7 | 11 | b | 12.8 | 15 | b | 10.4 | 21 | b | 8.7 | 27 | b | 7.5 | 34 | b | 6.5 | 41 | b | 5.6 | 48 | b | 5.0 |
| 600 x ∞ | 6 | b | 16.7 | 9 | b | 12.8 | 12 | b | 10.4 | 17 | b | 8.7 | 22 | b | 7.5 | 27 | b | 6.5 | 32 | b | 5.6 | 38 | b | 5.0 |
| 750 x 750 | 9 | b | 26.4 | 15 | b | 20.2 | 23 | b | 16.4 | 32 | b | 13.8 | 43 | b | 11.9 | 54 | b | 10.3 | 65 | b | 8.9 | 75 | s | 7.7 |
| 750 x 1500 | 4 | b | 26.1 | 7 | b | 20.0 | 10 | b | 16.2 | 13 | b | 13.7 | 18 | b | 11.8 | 22 | b | 10.2 | 26 | b | 8.8 | 31 | b | 7.8 |
| 750 x ∞ | 4 | b | 26.1 | 6 | b | 20.0 | 8 | b | 16.2 | 11 | b | 13.7 | 14 | b | 11.8 | 17 | b | 10.2 | 21 | b | 8.8 | 24 | b | 7.8 |
| 1000 x 1000 | 5 | b | 47.0 | 8 | b | 36.0 | 13 | b | 29.2 | 18 | b | 24.5 | 24 | b | 21.1 | 30 | b | 18.2 | 37 | b | 15.8 | 43 | b | 13.9 |
| 1000 x 2000 | 2 | b | 46.4 | 4 | b | 35.6 | 6 | b | 28.8 | 8 | b | 24.3 | 10 | b | 20.9 | 12 | b | 18.1 | 15 | b | 15.7 | 17 | b | 13.8 |
| 1000 x ∞ | 2 | b | 46.4 | 3 | b | 35.6 | 4 | b | 28.8 | 6 | b | 24.3 | 8 | b | 20.9 | 10 | b | 18.1 | 12 | b | 15.7 | 14 | b | 13.8 |
| 1200 x 1200 | 3 | b | 67.7 | 6 | b | 51.8 | 9 | b | 42.0 | 12 | b | 35.3 | 17 | b | 30.4 | 21 | b | 26.3 | 25 | b | 22.8 | 30 | b | 20.1 |
| 1200 x 2400 | 2 | b | 66.9 | 3 | b | 51.2 | 4 | b | 41.5 | 5 | b | 35.0 | 7 | b | 30.1 | 9 | b | 26.0 | 10 | b | 22.5 | 12 | b | 19.9 |
| 1500 x 1500 | 2 | b | 105.7 | 4 | b | 81.0 | 6 | b | 65.6 | 8 | b | 55.2 | 11 | b | 47.6 | 13 | b | 41.0 | 16 | b | 35.6 | 19 | b | 31.4 |
| 1500 x 3000 | 1 | b | 104.5 | 2 | b | 81.1 | 2 | b | 64.9 | 3 | b | 54.6 | 4 | b | 47.1 | 5 | b | 40.6 | 7 | b | 35.2 | 8 | b | 31.1 |




Medium-term loading

Service class 1

$k_{mod}$ = 0.80

$k_{def}$ = 0.25

$\gamma_q$ = 1.5

$\gamma_m$ = 1.3

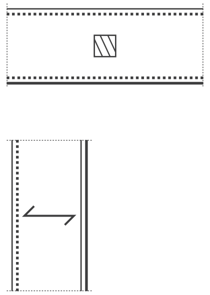
q given in kN/$m^2$

u given in mm

grain direction of surface veneers

Table 4-12. Combi plywood | A concentrated central load over an area of 50 x 50 mm on a single span plate strip | b = bending strength limitation s = shear strength limitation

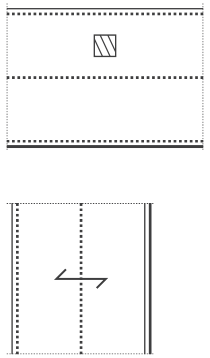
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 0.9 | b | 2.8 | 1.2 | s | 1.7 | 1.6 | s | 1.2 | 1.8 | s | 0.9 | 2.2 | s | 0.7 | 2.4 | s | 0.5 | 2.7 | s | 0.4 | 3.0 | s | 0.3 |
| 400 | 0.9 | b | 4.6 | 1.2 | s | 3.1 | 1.6 | s | 2.2 | 1.8 | s | 1.6 | 2.2 | s | 1.2 | 2.4 | s | 0.9 | 2.7 | s | 0.8 | 3.0 | s | 0.6 |
| 500 | 0.8 | b | 6.8 | 1.2 | s | 4.8 | 1.6 | s | 3.5 | 1.8 | s | 2.4 | 2.2 | s | 1.9 | 2.4 | s | 1.5 | 2.7 | s | 1.2 | 3.0 | s | 1.0 |
| 600 | 0.8 | b | 9.3 | 1.2 | s | 7.0 | 1.6 | s | 5.0 | 1.8 | s | 3.5 | 2.2 | s | 2.8 | 2.4 | s | 2.1 | 2.7 | s | 1.7 | 3.0 | s | 1.4 |
| 750 | 0.7 | b | 13.7 | 1.1 | b | 10.4 | 1.6 | s | 7.9 | 1.8 | s | 5.6 | 2.2 | s | 4.3 | 2.4 | s | 3.3 | 2.7 | s | 2.7 | 3.0 | s | 2.2 |
| 1000 | 0.7 | b | 22.6 | 1.1 | b | 17.2 | 1.6 | b | 13.9 | 1.8 | s | 10.1 | 2.2 | s | 7.8 | 2.4 | s | 6.0 | 2.8 | s | 4.9 | 3.0 | s | 4.0 |
| 1200 | 0.6 | b | 31.2 | 1.0 | b | 23.8 | 1.5 | b | 19.2 | 1.9 | s | 14.7 | 2.2 | s | 11.4 | 2.5 | s | 8.8 | 2.8 | s | 7.2 | 3.1 | s | 5.9 |
| 1500 | 0.6 | b | 46.3 | 1.0 | b | 35.3 | 1.4 | b | 28.5 | 1.9 | s | 23.4 | 2.3 | s | 18.2 | 2.5 | s | 14.0 | 2.9 | s | 11.4 | 3.1 | s | 9.4 |



Medium-term loading
Service class 1
$k_{mod}$ = 0.80
$k_{def}$ = 0.25
$\gamma_q$ = 1.5
$\gamma_m$ = 1.3
F given in kN
u given in mm
⟷ grain direction of surface veneers

Table 4-13. Combi plywood | A concentrated load over an area of 50 x 50 mm on a double span plate strip at the centre of one span | b = bending strength limitation s = shear strength limitation

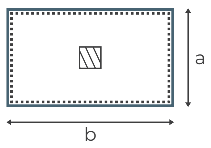
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 1.0 | b | 2.5 | 1.3 | s | 1.4 | 1.6 | s | 1.0 | 1.9 | s | 0.7 | 2.2 | s | 0.6 | 2.5 | s | 0.4 | 2.8 | s | 0.3 | 3.1 | s | 0.3 |
| 400 | 0.9 | b | 4.0 | 1.3 | s | 2.5 | 1.6 | s | 1.8 | 1.9 | s | 1.3 | 2.2 | s | 1.0 | 2.5 | s | 0.8 | 2.8 | s | 0.6 | 3.1 | s | 0.5 |
| 500 | 0.9 | b | 5.9 | 1.3 | s | 4.0 | 1.6 | s | 2.9 | 1.9 | s | 2.0 | 2.2 | s | 1.6 | 2.5 | s | 1.2 | 2.8 | s | 1.0 | 3.1 | s | 0.8 |
| 600 | 0.8 | b | 8.0 | 1.3 | s | 5.9 | 1.7 | s | 4.2 | 1.9 | s | 3.0 | 2.3 | s | 2.3 | 2.5 | s | 1.8 | 2.9 | s | 1.5 | 3.2 | s | 1.2 |
| 750 | 0.8 | b | 11.8 | 1.2 | b | 9.0 | 1.7 | s | 6.7 | 1.9 | s | 4.7 | 2.3 | s | 3.7 | 2.6 | s | 2.9 | 2.9 | s | 2.3 | 3.2 | s | 1.9 |
| 1000 | 0.7 | b | 19.4 | 1.1 | b | 14.8 | 1.7 | b | 12.0 | 2.0 | s | 8.7 | 2.4 | s | 6.8 | 2.6 | s | 5.2 | 3.0 | s | 4.3 | 3.3 | s | 3.5 |
| 1200 | 0.7 | b | 26.7 | 1.1 | b | 20.4 | 1.6 | b | 16.4 | 2.1 | s | 12.9 | 2.5 | s | 10.1 | 2.7 | s | 7.8 | 3.1 | s | 6.4 | 3.4 | s | 5.2 |
| 1500 | 0.6 | b | 39.6 | 1.0 | b | 30.1 | 1.5 | b | 24.3 | 2.1 | b | 20.4 | 2.6 | s | 17.0 | 3.0 | s | 13.1 | 3.4 | s | 10.8 | 3.7 | s | 8.8 |

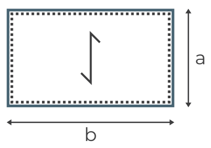


Medium-term loading
Service class 1
$k_{mod}$ = 0.80
$k_{def}$ = 0.25
$\gamma_q$ = 1.5
$\gamma_m$ = 1.3
F given in kN
u given in mm
⟷ grain direction of surface veneers

Table 4-14. Combi plywood | A concentrated central load over an area of 50 x 50 mm on a simply supported plate | b = bending strength limitation s = shear strength limitation

| Span c/c | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| a x b | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 x 300 | 1.0 | s | 2.4 | 1.2 | s | 1.3 | 1.6 | s | 0.9 | 1.8 | s | 0.6 | 2.2 | s | 0.5 | 2.4 | s | 0.4 | 2.7 | s | 0.3 | 3.0 | s | 0.2 |
| 300 x 600 | 0.9 | b | 2.8 | 1.2 | s | 1.7 | 1.6 | s | 1.2 | 1.8 | s | 0.8 | 2.2 | s | 0.7 | 2.4 | s | 0.5 | 2.7 | s | 0.4 | 3.0 | s | 0.3 |
| 300 x ∞ | 0.9 | b | 2.8 | 1.2 | s | 1.7 | 1.6 | s | 1.2 | 1.8 | s | 0.9 | 2.2 | s | 0.7 | 2.4 | s | 0.5 | 2.7 | s | 0.4 | 3.0 | s | 0.3 |
| 400 x 400 | 1.0 | b | 4.1 | 1.2 | s | 2.3 | 1.6 | s | 1.6 | 1.8 | s | 1.1 | 2.2 | s | 0.8 | 2.4 | s | 0.6 | 2.7 | s | 0.5 | 3.0 | s | 0.4 |
| 400 x 800 | 0.9 | b | 4.6 | 1.2 | s | 3.0 | 1.6 | s | 2.2 | 1.8 | s | 1.5 | 2.2 | s | 1.2 | 2.4 | s | 0.9 | 2.7 | s | 0.7 | 3.0 | s | 0.6 |
| 400 x ∞ | 0.9 | b | 4.6 | 1.2 | s | 3.1 | 1.6 | s | 2.2 | 1.8 | s | 1.6 | 2.2 | s | 1.2 | 2.4 | s | 0.9 | 2.7 | s | 0.8 | 3.0 | s | 0.6 |
| 500 x 500 | 0.9 | b | 6.0 | 1.2 | s | 3.6 | 1.6 | s | 2.5 | 1.8 | s | 1.7 | 2.1 | s | 1.3 | 2.4 | s | 1.0 | 2.7 | s | 0.8 | 3.0 | s | 0.7 |
| 500 x 1000 | 0.8 | b | 6.7 | 1.2 | s | 4.7 | 1.6 | s | 3.4 | 1.8 | s | 2.4 | 2.1 | s | 1.9 | 2.4 | s | 1.4 | 2.7 | s | 1.2 | 3.0 | s | 1.0 |
| 500 x ∞ | 0.8 | b | 6.8 | 1.2 | s | 4.8 | 1.6 | s | 3.5 | 1.8 | s | 2.4 | 2.2 | s | 1.9 | 2.4 | s | 1.5 | 2.7 | s | 1.2 | 3.0 | s | 1.0 |
| 600 x 600 | 0.9 | b | 8.2 | 1.2 | s | 5.2 | 1.6 | s | 3.6 | 1.8 | s | 2.5 | 2.1 | s | 1.9 | 2.4 | s | 1.5 | 2.7 | s | 1.2 | 3.0 | s | 1.0 |
| 600 x 1200 | 0.8 | b | 9.2 | 1.2 | s | 6.9 | 1.6 | s | 4.9 | 1.8 | s | 3.5 | 2.1 | s | 2.7 | 2.4 | s | 2.1 | 2.7 | s | 1.7 | 3.0 | s | 1.4 |
| 600 x ∞ | 0.8 | b | 9.3 | 1.2 | s | 7.0 | 1.6 | s | 5.0 | 1.8 | s | 3.5 | 2.2 | s | 2.8 | 2.4 | s | 2.1 | 2.7 | s | 1.7 | 3.0 | s | 1.4 |
| 750 x 750 | 0.8 | b | 12.0 | 1.2 | s | 8.2 | 1.6 | s | 5.7 | 1.8 | s | 4.0 | 2.2 | s | 3.0 | 2.4 | s | 2.3 | 2.7 | s | 1.9 | 3.0 | s | 1.5 |
| 750 x 1500 | 0.7 | b | 13.6 | 1.2 | b | 10.3 | 1.6 | s | 7.8 | 1.8 | s | 5.4 | 2.2 | s | 4.2 | 2.4 | s | 3.3 | 2.7 | s | 2.7 | 3.0 | s | 2.2 |
| 750 x ∞ | 0.7 | b | 13.7 | 1.1 | b | 10.4 | 1.6 | s | 7.9 | 1.8 | s | 5.6 | 2.2 | s | 4.3 | 2.4 | s | 3.3 | 2.7 | s | 2.7 | 3.0 | s | 2.2 |
| 1000 x 1000 | 0.7 | b | 19.6 | 1.2 | b | 14.7 | 1.6 | s | 10.3 | 1.8 | s | 7.1 | 2.2 | s | 5.5 | 2.4 | s | 4.2 | 2.8 | s | 3.4 | 3.0 | s | 2.8 |
| 1000 x 2000 | 0.7 | b | 22.5 | 1.1 | b | 17.1 | 1.6 | b | 13.8 | 1.8 | s | 9.8 | 2.2 | s | 7.6 | 2.4 | s | 5.8 | 2.8 | s | 4.8 | 3.0 | s | 3.9 |
| 1000 x ∞ | 0.7 | b | 22.6 | 1.1 | b | 17.2 | 1.6 | b | 13.9 | 1.8 | s | 10.1 | 2.2 | s | 7.8 | 2.4 | s | 6.0 | 2.8 | s | 4.9 | 3.0 | s | 4.0 |
| 1200 x 1200 | 0.7 | b | 26.8 | 1.2 | b | 20.1 | 1.6 | s | 15.0 | 1.8 | s | 10.3 | 2.2 | s | 7.9 | 2.4 | s | 6.0 | 2.8 | s | 4.9 | 3.0 | s | 4.0 |
| 1200 x 2400 | 0.6 | b | 31.0 | 1.0 | b | 23.6 | 1.5 | b | 19.0 | 1.8 | s | 14.2 | 2.2 | s | 11.0 | 2.4 | s | 8.5 | 2.8 | s | 6.9 | 3.0 | s | 5.7 |
| 1500 x 1500 | 0.7 | b | 39.3 | 1.1 | b | 29.7 | 1.6 | b | 23.6 | 1.9 | s | 16.4 | 2.2 | s | 12.6 | 2.5 | s | 9.6 | 2.8 | s | 7.8 | 3.1 | s | 6.4 |
| 1500 x 3000 | 0.6 | b | 46.0 | 1.0 | b | 35.0 | 1.4 | b | 28.2 | 1.9 | s | 22.5 | 2.2 | s | 17.5 | 2.5 | s | 13.4 | 2.8 | s | 11.0 | 3.1 | s | 9.0 |

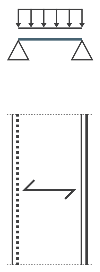



Medium-term loading
Service class 1
$k_{mod}$ = 0.80
$k_{def}$ = 0.25
$\gamma\gamma_q$ = 1.5
$\gamma_m$ = 1.3
F given in kN
u given in mm
⟷ grain direction of surface veneers

Table 4-15. Combi Mirror plywood | A uniformly distributed load on a single span plate strip | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 | 23 | b | 4.8 | 38 | b | 4.0 | 45 | s | 2.9 | 55 | s | 2.3 | 62 | s | 1.9 | 71 | s | 1.7 | 78 | s | 1.5 | 87 | s | 1.4 |
| 400 | 13 | b | 8.1 | 21 | b | 6.5 | 31 | b | 5.5 | 41 | s | 4.8 | 46 | s | 3.8 | 53 | s | 3.2 | 59 | s | 2.7 | 65 | s | 2.4 |
| 500 | 8 | b | 12.2 | 14 | b | 9.7 | 20 | b | 8.1 | 27 | b | 7.1 | 36 | b | 6.4 | 43 | s | 5.5 | 47 | s | 4.6 | 52 | s | 4.1 |
| 600 | 6 | b | 17.4 | 9 | b | 13.6 | 14 | b | 11.3 | 19 | b | 9.8 | 25 | b | 8.7 | 32 | b | 8.0 | 39 | s | 7.4 | 44 | s | 6.4 |
| 750 | 4 | b | 26.8 | 6 | b | 20.8 | 9 | b | 17.2 | 12 | b | 14.7 | 16 | b | 13.0 | 20 | b | 11.7 | 25 | b | 10.7 | 31 | b | 10.0 |
| 1000 | 2 | b | 47.1 | 3 | b | 36.4 | 5 | b | 29.8 | 7 | b | 25.3 | 9 | b | 22.1 | 11 | b | 19.8 | 14 | b | 17.9 | 17 | b | 16.5 |
| 1200 | 1 | b | 67.5 | 2 | b | 52.1 | 3 | b | 42.5 | 5 | b | 36.0 | 6 | b | 31.3 | 8 | b | 27.9 | 10 | b | 25.2 | 12 | b | 23.0 |
| 1500 | 1 | b | 105.2 | 2 | b | 80.9 | 2 | b | 65.9 | 3 | b | 55.7 | 4 | b | 48.3 | 5 | b | 42.8 | 6 | b | 38.5 | 8 | b | 35.1 |



Medium-term loading

Service class 1

$k_{mod}$ = 0.80

$k_{def}$ = 0.25

$\gamma_q$ = 1.5

$\gamma_m$ = 1.3

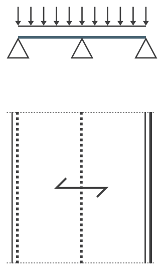
q given in kN/m²

u given in mm

⟷ grain direction of surface veneers

Table 4-16. Combi Mirror plywood | Table A2. A uniformly distributed load on a double span plate strip | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 | 23 | s | 2.4 | 31 | s | 1.9 | 36 | s | 1.4 | 44 | s | 1.3 | 49 | s | 1.1 | 57 | s | 1.0 | 63 | s | 1.0 | 70 | s | 0.9 |
| 400 | 13 | b | 3.8 | 21 | b | 3.3 | 27 | s | 2.6 | 33 | s | 2.2 | 37 | s | 1.9 | 43 | s | 1.7 | 47 | s | 1.5 | 52 | s | 1.4 |
| 500 | 8 | b | 5.6 | 14 | b | 4.6 | 20 | b | 4.1 | 26 | s | 3.6 | 30 | s | 3.0 | 34 | s | 2.6 | 38 | s | 2.3 | 42 | s | 2.1 |
| 600 | 6 | b | 7.7 | 9 | b | 6.2 | 14 | b | 5.4 | 19 | b | 4.9 | 25 | s | 4.5 | 28 | s | 3.9 | 31 | s | 3.4 | 35 | s | 3.0 |
| 750 | 4 | b | 11.6 | 6 | b | 9.2 | 9 | b | 7.8 | 12 | b | 6.9 | 16 | b | 6.3 | 20 | b | 5.9 | 25 | s | 5.6 | 28 | s | 4.9 |
| 1000 | 2 | b | 20.0 | 3 | b | 15.7 | 5 | b | 13.1 | 7 | b | 11.3 | 9 | b | 10.1 | 11 | b | 9.2 | 14 | b | 8.6 | 17 | b | 8.1 |
| 1200 | 1 | b | 28.5 | 2 | b | 22.2 | 3 | b | 18.3 | 5 | b | 15.8 | 6 | b | 13.9 | 8 | b | 12.6 | 10 | b | 11.6 | 12 | b | 10.8 |
| 1500 | 1 | b | 44.1 | 2 | b | 34.2 | 2 | b | 28.1 | 3 | b | 23.9 | 4 | b | 21.0 | 5 | b | 18.8 | 6 | b | 17.1 | 8 | b | 15.8 |



Medium-term loading

Service class 1

$k_{mod}$ = 0.80

$k_{def}$ = 0.25

$\gamma_q$ = 1.5

$\gamma_m$ = 1.3

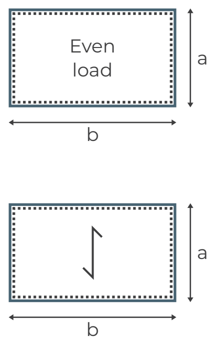
q given in kN/m²

u given in mm

⟷ grain direction of surface veneers

Table 4-17. Combi Mirror plywood | A uniformly distributed load on a simply supported plate | b = bending strength limitation s = shear strength limitation

| Span c/c | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| a x b | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 300 x 300 | 42 | b | 3.5 | 71 | b | 2.7 | 85 | s | 1.7 | 105 | s | 1.2 | 120 | s | 0.9 | 139 | s | 0.7 | 154 | s | 0.6 | 173 | s | 0.5 |
| 300 x 600 | 26 | b | 4.2 | 43 | b | 3.2 | 51 | s | 2.1 | 62 | s | 1.5 | 70 | s | 1.1 | 81 | s | 0.9 | 90 | s | 0.7 | 100 | s | 0.6 |
| 300 x ∞ | 23 | b | 4.2 | 38 | b | 3.2 | 45 | s | 2.1 | 55 | s | 1.6 | 62 | s | 1.2 | 71 | s | 0.9 | 78 | s | 0.7 | 87 | s | 0.6 |
| 400 x 400 | 24 | b | 6.2 | 40 | b | 4.8 | 60 | b | 3.8 | 79 | s | 3.0 | 90 | s | 2.2 | 104 | s | 1.7 | 116 | s | 1.3 | 130 | s | 1.1 |
| 400 x 800 | 15 | b | 7.4 | 24 | b | 5.7 | 36 | b | 4.6 | 47 | s | 3.6 | 53 | s | 2.7 | 61 | s | 2.1 | 67 | s | 1.7 | 75 | s | 1.4 |
| 400 x ∞ | 13 | b | 7.4 | 21 | b | 5.7 | 31 | b | 4.6 | 41 | s | 3.8 | 46 | s | 2.8 | 53 | s | 2.2 | 59 | s | 1.7 | 65 | s | 1.4 |
| 500 x 500 | 15 | b | 9.7 | 26 | b | 7.4 | 39 | b | 6.0 | 54 | b | 5.0 | 72 | s | 4.2 | 84 | s | 3.3 | 93 | s | 2.6 | 104 | s | 2.2 |
| 500 x 1000 | 10 | b | 11.6 | 16 | b | 8.9 | 23 | b | 7.2 | 32 | b | 6.1 | 42 | s | 5.2 | 49 | s | 4.1 | 54 | s | 3.3 | 60 | s | 2.7 |
| 500 x ∞ | 8 | b | 11.6 | 14 | b | 8.9 | 20 | b | 7.2 | 27 | b | 6.1 | 36 | b | 5.2 | 43 | s | 4.3 | 47 | s | 3.4 | 52 | s | 2.8 |
| 600 x 600 | 10 | b | 14.0 | 18 | b | 10.7 | 27 | b | 8.6 | 38 | b | 7.1 | 50 | b | 6.1 | 64 | b | 5.3 | 77 | s | 4.6 | 86 | s | 3.8 |
| 600 x 1200 | 7 | b | 16.7 | 11 | b | 12.8 | 16 | b | 10.4 | 22 | b | 8.7 | 29 | b | 7.5 | 38 | b | 6.6 | 45 | s | 5.7 | 50 | s | 4.7 |
| 600 x ∞ | 6 | b | 16.7 | 9 | b | 12.8 | 14 | b | 10.4 | 19 | b | 8.7 | 25 | b | 7.5 | 32 | b | 6.6 | 39 | s | 5.9 | 44 | s | 4.9 |
| 750 x 750 | 7 | b | 21.8 | 11 | b | 16.7 | 17 | b | 13.4 | 24 | b | 11.2 | 32 | b | 9.5 | 41 | b | 8.3 | 51 | b | 7.4 | 63 | b | 6.6 |
| 750 x 1500 | 4 | b | 26.2 | 7 | b | 20.1 | 10 | b | 16.3 | 14 | b | 13.7 | 19 | b | 11.8 | 24 | b | 10.4 | 30 | b | 9.2 | 37 | b | 8.4 |
| 750 x ∞ | 4 | b | 26.1 | 6 | b | 20.0 | 9 | b | 16.3 | 12 | b | 13.7 | 16 | b | 11.8 | 20 | b | 10.4 | 25 | b | 9.2 | 31 | b | 8.4 |
| 1000 x 1000 | 4 | b | 38.8 | 6 | b | 29.7 | 10 | b | 23.8 | 14 | b | 19.8 | 18 | b | 17.0 | 23 | b | 14.8 | 29 | b | 13.1 | 35 | b | 11.8 |
| 1000 x 2000 | 2 | b | 46.5 | 4 | b | 35.7 | 6 | b | 28.9 | 8 | b | 24.3 | 11 | b | 20.9 | 14 | b | 18.4 | 17 | b | 16.4 | 21 | b | 14.9 |
| 1000 x ∞ | 2 | b | 46.5 | 3 | b | 35.6 | 5 | b | 28.9 | 7 | b | 24.3 | 9 | b | 20.9 | 11 | b | 18.4 | 14 | b | 16.4 | 17 | b | 14.8 |
| 1200 x 1200 | 3 | b | 55.9 | 4 | b | 42.8 | 7 | b | 34.3 | 9 | b | 28.6 | 13 | b | 24.4 | 16 | b | 21.3 | 20 | b | 18.9 | 24 | b | 17.0 |
| 1200 x 2400 | 2 | b | 67.0 | 3 | b | 51.3 | 4 | b | 41.6 | 6 | b | 35.0 | 7 | b | 30.2 | 9 | b | 26.6 | 12 | b | 23.7 | 14 | b | 21.4 |
| 1500 x 1500 | 2 | b | 87.3 | 3 | b | 66.9 | 4 | b | 53.6 | 6 | b | 44.6 | 8 | b | 38.1 | 10 | b | 33.3 | 13 | b | 29.5 | 16 | b | 26.6 |
| 1500 x 3000 | 1 | b | 104.6 | 2 | b | 80.2 | 3 | b | 65.1 | 4 | b | 54.7 | 5 | b | 47.1 | 6 | b | 41.5 | 8 | b | 37.0 | 9 | b | 33.4 |




Medium-term loading

Service class 1

$k_{mod} = 0.80$

$k_{def} = 0.25$

$\gamma_q = 1.5$

$\gamma_m = 1.3$

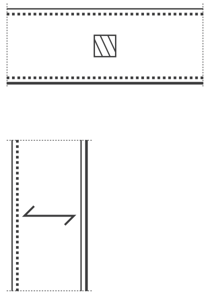
q given in kN/m²

u given in mm

⟷ grain direction of surface veneers

Table 4-18. Combi Mirror plywood | A concentrated central load over an area of 50 x 50 mm on a single span plate strip | b = bending strength limitation s = shear strength limitation

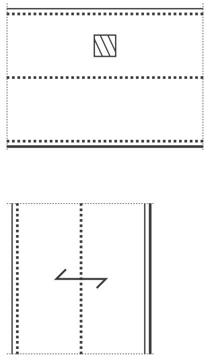
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 0.7 | b | 2.3 | 1.2 | s | 1.8 | 1.4 | s | 1.1 | 1.8 | s | 0.8 | 2.0 | s | 0.6 | 2.3 | s | 0.5 | 2.6 | s | 0.4 | 2.9 | s | 0.3 |
| 400 | 0.6 | b | 3.6 | 1.1 | b | 2.9 | 1.5 | s | 2.0 | 1.8 | s | 1.5 | 2.0 | s | 1.1 | 2.3 | s | 0.9 | 2.6 | s | 0.7 | 2.9 | s | 0.6 |
| 500 | 0.6 | b | 5.1 | 1.0 | b | 4.2 | 1.5 | s | 3.2 | 1.8 | s | 2.4 | 2.0 | s | 1.7 | 2.3 | s | 1.4 | 2.6 | s | 1.1 | 2.9 | s | 0.9 |
| 600 | 0.5 | b | 6.9 | 0.9 | b | 5.6 | 1.5 | s | 4.6 | 1.8 | s | 3.4 | 2.0 | s | 2.5 | 2.3 | s | 2.0 | 2.6 | s | 1.6 | 2.9 | s | 1.3 |
| 750 | 0.5 | b | 10.0 | 0.9 | b | 8.1 | 1.3 | b | 6.7 | 1.8 | s | 5.4 | 2.0 | s | 3.9 | 2.3 | s | 3.1 | 2.6 | s | 2.4 | 2.9 | s | 2.0 |
| 1000 | 0.4 | b | 16.2 | 0.8 | b | 13.1 | 1.2 | b | 10.9 | 1.7 | b | 9.3 | 2.0 | s | 7.0 | 2.3 | s | 5.5 | 2.6 | s | 4.4 | 2.9 | s | 3.6 |
| 1200 | 0.4 | b | 22.0 | 0.7 | b | 17.8 | 1.1 | b | 14.8 | 1.6 | b | 12.6 | 2.0 | s | 10.1 | 2.3 | s | 8.0 | 2.6 | s | 6.3 | 2.9 | s | 5.2 |
| 1500 | 0.4 | b | 32.2 | 0.7 | b | 26.1 | 1.1 | b | 21.7 | 1.5 | b | 18.5 | 2.0 | s | 15.8 | 2.3 | s | 12.5 | 2.6 | s | 9.8 | 2.9 | s | 8.1 |



Medium-term loading
Service class 1
$k_{mod} = 0.80$
$k_{def} = 0.25$
$\gamma_q = 1.5$
$\gamma_m = 1.3$
F given in kN
u given in mm
⟷ grain direction of surface veneers

Table 4-19. Combi Mirror plywood | A concentrated load over an area of 50 x 50 mm on a double span plate strip at the centre of one span | b = bending strength limitation s = shear strength limitation

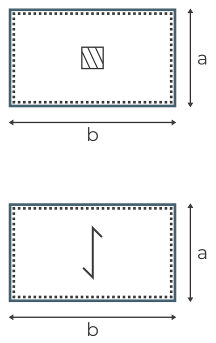
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 0.8 | s | 1.9 | 1.1 | s | 1.2 | 1.3 | s | 0.8 | 1.6 | s | 0.6 | 1.8 | s | 0.4 | 2.0 | s | 0.3 | 2.3 | s | 0.3 | 2.5 | s | 0.2 |
| 400 | 0.7 | b | 3.1 | 1.1 | s | 2.3 | 1.3 | s | 1.5 | 1.6 | s | 1.1 | 1.8 | s | 0.8 | 2.1 | s | 0.6 | 2.3 | s | 0.5 | 2.6 | s | 0.4 |
| 500 | 0.6 | b | 4.3 | 1.1 | b | 3.5 | 1.4 | s | 2.4 | 1.7 | s | 1.7 | 1.9 | s | 1.3 | 2.2 | s | 1.0 | 2.4 | s | 0.8 | 2.7 | s | 0.7 |
| 600 | 0.6 | b | 5.8 | 1.0 | b | 4.7 | 1.4 | s | 3.5 | 1.7 | s | 2.6 | 1.9 | s | 1.9 | 2.2 | s | 1.5 | 2.4 | s | 1.2 | 2.7 | s | 1.0 |
| 750 | 0.5 | b | 8.4 | 0.9 | b | 6.8 | 1.4 | s | 5.5 | 1.7 | s | 4.1 | 1.9 | s | 3.0 | 2.2 | s | 2.4 | 2.4 | s | 1.9 | 2.7 | s | 1.5 |
| 1000 | 0.5 | b | 13.5 | 0.8 | b | 10.9 | 1.3 | b | 9.1 | 1.7 | s | 7.4 | 2.0 | s | 5.4 | 2.3 | s | 4.3 | 2.5 | s | 3.4 | 2.8 | s | 2.8 |
| 1200 | 0.4 | b | 18.4 | 0.8 | b | 14.9 | 1.2 | b | 12.3 | 1.7 | b | 10.5 | 2.0 | s | 7.9 | 2.3 | s | 6.2 | 2.5 | s | 4.9 | 2.8 | s | 4.1 |
| 1500 | 0.4 | b | 26.8 | 0.7 | b | 21.6 | 1.1 | b | 17.9 | 1.6 | b | 15.3 | 1.9 | s | 12.2 | 2.3 | s | 9.6 | 2.5 | s | 7.6 | 2.8 | s | 6.3 |



Medium-term loading
Service class 1
$k_{mod} = 0.80$
$k_{def} = 0.25$
$\gamma_q = 1.5$
$\gamma_m = 1.3$
F given in kN
u given in mm
⟷ grain direction of surface veneers

Table 4-20. Combi Mirror plywood | A concentrated central load over an area of 50 x 50 mm on a simply supported plate | b = bending strength limitation s = shear strength limitation

| Span c/c | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| a x b | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 x 300 | 0.7 | b | 1.8 | 1.2 | b | 1.4 | 1.5 | s | 0.9 | 1.8 | s | 0.7 | 2.0 | s | 0.5 | 2.4 | s | 0.4 | 2.6 | s | 0.3 | 2.9 | s | 0.2 |
| 300 x 600 | 0.7 | b | 2.3 | 1.2 | s | 1.7 | 1.4 | s | 1.1 | 1.8 | s | 0.8 | 2.0 | s | 0.6 | 2.3 | s | 0.5 | 2.6 | s | 0.4 | 2.9 | s | 0.3 |
| 300 x ∞ | 0.7 | b | 2.3 | 1.2 | s | 1.8 | 1.4 | s | 1.1 | 1.8 | s | 0.8 | 2.0 | s | 0.6 | 2.3 | s | 0.5 | 2.6 | s | 0.4 | 2.9 | s | 0.3 |
| 400 x 400 | 0.6 | b | 2.8 | 1.1 | b | 2.2 | 1.5 | s | 1.6 | 1.8 | s | 1.2 | 2.0 | s | 0.9 | 2.4 | s | 0.7 | 2.6 | s | 0.5 | 2.9 | s | 0.4 |
| 400 x 800 | 0.6 | b | 3.6 | 1.1 | b | 2.9 | 1.5 | s | 2.0 | 1.8 | s | 1.5 | 2.0 | s | 1.1 | 2.3 | s | 0.9 | 2.6 | s | 0.7 | 2.9 | s | 0.6 |
| 400 x ∞ | 0.6 | b | 3.6 | 1.1 | b | 2.9 | 1.5 | s | 2.0 | 1.8 | s | 1.5 | 2.0 | s | 1.1 | 2.3 | s | 0.9 | 2.6 | s | 0.7 | 2.9 | s | 0.6 |
| 500 x 500 | 0.6 | b | 4.0 | 1.0 | b | 3.1 | 1.5 | b | 2.5 | 1.8 | s | 1.8 | 2.0 | s | 1.3 | 2.3 | s | 1.1 | 2.6 | s | 0.8 | 2.9 | s | 0.7 |
| 500 x 1000 | 0.6 | b | 5.1 | 1.0 | b | 4.1 | 1.5 | s | 3.2 | 1.8 | s | 2.3 | 2.0 | s | 1.7 | 2.3 | s | 1.3 | 2.6 | s | 1.1 | 2.9 | s | 0.9 |
| 500 x ∞ | 0.6 | b | 5.1 | 1.0 | b | 4.2 | 1.5 | s | 3.2 | 1.8 | s | 2.4 | 2.0 | s | 1.7 | 2.3 | s | 1.4 | 2.6 | s | 1.1 | 2.9 | s | 0.9 |
| 600 x 600 | 0.5 | b | 5.4 | 0.9 | b | 4.2 | 1.4 | b | 3.4 | 1.8 | s | 2.7 | 2.0 | s | 1.9 | 2.3 | s | 1.5 | 2.6 | s | 1.2 | 2.9 | s | 1.0 |
| 600 x 1200 | 0.5 | b | 6.8 | 0.9 | b | 5.5 | 1.4 | b | 4.6 | 1.8 | s | 3.4 | 2.0 | s | 2.5 | 2.3 | s | 2.0 | 2.6 | s | 1.5 | 2.9 | s | 1.3 |
| 600 x ∞ | 0.5 | b | 6.9 | 0.9 | b | 5.6 | 1.5 | s | 4.6 | 1.8 | s | 3.4 | 2.0 | s | 2.5 | 2.3 | s | 2.0 | 2.6 | s | 1.6 | 2.9 | s | 1.3 |
| 750 x 750 | 0.5 | b | 7.9 | 0.8 | b | 6.2 | 1.3 | b | 5.0 | 1.8 | s | 4.2 | 2.0 | s | 3.0 | 2.3 | s | 2.4 | 2.6 | s | 1.9 | 2.9 | s | 1.5 |
| 750 x 1500 | 0.5 | b | 9.9 | 0.9 | b | 8.0 | 1.3 | b | 6.6 | 1.8 | s | 5.3 | 2.0 | s | 3.9 | 2.3 | s | 3.1 | 2.6 | s | 2.4 | 2.9 | s | 2.0 |
| 750 x ∞ | 0.5 | b | 10.0 | 0.9 | b | 8.1 | 1.3 | b | 6.7 | 1.8 | s | 5.4 | 2.0 | s | 3.9 | 2.3 | s | 3.1 | 2.6 | s | 2.4 | 2.9 | s | 2.0 |
| 1000 x 1000 | 0.4 | b | 12.8 | 0.8 | b | 10.0 | 1.2 | b | 8.1 | 1.6 | b | 6.8 | 2.0 | s | 5.4 | 2.3 | s | 4.3 | 2.6 | s | 3.3 | 2.9 | s | 2.8 |
| 1000 x 2000 | 0.4 | b | 16.0 | 0.8 | b | 12.9 | 1.2 | b | 10.7 | 1.7 | b | 9.1 | 2.0 | s | 6.9 | 2.3 | s | 5.5 | 2.6 | s | 4.3 | 2.9 | s | 3.6 |
| 1000 x ∞ | 0.4 | b | 16.2 | 0.8 | b | 13.1 | 1.2 | b | 10.9 | 1.7 | b | 9.3 | 2.0 | s | 7.0 | 2.3 | s | 5.5 | 2.6 | s | 4.4 | 2.9 | s | 3.6 |
| 1200 x 1200 | 0.4 | b | 17.5 | 0.7 | b | 13.7 | 1.1 | b | 11.1 | 1.5 | b | 9.3 | 2.0 | s | 7.8 | 2.3 | s | 6.1 | 2.6 | s | 4.8 | 2.9 | s | 4.0 |
| 1200 x 2400 | 0.4 | b | 21.8 | 0.7 | b | 17.6 | 1.1 | b | 14.6 | 1.6 | b | 12.5 | 2.0 | s | 10.0 | 2.3 | s | 7.9 | 2.6 | s | 6.2 | 2.9 | s | 5.1 |
| 1500 x 1500 | 0.4 | b | 25.7 | 0.7 | b | 20.1 | 1.0 | b | 16.3 | 1.5 | b | 13.7 | 1.9 | b | 11.8 | 2.3 | s | 9.6 | 2.6 | s | 7.6 | 2.9 | s | 6.2 |
| 1500 x 3000 | 0.4 | b | 32.0 | 0.7 | b | 25.8 | 1.1 | b | 21.4 | 1.5 | b | 18.2 | 2.0 | s | 15.6 | 2.3 | s | 12.4 | 2.6 | s | 9.8 | 2.9 | s | 8.1 |




Medium-term loading

Service class 1

$k_{mod} = 0.80$

$k_{def} = 0.25$

$\gamma_q = 1.5$

$\gamma_m = 1.3$

F given in kN

u given in mm

⟷ grain direction of surface veneers

## 4.4 VEHICLE FLOORS

Below are presented, based on the general design principles, tabulated load resistance values for vehicle floors and the deflection values for different spans and thicknesses. Also, the tables show whether the bending or shear strength is design governing. The tables include the following support and load cases:

- A concentrated load over an area of 80 x 180 mm (the contact area of a forklift wheel) on a continuous plate strip with one and two equal span lengths (Tables 4-21, 4-22, 4-24 and 4-25).
- A concentrated load over an area of 80 x 180 mm (the contact area of a forklift wheel) on a simply supported plate (Tables 4-23 and 4-26).

Since it is reasonable to use a lower reliability in the design of vehicle floors than for the floors of buildings, the load resistances and deflections were calculated according to the following assumptions:

| | |
|---|---|
| $\gamma_q$ | = 1.0, the partial safety factor for load |
| $\gamma_m$ | = 1.0, the partial safety factor for the material |
| $k_{mod}$ | = 0.90, the factor taking into account the effect of duration of load and moisture content |
| $k_{def}$ | = 0.00, the factor taking into account the effect of duration of load and moisture content |

The design and deflection values are valid for service class 2 and load duration class short-term. For other assumptions, the tabulated load resistance values shall be multiplied by a correction factor $k_{load,\,corr}$ given by the formula 4-11:

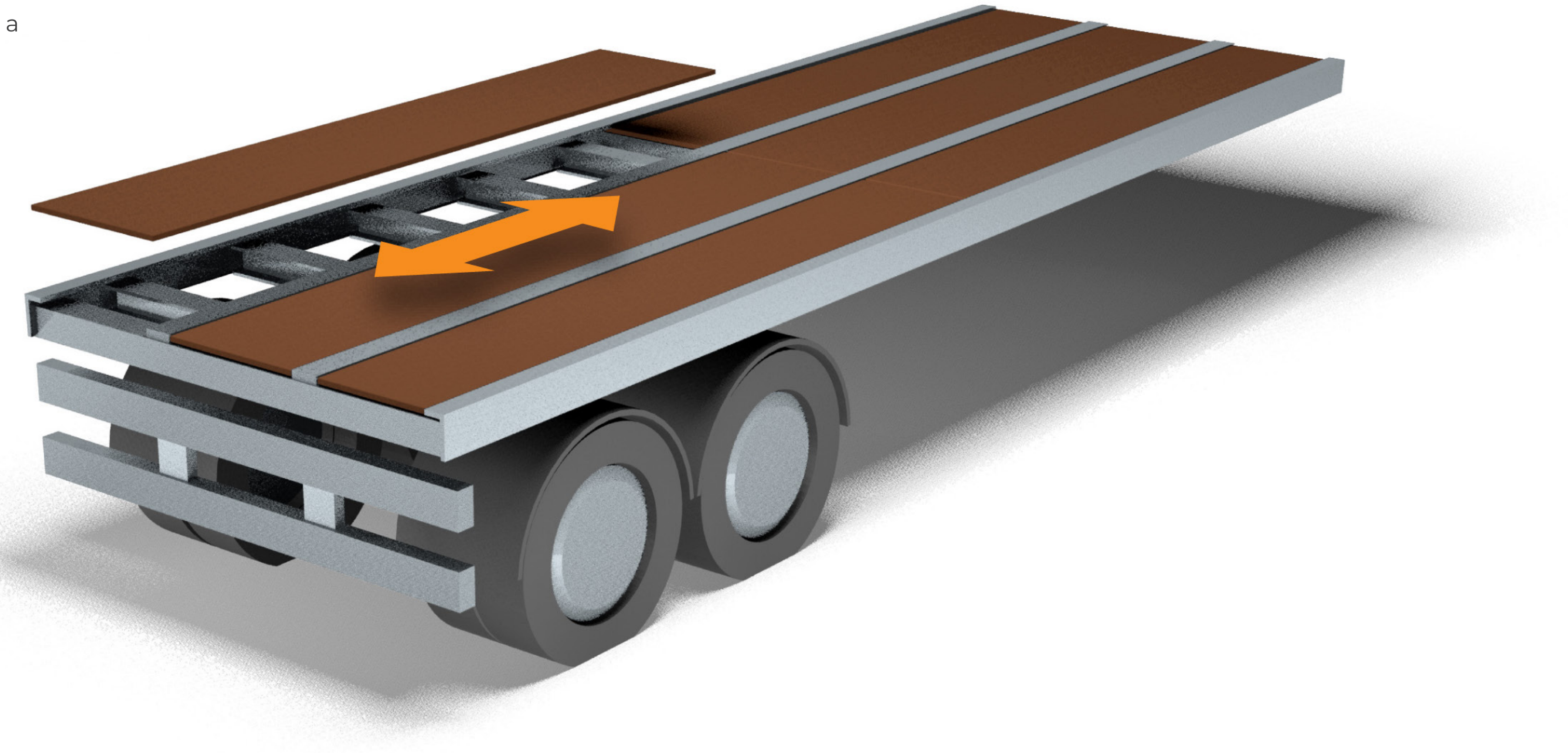
$$k_{load,\,corr} = \frac{k_{mod}}{\gamma_m \gamma_q} \cdot \frac{1.0 \cdot 1.0}{0.90}$$

Formula 4-11

The tabulated deflection values shall be multiplied by a correction factor $k_{def,\,corr}$ given by the formula 4-12:

$$k_{def,\,corr} = \frac{1 + k_{def}}{1 + 0.00} \cdot k_{load,\,corr} =$$

Formula 4-12

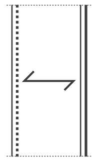


## LOAD RESISTANCE F [kN] AND CORRESPONDING DEFLECTION u [mm] VALUES FOR FINNISH PLYWOOD WHICH CAN BE USED IN THE DESIGN OF FLOORS EXPOSED TO LOADS CAUSED BY FORK LIFT TRUCKS.

Table 4-21. Birch plywood | A concentrated central load over an area of 80 x 180 mm on a single span plate strip | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 3.0 | b | 6.0 | 5.0 | b | 4.6 | 7.4 | b | 3.7 | 10.3 | b | 3.1 | 13.7 | b | 2.7 | 17.6 | b | 2.4 |
| 400 | 2.6 | b | 10.0 | 4.3 | b | 7.6 | 6.4 | b | 6.2 | 9.0 | b | 5.2 | 11.9 | b | 4.4 | 15.3 | b | 3.9 |
| 500 | 2.4 | b | 14.7 | 3.9 | b | 11.2 | 5.9 | b | 9.0 | 8.2 | b | 7.6 | 10.9 | b | 6.5 | 13.9 | b | 5.7 |
| 600 | 2.2 | b | 20.1 | 3.7 | b | 15.3 | 5.5 | b | 12.4 | 7.6 | b | 10.4 | 10.1 | b | 8.9 | 13.0 | b | 7.9 |
| 750 | 2.0 | b | 29.6 | 3.4 | b | 22.5 | 5.1 | b | 18.2 | 7.0 | b | 15.2 | 9.4 | b | 13.1 | 12.0 | b | 11.5 |
| 1000 | 1.9 | b | 48.7 | 3.1 | b | 37.0 | 4.6 | b | 29.9 | 6.4 | b | 25.1 | 8.5 | b | 21.6 | 11.0 | b | 19.0 |
| 1200 | 1.8 | b | 66.8 | 2.9 | b | 50.8 | 4.4 | b | 41.1 | 6.1 | b | 34.4 | 8.1 | b | 29.6 | 10.4 | b | 26.0 |
| 1500 | 1.7 | b | 98.5 | 2.7 | b | 75.0 | 4.1 | b | 60.6 | 5.7 | b | 50.8 | 7.6 | b | 43.7 | 9.7 | b | 38.4 |

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 21.9 | b | 2.1 | 26.7 | b | 1.9 | 37.8 | b | 1.6 | 45.9 | s | 1.2 | 48.9 | s | 1.1 | 55.3 | s | 0.8 |
| 400 | 19.1 | b | 3.5 | 23.3 | b | 3.1 | 33.0 | b | 2.6 | 44.3 | b | 2.3 | 49.7 | s | 2.1 | 56.2 | s | 1.6 |
| 500 | 17.4 | b | 5.1 | 21.2 | b | 4.6 | 30.1 | b | 3.9 | 40.4 | b | 3.3 | 46.0 | b | 3.1 | 56.6 | s | 2.6 |
| 600 | 16.2 | b | 7.0 | 19.8 | b | 6.3 | 28.0 | b | 5.3 | 37.7 | b | 4.5 | 43.0 | b | 4.2 | 54.8 | b | 3.7 |
| 750 | 15.0 | b | 10.3 | 18.3 | b | 9.3 | 25.9 | b | 7.8 | 34.8 | b | 6.7 | 39.7 | b | 6.2 | 50.6 | b | 5.5 |
| 1000 | 13.6 | b | 16.9 | 16.7 | b | 15.2 | 23.6 | b | 12.8 | 31.7 | b | 10.9 | 36.2 | b | 10.2 | 46.2 | b | 9.0 |
| 1200 | 12.9 | b | 23.2 | 15.8 | b | 20.9 | 22.4 | b | 17.5 | 30.1 | b | 15.0 | 34.3 | b | 14.0 | 43.7 | b | 12.4 |
| 1500 | 12.1 | b | 34.2 | 14.8 | b | 30.9 | 21.0 | b | 25.8 | 28.2 | b | 22.2 | 32.2 | b | 20.7 | 41.1 | b | 18.3 |



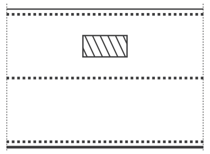
Short-term loading
Service class 2

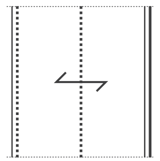
$k_{mod} = 0.90$
$k_{def} = 0.00$
$\gamma_q = 1.0$
$\gamma_m = 1.0$

F given in kN
u given in mm
⟵ grain direction of surface veneers

Table 4-22. Birch plywood | A concentrated load over an area of 80 x 180 mm on a double span plate strip at the centre of one span | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 3.5 | b | 5.4 | 5.8 | b | 4.1 | 8.6 | b | 3.4 | 11.9 | b | 2.8 | 15.8 | b | 2.4 | 20.3 | b | 2.1 | 22.7 | s | 1.7 | 25.4 | s | 1.4 | 30.2 | s | 1.0 | 35.0 | s | 0.7 | 37.3 | s | 0.6 | 42.2 | s | 0.5 |
| 400 | 3.0 | b | 8.9 | 4.9 | b | 6.8 | 7.3 | b | 5.5 | 10.2 | b | 4.6 | 13.6 | b | 4.0 | 17.4 | b | 3.5 | 21.7 | b | 3.1 | 26.5 | b | 2.8 | 32.8 | s | 2.0 | 38.1 | s | 1.5 | 40.5 | s | 1.3 | 45.8 | s | 1.0 |
| 500 | 2.7 | b | 13.0 | 4.4 | b | 9.9 | 6.6 | b | 8.0 | 9.2 | b | 6.7 | 12.2 | b | 5.8 | 15.7 | b | 5.1 | 19.5 | b | 4.5 | 23.9 | b | 4.1 | 33.8 | b | 3.4 | 40.0 | s | 2.6 | 42.6 | s | 2.3 | 48.1 | s | 1.8 |
| 600 | 2.5 | b | 17.8 | 4.1 | b | 13.5 | 6.1 | b | 10.9 | 8.5 | b | 9.2 | 11.3 | b | 7.9 | 14.5 | b | 6.9 | 18.1 | b | 6.2 | 22.1 | b | 5.6 | 31.3 | b | 4.7 | 41.3 | s | 3.9 | 44.0 | s | 3.4 | 49.7 | s | 2.7 |
| 750 | 2.3 | b | 26.0 | 3.8 | b | 19.8 | 5.6 | b | 16.0 | 7.8 | b | 13.4 | 10.4 | b | 11.5 | 13.3 | b | 10.1 | 16.6 | b | 9.0 | 20.2 | b | 8.1 | 28.7 | b | 6.8 | 38.5 | b | 5.8 | 43.9 | b | 5.5 | 51.2 | s | 4.4 |
| 1000 | 2.0 | b | 42.5 | 3.4 | b | 32.3 | 5.1 | b | 26.1 | 7.0 | b | 21.9 | 9.3 | b | 18.8 | 12.0 | b | 16.5 | 15.0 | b | 14.7 | 18.3 | b | 13.3 | 25.9 | b | 11.1 | 34.8 | b | 9.5 | 39.7 | b | 8.9 | 50.6 | b | 7.9 |
| 1200 | 1.9 | b | 58.1 | 3.2 | b | 44.2 | 4.8 | b | 35.7 | 6.6 | b | 29.9 | 8.8 | b | 25.7 | 11.3 | b | 22.6 | 14.1 | b | 20.1 | 17.2 | b | 18.2 | 24.4 | b | 15.2 | 32.8 | b | 13.0 | 37.4 | b | 12.2 | 47.7 | b | 10.8 |
| 1500 | 1.8 | b | 85.3 | 3.0 | b | 64.9 | 4.4 | b | 52.4 | 6.2 | b | 43.9 | 8.2 | b | 37.8 | 10.6 | b | 33.2 | 13.2 | b | 29.6 | 16.1 | b | 26.7 | 22.8 | b | 22.3 | 30.6 | b | 19.2 | 34.9 | b | 17.9 | 44.5 | b | 15.8 |





Short-term loading
Service class 2

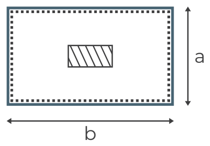
$k_{mod} = 0.90$
$k_{def} = 0.00$
$\gamma_q = 1.0$
$\gamma_m = 1.0$

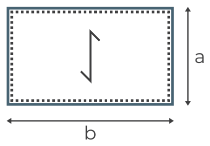
F given in kN
u given in mm
⟵⟶ grain direction of surface veneers

Table 4-23. Birch plywood | A concentrated central load over an area of 80 x 180 mm on a simply supported plate | b = bending strength limitation s = shear strength limitation

| Span c/c | Nominal thickness (mm) 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a x b | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 x 300 | 3.9 | b | 5.7 | 6.7 | b | 4.3 | 10.1 | b | 3.4 | 14.2 | b | 2.9 | 19.0 | b | 2.5 | 24.6 | b | 2.2 | 30.7 | b | 1.9 |
| 300 x 600 | 3.1 | b | 6.0 | 5.0 | b | 4.6 | 7.5 | b | 3.7 | 10.5 | b | 3.1 | 13.9 | b | 2.7 | 17.9 | b | 2.4 | 22.3 | b | 2.1 |
| 300 x ∞ | 3.0 | b | 6.0 | 5.0 | b | 4.6 | 7.4 | b | 3.7 | 10.3 | b | 3.1 | 13.7 | b | 2.7 | 17.6 | b | 2.4 | 21.9 | b | 2.1 |
| 400 x 400 | 3.3 | b | 9.3 | 5.5 | b | 7.0 | 8.3 | b | 5.6 | 11.7 | b | 4.7 | 15.7 | b | 4.0 | 20.2 | b | 3.5 | 25.3 | b | 3.1 |
| 400 x 800 | 2.6 | b | 10.0 | 4.4 | b | 7.6 | 6.5 | b | 6.1 | 9.1 | b | 5.1 | 12.1 | b | 4.4 | 15.6 | b | 3.9 | 19.4 | b | 3.5 |
| 400 x ∞ | 2.6 | b | 10.0 | 4.3 | b | 7.6 | 6.4 | b | 6.2 | 9.0 | b | 5.2 | 11.9 | b | 4.4 | 15.3 | b | 3.9 | 19.1 | b | 3.5 |
| 500 x 500 | 2.9 | b | 13.5 | 4.9 | b | 10.2 | 7.4 | b | 8.1 | 10.4 | b | 6.8 | 13.8 | b | 5.8 | 17.8 | b | 5.1 | 22.3 | b | 4.5 |
| 500 x 1000 | 2.4 | b | 14.6 | 4.0 | b | 11.1 | 5.9 | b | 9.0 | 8.3 | b | 7.5 | 11.0 | b | 6.5 | 14.2 | b | 5.7 | 17.6 | b | 5.1 |
| 500 x ∞ | 2.4 | b | 14.7 | 3.9 | b | 11.2 | 5.9 | b | 9.0 | 8.2 | b | 7.6 | 10.9 | b | 6.5 | 13.9 | b | 5.7 | 17.4 | b | 5.1 |
| 600 x 600 | 2.7 | b | 18.4 | 4.5 | b | 13.8 | 6.7 | b | 11.0 | 9.5 | b | 9.2 | 12.6 | b | 7.9 | 16.3 | b | 6.9 | 20.4 | b | 6.1 |
| 600 x 1200 | 2.2 | b | 20.1 | 3.7 | b | 15.3 | 5.5 | b | 12.3 | 7.7 | b | 10.3 | 10.3 | b | 8.9 | 13.2 | b | 7.8 | 16.4 | b | 6.9 |
| 600 x ∞ | 2.2 | b | 20.1 | 3.7 | b | 15.3 | 5.5 | b | 12.4 | 7.6 | b | 10.4 | 10.1 | b | 8.9 | 13.0 | b | 7.9 | 16.2 | b | 7.0 |
| 750 x 750 | 2.4 | b | 26.8 | 4.1 | b | 20.1 | 6.1 | b | 16.1 | 8.6 | b | 13.4 | 11.4 | b | 11.5 | 14.8 | b | 10.0 | 18.5 | b | 8.9 |
| 750 x 1500 | 2.1 | b | 29.5 | 3.4 | b | 22.4 | 5.1 | b | 18.1 | 7.1 | b | 15.1 | 9.5 | b | 13.0 | 12.2 | b | 11.4 | 15.2 | b | 10.2 |
| 750 x ∞ | 2.0 | b | 29.6 | 3.4 | b | 22.5 | 5.1 | b | 18.2 | 7.0 | b | 15.2 | 9.4 | b | 13.1 | 12.0 | b | 11.5 | 15.0 | b | 10.3 |
| 1000 x 1000 | 2.2 | b | 43.7 | 3.6 | b | 32.7 | 5.5 | b | 26.1 | 7.7 | b | 21.7 | 10.2 | b | 18.6 | 13.2 | b | 16.3 | 16.5 | b | 14.4 |
| 1000 x 2000 | 1.9 | b | 48.5 | 3.1 | b | 36.8 | 4.6 | b | 29.7 | 6.5 | b | 24.9 | 8.6 | b | 21.4 | 11.1 | b | 18.8 | 13.8 | b | 16.7 |
| 1000 x ∞ | 1.9 | b | 48.7 | 3.1 | b | 37.0 | 4.6 | b | 29.9 | 6.4 | b | 25.1 | 8.5 | b | 21.6 | 11.0 | b | 19.0 | 13.6 | b | 16.9 |
| 1200 x 1200 | 2.0 | b | 59.6 | 3.4 | b | 44.5 | 5.1 | b | 35.6 | 7.2 | b | 29.6 | 9.6 | b | 25.3 | 12.3 | b | 22.2 | 15.4 | b | 19.7 |
| 1200 x 2400 | 1.8 | b | 66.5 | 2.9 | b | 50.5 | 4.4 | b | 40.8 | 6.1 | b | 34.1 | 8.2 | b | 29.3 | 10.5 | b | 25.8 | 13.1 | b | 22.9 |
| 1500 x 1500 | 1.9 | b | 87.3 | 3.2 | b | 65.2 | 4.7 | b | 52.1 | 6.7 | b | 43.3 | 8.9 | b | 37.0 | 11.5 | b | 32.4 | 14.3 | b | 28.7 |
| 1500 x 3000 | 1.7 | b | 98.1 | 2.8 | b | 74.5 | 4.1 | b | 60.1 | 5.8 | b | 50.3 | 7.6 | b | 43.3 | 9.8 | b | 38.0 | 12.3 | b | 33.8 |

| Span c/c | Nominal thickness (mm) 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a x b | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 x 300 | 37.7 | b | 1.7 | 45.1 | s | 1.2 | 52.4 | s | 0.9 | 55.8 | s | 0.8 | 63.1 | s | 0.6 |
| 300 x 600 | 27.3 | b | 1.9 | 38.6 | b | 1.6 | 46.4 | s | 1.2 | 49.4 | s | 1.1 | 55.8 | s | 0.8 |
| 300 x ∞ | 26.7 | b | 1.9 | 37.8 | b | 1.6 | 45.9 | s | 1.2 | 48.9 | s | 1.1 | 55.3 | s | 0.8 |
| 400 x 400 | 31.0 | b | 2.8 | 43.3 | s | 2.3 | 50.2 | s | 1.7 | 53.5 | s | 1.5 | 60.5 | s | 1.2 |
| 400 x 800 | 23.7 | b | 3.1 | 33.6 | b | 2.6 | 45.1 | b | 2.2 | 50.0 | s | 2.0 | 56.5 | s | 1.6 |
| 400 x ∞ | 23.3 | b | 3.1 | 33.0 | b | 2.6 | 44.3 | b | 2.3 | 49.7 | s | 2.1 | 56.2 | s | 1.6 |
| 500 x 500 | 27.3 | b | 4.1 | 38.9 | b | 3.4 | 49.3 | s | 2.7 | 52.5 | s | 2.4 | 59.3 | s | 1.9 |
| 500 x 1000 | 21.6 | b | 4.6 | 30.6 | b | 3.8 | 41.1 | b | 3.3 | 46.8 | b | 3.1 | 56.8 | s | 2.6 |
| 500 x ∞ | 21.2 | b | 4.6 | 30.1 | b | 3.9 | 40.4 | b | 3.3 | 46.0 | b | 3.1 | 56.6 | s | 2.6 |
| 600 x 600 | 25.0 | b | 5.5 | 35.5 | b | 4.6 | 47.8 | b | 3.9 | 51.9 | s | 3.5 | 58.7 | s | 2.7 |
| 600 x 1200 | 20.1 | b | 6.3 | 28.5 | b | 5.2 | 38.3 | b | 4.5 | 43.6 | b | 4.2 | 55.7 | b | 3.7 |
| 600 x ∞ | 19.8 | b | 6.3 | 28.0 | b | 5.3 | 37.7 | b | 4.5 | 43.0 | b | 4.2 | 54.8 | b | 3.7 |
| 750 x 750 | 22.6 | b | 8.0 | 32.1 | b | 6.7 | 43.3 | b | 5.7 | 49.4 | b | 5.3 | 58.2 | s | 4.3 |
| 750 x 1500 | 18.5 | b | 9.2 | 26.3 | b | 7.7 | 35.3 | b | 6.6 | 40.3 | b | 6.2 | 51.4 | b | 5.4 |
| 750 x ∞ | 18.3 | b | 9.3 | 25.9 | b | 7.8 | 34.8 | b | 6.7 | 39.7 | b | 6.2 | 50.6 | b | 5.5 |
| 1000 x 1000 | 20.2 | b | 13.0 | 28.7 | b | 10.8 | 38.6 | b | 9.3 | 44.1 | b | 8.6 | 56.3 | b | 7.6 |
| 1000 x 2000 | 16.9 | b | 15.1 | 23.9 | b | 12.6 | 32.1 | b | 10.8 | 36.7 | b | 10.1 | 46.8 | b | 8.9 |
| 1000 x ∞ | 16.7 | b | 15.2 | 23.6 | b | 12.8 | 31.7 | b | 10.9 | 36.2 | b | 10.2 | 46.2 | b | 9.0 |
| 1200 x 1200 | 18.9 | b | 17.7 | 26.8 | b | 14.7 | 36.1 | b | 12.6 | 41.2 | b | 11.8 | 52.7 | b | 10.4 |
| 1200 x 2400 | 16.0 | b | 20.7 | 22.6 | b | 17.3 | 30.4 | b | 14.9 | 34.7 | b | 13.9 | 44.3 | b | 12.3 |
| 1500 x 1500 | 17.5 | b | 25.9 | 24.9 | b | 21.6 | 33.5 | b | 18.4 | 38.2 | b | 17.2 | 48.8 | b | 15.2 |
| 1500 x 3000 | 15.0 | b | 30.6 | 21.2 | b | 25.5 | 28.5 | b | 21.9 | 32.6 | b | 20.5 | 41.6 | b | 18.1 |




Short-term loading

Service class 2

$k_{mod}$ = 0.90

$k_{def}$ = 0.00

$\gamma_q$ = 1.0

$\gamma_m$ = 1.0

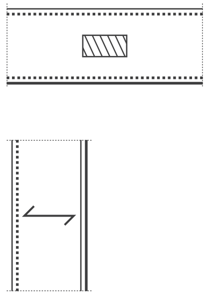
F given in kN

u given in mm

⟷ grain direction of surface veneers

Table 4-24. Combi plywood | A concentrated central load over an area of 80 x 180 mm on a single span plate strip | b = bending strength limitation s = shear strength limitation

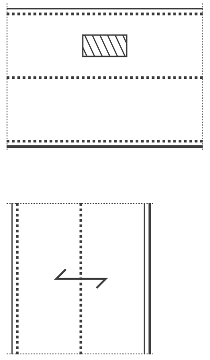
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 2.9 | b | 6.0 | 4.7 | b | 4.6 | 6.8 | b | 3.7 | 9.4 | b | 3.1 | 12.3 | b | 2.7 | 15.2 | b | 2.3 | 18.3 | b | 2.0 | 21.5 | b | 1.8 |
| 400 | 2.5 | b | 10.0 | 4.1 | b | 7.6 | 6.0 | b | 6.1 | 8.2 | b | 5.1 | 10.7 | b | 4.4 | 13.3 | b | 3.8 | 16.0 | b | 3.3 | 18.8 | b | 2.9 |
| 500 | 2.3 | b | 14.7 | 3.7 | b | 11.1 | 5.4 | b | 9.0 | 7.4 | b | 7.5 | 9.7 | b | 6.5 | 12.1 | b | 5.6 | 14.5 | b | 4.8 | 17.1 | b | 4.3 |
| 600 | 2.2 | b | 20.1 | 3.5 | b | 15.3 | 5.1 | b | 12.3 | 6.9 | b | 10.3 | 9.1 | b | 8.9 | 11.3 | b | 7.7 | 13.6 | b | 6.6 | 16.0 | b | 5.8 |
| 750 | 2.0 | b | 29.5 | 3.2 | b | 22.4 | 4.7 | b | 18.1 | 6.4 | b | 15.2 | 8.4 | b | 13.0 | 10.5 | b | 11.2 | 12.6 | b | 9.7 | 14.8 | b | 8.6 |
| 1000 | 1.8 | b | 48.5 | 2.9 | b | 36.9 | 4.3 | b | 29.7 | 5.8 | b | 24.9 | 7.7 | b | 21.4 | 9.5 | b | 18.5 | 11.4 | b | 16.0 | 13.5 | b | 14.1 |
| 1200 | 1.7 | b | 66.6 | 2.8 | b | 50.6 | 4.0 | b | 40.8 | 5.5 | b | 34.2 | 7.3 | b | 29.4 | 9.0 | b | 25.3 | 10.8 | b | 21.9 | 12.7 | b | 19.3 |
| 1500 | 1.6 | b | 98.3 | 2.6 | b | 74.6 | 3.8 | b | 60.2 | 5.2 | b | 50.5 | 6.8 | b | 43.4 | 8.5 | b | 37.4 | 10.2 | b | 32.3 | 12.0 | b | 28.5 |



Short-term loading
Service class 2
$k_{mod}$ = 0.90
$k_{def}$ = 0.00
$\gamma_q$ = 1.0
$\gamma_m$ = 1.0
F given in kN
u given in mm
⟷ grain direction of surface veneers

Table 4-25. Combi plywood | A concentrated load over an area of 80 x 180 mm on a double span plate strip at the centre of one span | b = bending strength limitation s = shear strength limitation

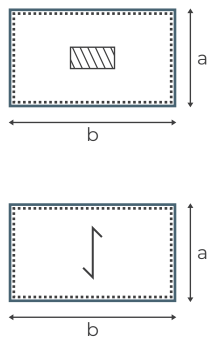
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 | 3.4 | b | 5.4 | 5.4 | b | 4.1 | 7.9 | b | 3.3 | 10.8 | b | 2.8 | 14.5 | s | 2.4 | 17.6 | s | 2.1 | 21.0 | s | 1.8 | 22.9 | s | 1.5 |
| 400 | 2.9 | b | 8.9 | 4.7 | b | 6.8 | 6.8 | b | 5.5 | 9.3 | b | 4.6 | 12.2 | b | 3.9 | 15.1 | b | 3.4 | 18.1 | b | 2.9 | 20.9 | s | 2.5 |
| 500 | 2.6 | b | 13.0 | 4.2 | b | 9.9 | 6.1 | b | 8.0 | 8.4 | b | 6.7 | 11.0 | b | 5.8 | 13.6 | b | 5.0 | 16.3 | b | 4.3 | 19.2 | b | 3.8 |
| 600 | 2.4 | b | 17.7 | 3.9 | b | 13.5 | 5.6 | b | 10.9 | 7.7 | b | 9.1 | 10.1 | b | 7.8 | 12.6 | b | 6.8 | 15.1 | b | 5.8 | 17.8 | b | 5.2 |
| 750 | 2.2 | b | 25.9 | 3.5 | b | 19.7 | 5.2 | b | 15.9 | 7.1 | b | 13.3 | 9.3 | b | 11.4 | 11.6 | b | 9.9 | 13.9 | b | 8.5 | 16.3 | b | 7.5 |
| 1000 | 2.0 | b | 42.4 | 3.2 | b | 32.2 | 4.7 | b | 25.9 | 6.4 | b | 21.7 | 8.4 | b | 18.7 | 10.5 | b | 16.1 | 12.5 | b | 13.9 | 14.7 | b | 12.3 |
| 1200 | 1.9 | b | 57.9 | 3.0 | b | 44.0 | 4.4 | b | 35.5 | 6.0 | b | 29.7 | 7.9 | b | 25.6 | 9.8 | b | 22.0 | 11.8 | b | 19.0 | 13.9 | b | 16.8 |
| 1500 | 1.7 | b | 85.1 | 2.8 | b | 64.6 | 4.1 | b | 52.1 | 5.6 | b | 43.7 | 7.4 | b | 37.5 | 9.2 | b | 32.3 | 11.0 | b | 28.0 | 13.0 | b | 24.7 |



Short-term loading
Service class 2
$k_{mod}$ = 0.90
$k_{def}$ = 0.00
$\gamma_q$ = 1.0
$\gamma_m$ = 1.0
F given in kN
u given in mm
⟷ grain direction of surface veneers

Table 4-26. Combi plywood | A concentrated central load over an area of 80 x 180 mm on a simply supported plate | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| a x b | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u | F | | u |
| 300 x 300 | 3.8 | b | 5.6 | 6.4 | b | 4.2 | 9.5 | b | 3.4 | 12.7 | s | 2.7 | 15.0 | s | 2.1 | 16.5 | s | 1.6 | 18.7 | s | 1.3 | 20.4 | s | 1.0 |
| 300 x 600 | 3.0 | b | 6.0 | 4.8 | b | 4.6 | 7.0 | b | 3.7 | 9.6 | b | 3.1 | 12.5 | b | 2.7 | 15.6 | b | 2.3 | 18.7 | b | 2.0 | 22.0 | s | 1.8 |
| 300 x ∞ | 2.9 | b | 6.0 | 4.7 | b | 4.6 | 6.8 | b | 3.7 | 9.4 | b | 3.1 | 12.3 | b | 2.7 | 15.2 | b | 2.3 | 18.3 | b | 2.0 | 21.5 | b | 1.8 |
| 400 x 400 | 3.2 | b | 9.2 | 5.3 | b | 6.9 | 7.8 | b | 5.5 | 10.9 | b | 4.6 | 14.3 | s | 3.9 | 15.9 | s | 3.0 | 18.0 | s | 2.4 | 19.6 | s | 2.0 |
| 400 x 800 | 2.6 | b | 9.9 | 4.1 | b | 7.5 | 6.1 | b | 6.1 | 8.3 | b | 5.1 | 10.9 | b | 4.4 | 13.6 | b | 3.8 | 16.3 | b | 3.3 | 19.2 | b | 2.9 |
| 400 x ∞ | 2.5 | b | 10.0 | 4.1 | b | 7.6 | 6.0 | b | 6.1 | 8.2 | b | 5.1 | 10.7 | b | 4.4 | 13.3 | b | 3.8 | 16.0 | b | 3.3 | 18.8 | b | 2.9 |
| 500 x 500 | 2.8 | b | 13.4 | 4.6 | b | 10.1 | 6.9 | b | 8.0 | 9.6 | b | 6.7 | 12.7 | b | 5.7 | 15.4 | s | 4.7 | 17.4 | s | 3.8 | 19.0 | s | 3.1 |
| 500 x 1000 | 2.3 | b | 14.6 | 3.8 | b | 11.1 | 5.5 | b | 8.9 | 7.6 | b | 7.5 | 9.9 | b | 6.4 | 12.3 | b | 5.5 | 14.8 | b | 4.8 | 17.4 | b | 4.2 |
| 500 x ∞ | 2.3 | b | 14.7 | 3.7 | b | 11.1 | 5.4 | b | 9.0 | 7.4 | b | 7.5 | 9.7 | b | 6.5 | 12.1 | b | 5.6 | 14.5 | b | 4.8 | 17.1 | b | 4.3 |
| 600 x 600 | 2.6 | b | 18.3 | 4.3 | b | 13.7 | 6.3 | b | 10.9 | 8.7 | b | 9.0 | 11.6 | b | 7.7 | 14.5 | b | 6.6 | 17.0 | s | 5.6 | 18.6 | s | 4.6 |
| 600 x 1200 | 2.2 | b | 20.0 | 3.5 | b | 15.2 | 5.1 | b | 12.2 | 7.0 | b | 10.3 | 9.2 | b | 8.8 | 11.5 | b | 7.6 | 13.8 | b | 6.6 | 16.2 | b | 5.8 |
| 600 x ∞ | 2.2 | b | 20.1 | 3.5 | b | 15.3 | 5.1 | b | 12.3 | 6.9 | b | 10.3 | 9.1 | b | 8.9 | 11.3 | b | 7.7 | 13.6 | b | 6.6 | 16.0 | b | 5.8 |
| 750 x 750 | 2.3 | b | 26.6 | 3.9 | b | 19.9 | 5.7 | b | 15.8 | 7.9 | b | 13.1 | 10.5 | b | 11.2 | 13.1 | b | 9.6 | 15.8 | b | 8.3 | 18.3 | s | 7.2 |
| 750 x 1500 | 2.0 | b | 29.4 | 3.2 | b | 22.3 | 4.7 | b | 18.0 | 6.5 | b | 15.0 | 8.5 | b | 12.9 | 10.6 | b | 11.1 | 12.8 | b | 9.6 | 15.0 | b | 8.5 |
| 750 x ∞ | 2.0 | b | 29.5 | 3.2 | b | 22.4 | 4.7 | b | 18.1 | 6.4 | b | 15.2 | 8.4 | b | 13.0 | 10.5 | b | 11.2 | 12.6 | b | 9.7 | 14.8 | b | 8.6 |
| 1000 x 1000 | 2.1 | b | 43.4 | 3.4 | b | 32.3 | 5.1 | b | 25.7 | 7.1 | b | 21.3 | 9.3 | b | 18.2 | 11.7 | b | 15.5 | 14.1 | b | 13.4 | 16.5 | b | 11.8 |
| 1000 x 2000 | 1.8 | b | 48.3 | 2.9 | b | 36.6 | 4.3 | b | 29.5 | 5.9 | b | 24.7 | 7.8 | b | 21.2 | 9.7 | b | 18.3 | 11.6 | b | 15.8 | 13.7 | b | 13.9 |
| 1000 x ∞ | 1.8 | b | 48.5 | 2.9 | b | 36.9 | 4.3 | b | 29.7 | 5.8 | b | 24.9 | 7.7 | b | 21.4 | 9.5 | b | 18.5 | 11.4 | b | 16.0 | 13.5 | b | 14.1 |
| 1200 x 1200 | 2.0 | b | 59.2 | 3.2 | b | 44.0 | 4.8 | b | 34.7 | 6.6 | b | 29.0 | 8.7 | b | 24.7 | 10.9 | b | 21.2 | 13.1 | b | 18.2 | 15.5 | b | 16.1 |
| 1200 x 2400 | 1.7 | b | 66.3 | 2.8 | b | 50.3 | 4.1 | b | 40.5 | 5.6 | b | 33.9 | 7.3 | b | 29.1 | 9.2 | b | 25.1 | 11.0 | b | 21.7 | 12.9 | b | 19.1 |
| 1500 x 1500 | 1.8 | b | 86.7 | 3.0 | b | 64.4 | 4.4 | b | 51.1 | 6.1 | b | 42.4 | 8.1 | b | 36.1 | 10.1 | b | 30.9 | 12.2 | b | 26.6 | 14.3 | b | 23.5 |
| 1500 x 3000 | 1.6 | b | 97.8 | 2.6 | b | 74.1 | 3.8 | b | 59.7 | 5.3 | b | 50.0 | 6.9 | b | 43.0 | 8.6 | b | 37.0 | 10.3 | b | 32.0 | 12.1 | b | 28.2 |




Short-term loading

Service class 2

$k_{mod} = 0.90$

$k_{def} = 0.00$

$\gamma_q = 1.0$

$\gamma_m = 1.0$

F given in kN

u given in mm

⟷ grain direction of surface veneers

## 4.5 CONCRETE FORMWORK

The majority of Finnish plywood used in concrete formwork is film coated. The strength and stiffness of the formwork board depends on the type of plywood used. Below are presented, based on the general design principles, tabulated load resistance values for concrete formwork and the deflection values for different spans and thicknesses. Information is also given whether the bending or shear strength is design governing. The pre-set deflection value for formwork board is, however, in most cases design governing. The tables include the following support and load cases:

- A uniformly distributed load on a continuous plate strip with three equal span lengths (Tables 4-27 to 4-30).

The load resistances and deflections were calculated according to the following assumptions:

$\gamma_q$ = 1.2, the partial safety factor for load

$\gamma_m$ = 1.3, the partial safety factor for the material

$k_{mod}$ = 0.70, the factor taking into account the effect of duration of load and moisture content

$k_{def}$ = 0.40, the factor taking into account the effect of duration of load and moisture content

The design and deflection values are valid for service class 3 a and load duration class short-term. For other assumptions the tabulated load resistance values shall be multiplied by a correction factor $k_{load,\,corr}$ given by the formula 4-13:

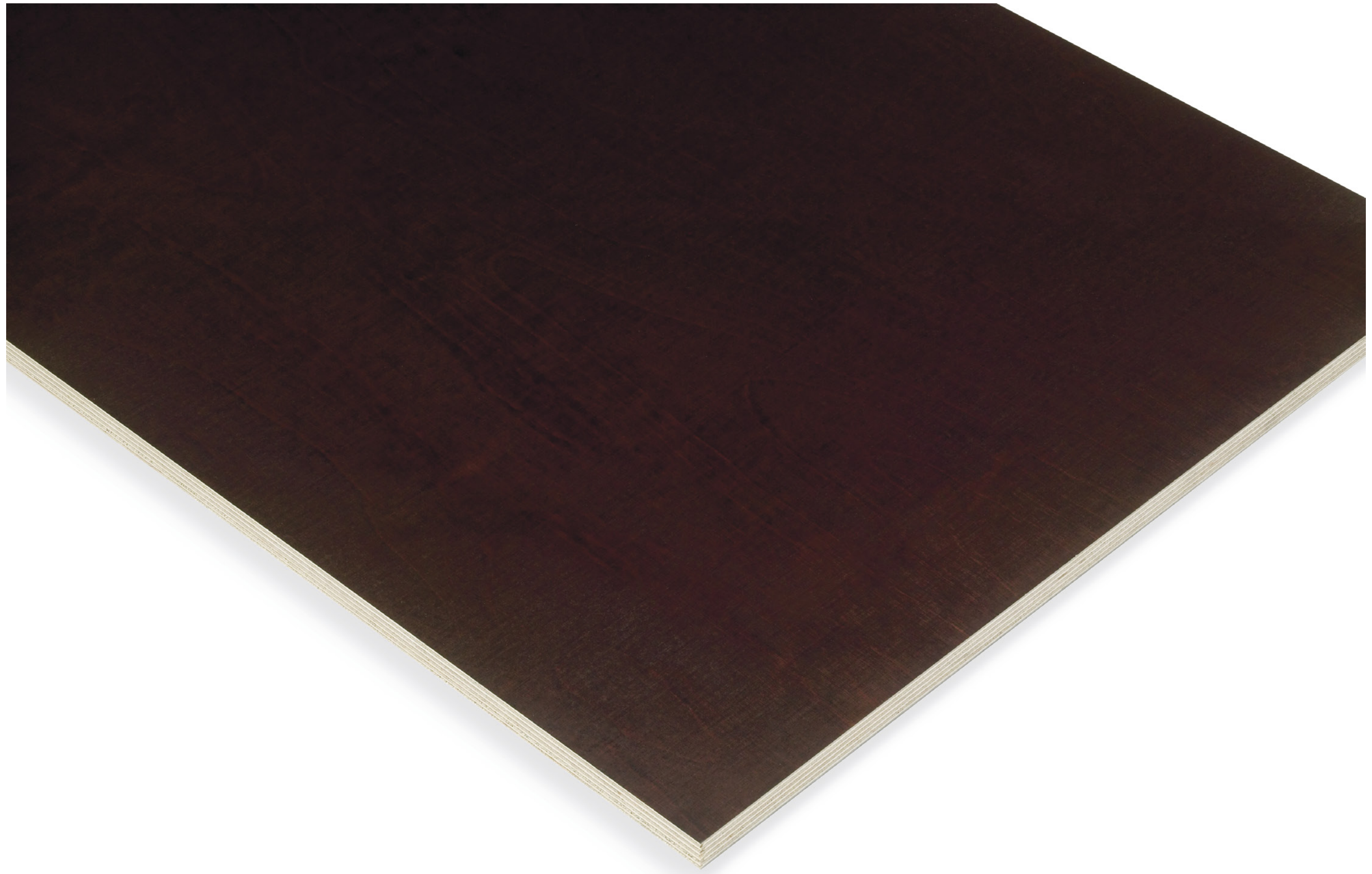
$$k_{load,\,corr} = \frac{k_{mod}}{\gamma m \gamma q} \bullet \frac{1.3 \bullet 1.2}{0.70}$$

Formula 4-13

The tabulated deflection values shall be multiplied by a correction factor $k_{def,\,corr}$ given by the formula 4-14:

$$k_{def,\,corr} = \frac{1 + k_{def}}{\gamma m \gamma q} \bullet k_{load,\,corr} =$$

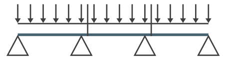
Formula 4-14

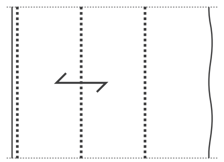


## LOAD RESISTANCE Q [kN/m²] AND CORRESPONDING DEFLECTION u [mm] VALUES FOR FINNISH PLYWOOD TO BE USED IN THE DESIGN OF CONCRETE FORMWORK

Table 4-27. Birch plywood | A uniformly distributed load on a continuous plate strip with three equal span lengths. Face grain parallel to span. | b = bending strength limitation  s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 100 | 123 | s | 0.3 | 166 | s | 0.3 | 193 | s | 0.2 | 234 | s | 0.2 | 263 | s | 0.2 | 303 | s | 0.2 | 333 | s | 0.2 | 372 | s | 0.2 | 441 | s | 0.2 | 511 | s | 0.1 | 544 | s | 0.1 | 613 | s | 0.1 |
| 150 | 82 | s | 0.8 | 111 | s | 0.6 | 129 | s | 0.4 | 156 | s | 0.4 | 176 | s | 0.3 | 202 | s | 0.3 | 222 | s | 0.3 | 248 | s | 0.3 | 294 | s | 0.3 | 340 | s | 0.2 | 363 | s | 0.2 | 409 | s | 0.2 |
| 200 | 61 | s | 1.6 | 83 | s | 1.1 | 97 | s | 0.8 | 117 | s | 0.7 | 132 | s | 0.6 | 152 | s | 0.5 | 167 | s | 0.5 | 186 | s | 0.4 | 220 | s | 0.4 | 255 | s | 0.4 | 272 | s | 0.3 | 306 | s | 0.3 |
| 250 | 46 | b | 2.7 | 67 | s | 2.0 | 77 | s | 1.4 | 94 | s | 1.1 | 105 | s | 0.9 | 121 | s | 0.8 | 133 | s | 0.7 | 149 | s | 0.6 | 176 | s | 0.6 | 204 | s | 0.5 | 218 | s | 0.5 | 245 | s | 0.5 |
| 300 | 32 | b | 3.7 | 51 | b | 3.0 | 64 | s | 2.2 | 78 | s | 1.8 | 88 | s | 1.4 | 101 | s | 1.2 | 111 | s | 1.0 | 124 | s | 0.9 | 147 | s | 0.8 | 170 | s | 0.7 | 181 | s | 0.7 | 204 | s | 0.6 |
| 350 | 24 | b | 5.0 | 38 | b | 4.0 | 55 | b | 3.4 | 67 | s | 2.6 | 75 | s | 2.1 | 87 | s | 1.7 | 95 | s | 1.5 | 106 | s | 1.3 | 126 | s | 1.1 | 146 | s | 0.9 | 155 | s | 0.9 | 175 | s | 0.8 |
| 400 | 18 | b | 6.4 | 29 | b | 5.0 | 42 | b | 4.2 | 58 | b | 3.7 | 66 | s | 2.9 | 76 | s | 2.4 | 83 | s | 2.0 | 93 | s | 1.8 | 110 | s | 1.4 | 128 | s | 1.2 | 136 | s | 1.1 | 153 | s | 1.0 |
| 500 | 12 | b | 9.8 | 18 | b | 7.6 | 27 | b | 6.4 | 37 | b | 5.5 | 49 | b | 4.9 | 61 | s | 4.3 | 67 | s | 3.6 | 74 | s | 3.1 | 88 | s | 2.4 | 102 | s | 1.9 | 109 | s | 1.8 | 123 | s | 1.5 |
| 600 | 8 | b | 13.9 | 13 | b | 10.8 | 19 | b | 8.9 | 26 | b | 7.7 | 34 | b | 6.8 | 43 | b | 6.1 | 54 | b | 5.6 | 62 | s | 4.9 | 73 | s | 3.7 | 85 | s | 3.0 | 91 | s | 2.7 | 102 | s | 2.3 |





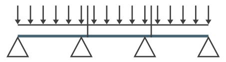
Short-term loading
Service class 3

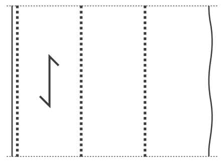
$k_{mod} = 0.70$
$k_{def} = 0.40$
$\gamma_q = 1.2$
$\gamma_m = 1.3$

q given in kN/m²
u given in mm
⟷ grain direction of surface veneers

Table 4-28. Birch plywood | A uniformly distributed load on a continuous plate strip with three equal span lengths. Face grain perpendicular to span. | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | | 35 | | | 40 | | | 45 | | | 50 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 100 | 108 | s | 0.4 | 133 | s | 0.3 | 176 | s | 0.2 | 205 | s | 0.2 | 245 | s | 0.2 | 276 | s | 0.2 | 315 | s | 0.2 | 346 | s | 0.2 | 417 | s | 0.2 | 487 | s | 0.2 | 525 | s | 0.1 | 594 | s | 0.1 |
| 150 | 72 | s | 1.1 | 89 | s | 0.7 | 118 | s | 0.5 | 137 | s | 0.4 | 163 | s | 0.4 | 184 | s | 0.3 | 210 | s | 0.3 | 231 | s | 0.3 | 278 | s | 0.3 | 324 | s | 0.2 | 350 | s | 0.2 | 396 | s | 0.2 |
| 200 | 51 | b | 2.3 | 66 | s | 1.3 | 88 | s | 1.0 | 103 | s | 0.8 | 123 | s | 0.6 | 138 | s | 0.5 | 158 | s | 0.5 | 173 | s | 0.4 | 208 | s | 0.4 | 243 | s | 0.4 | 262 | s | 0.4 | 297 | s | 0.3 |
| 250 | 33 | b | 3.4 | 53 | s | 2.4 | 71 | s | 1.7 | 82 | s | 1.3 | 98 | s | 1.0 | 111 | s | 0.9 | 126 | s | 0.8 | 138 | s | 0.7 | 167 | s | 0.6 | 195 | s | 0.5 | 210 | s | 0.5 | 237 | s | 0.5 |
| 300 | 23 | b | 4.8 | 40 | b | 3.6 | 59 | s | 2.8 | 68 | s | 2.0 | 82 | s | 1.6 | 92 | s | 1.3 | 105 | s | 1.1 | 115 | s | 1.0 | 139 | s | 0.8 | 162 | s | 0.7 | 175 | s | 0.7 | 198 | s | 0.6 |
| 350 | 17 | b | 6.4 | 29 | b | 4.7 | 45 | b | 3.8 | 59 | s | 3.0 | 70 | s | 2.4 | 79 | s | 1.9 | 90 | s | 1.6 | 99 | s | 1.4 | 119 | s | 1.1 | 139 | s | 0.9 | 150 | s | 0.9 | 170 | s | 0.8 |
| 400 | 13 | b | 8.2 | 22 | b | 6.1 | 35 | b | 4.9 | 49 | b | 4.2 | 61 | s | 3.4 | 69 | s | 2.7 | 79 | s | 2.3 | 87 | s | 1.9 | 104 | s | 1.5 | 122 | s | 1.2 | 131 | s | 1.2 | 148 | s | 1.0 |
| 500 | 8 | b | 12.7 | 14 | b | 9.2 | 22 | b | 7.4 | 32 | b | 6.2 | 43 | b | 5.4 | 55 | s | 4.8 | 63 | s | 4.0 | 69 | s | 3.3 | 83 | s | 2.5 | 97 | s | 2.0 | 105 | s | 1.9 | 119 | s | 1.6 |
| 600 | 6 | b | 18.2 | 10 | b | 13.1 | 15 | b | 10.4 | 22 | b | 8.7 | 30 | b | 7.5 | 38 | b | 6.7 | 48 | b | 6.0 | 58 | s | 5.4 | 69 | s | 4.0 | 81 | s | 3.2 | 87 | s | 2.9 | 99 | s | 2.4 |





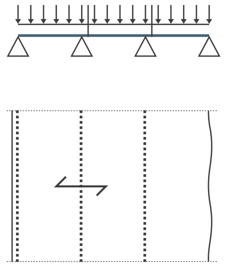
Short-term loading
Service class 3

$k_{mod}$ = 0.70
$k_{def}$ = 0.40
$\gamma_q$ = 1.2
$\gamma_m$ = 1.3

q given in kN/m²
u given in mm
⟷ grain direction of surface veneers

Table 4-29. Combi plywood | A uniformly distributed load on a continuous plate strip with three equal span lengths. Face grain parallel to span. | b = bending strength limitation s = shear strength limitation

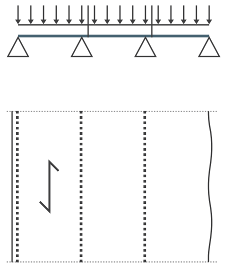
| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 100 | 123 | s | 0.3 | 166 | s | 0.3 | 193 | s | 0.2 | 234 | s | 0.2 | 263 | s | 0.2 | 303 | s | 0.2 | 333 | s | 0.2 | 372 | s | 0.2 |
| 150 | 82 | s | 0.8 | 111 | s | 0.6 | 129 | s | 0.4 | 156 | s | 0.4 | 176 | s | 0.3 | 202 | s | 0.3 | 222 | s | 0.3 | 248 | s | 0.3 |
| 200 | 61 | s | 1.6 | 83 | s | 1.2 | 97 | s | 0.8 | 117 | s | 0.7 | 132 | s | 0.6 | 152 | s | 0.5 | 167 | s | 0.5 | 186 | s | 0.4 |
| 250 | 44 | b | 2.7 | 67 | b | 2.0 | 77 | s | 1.4 | 94 | s | 1.1 | 105 | s | 0.9 | 121 | s | 0.8 | 133 | s | 0.7 | 149 | s | 0.6 |
| 300 | 31 | b | 3.7 | 48 | b | 3.0 | 64 | s | 2.2 | 78 | s | 1.8 | 88 | s | 1.4 | 101 | s | 1.2 | 111 | s | 1.0 | 124 | s | 0.9 |
| 350 | 23 | b | 4.9 | 35 | b | 3.9 | 50 | b | 3.3 | 67 | b | 2.6 | 75 | s | 2.1 | 87 | s | 1.7 | 95 | s | 1.5 | 106 | s | 1.3 |
| 400 | 17 | b | 6.4 | 27 | b | 5.0 | 38 | b | 4.2 | 52 | b | 3.7 | 66 | b | 2.9 | 76 | s | 2.4 | 83 | s | 2.0 | 93 | s | 1.8 |
| 500 | 11 | b | 9.7 | 17 | b | 7.6 | 25 | b | 6.3 | 33 | b | 5.4 | 43 | b | 4.8 | 53 | b | 4.3 | 63 | b | 3.8 | 74 | b | 3.5 |
| 600 | 8 | b | 13.9 | 12 | b | 10.8 | 17 | b | 8.9 | 23 | b | 7.6 | 30 | b | 6.7 | 37 | b | 5.9 | 44 | b | 5.2 | 52 | b | 4.7 |



Short-term loading
Service class 3
$k_{mod}$ = 0.70
$k_{def}$ = 0.40
$\gamma_q$ = 1.2
$\gamma_m$ = 1.3
q given in kN/m²
u given in mm
⟷ grain direction of surface veneers

Table 4-30. Combi plywood | A uniformly distributed load on a continuous plate strip with three equal span lengths. | Face grain perpendicular to span. | b = bending strength limitation s = shear strength limitation

| Span | Nominal thickness (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c/c | 9 | | | 12 | | | 15 | | | 18 | | | 21 | | | 24 | | | 27 | | | 30 | | |
| mm | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u | q | | u |
| 100 | 69 | s | 0.5 | 85 | s | 0.4 | 113 | s | 0.3 | 132 | s | 0.3 | 158 | s | 0.3 | 177 | s | 0.3 | 202 | s | 0.3 | 221 | s | 0.3 |
| 150 | 46 | s | 1.1 | 57 | s | 0.7 | 75 | s | 0.6 | 88 | s | 0.5 | 105 | s | 0.5 | 118 | s | 0.5 | 135 | s | 0.5 | 147 | s | 0.4 |
| 200 | 35 | s | 2.0 | 42 | s | 1.2 | 56 | s | 1.0 | 66 | s | 0.8 | 79 | s | 0.8 | 88 | s | 0.7 | 101 | s | 0.7 | 111 | s | 0.6 |
| 250 | 28 | s | 3.4 | 34 | s | 2.0 | 45 | s | 1.6 | 53 | s | 1.3 | 63 | s | 1.1 | 71 | s | 1.0 | 81 | s | 1.0 | 88 | s | 0.9 |
| 300 | 23 | b | 5.4 | 28 | s | 3.1 | 38 | s | 2.4 | 44 | s | 1.8 | 53 | s | 1.6 | 59 | s | 1.4 | 67 | s | 1.3 | 74 | s | 1.2 |
| 350 | 17 | b | 7.0 | 24 | s | 4.6 | 32 | s | 3.4 | 38 | s | 2.6 | 45 | s | 2.2 | 51 | s | 1.9 | 58 | s | 1.7 | 63 | s | 1.5 |
| 400 | 13 | b | 8.9 | 21 | s | 6.5 | 28 | s | 4.8 | 33 | s | 3.5 | 39 | s | 2.9 | 44 | s | 2.4 | 51 | s | 2.2 | 55 | s | 1.9 |
| 500 | 8 | b | 13.3 | 14 | b | 10.0 | 22 | b | 8.3 | 26 | s | 6.1 | 32 | s | 4.9 | 35 | s | 4.0 | 40 | s | 3.5 | 44 | s | 3.0 |
| 600 | 6 | b | 18.8 | 10 | b | 13.9 | 15 | b | 11.3 | 22 | s | 9.8 | 26 | s | 7.8 | 29 | s | 6.2 | 34 | s | 5.3 | 37 | s | 4.5 |

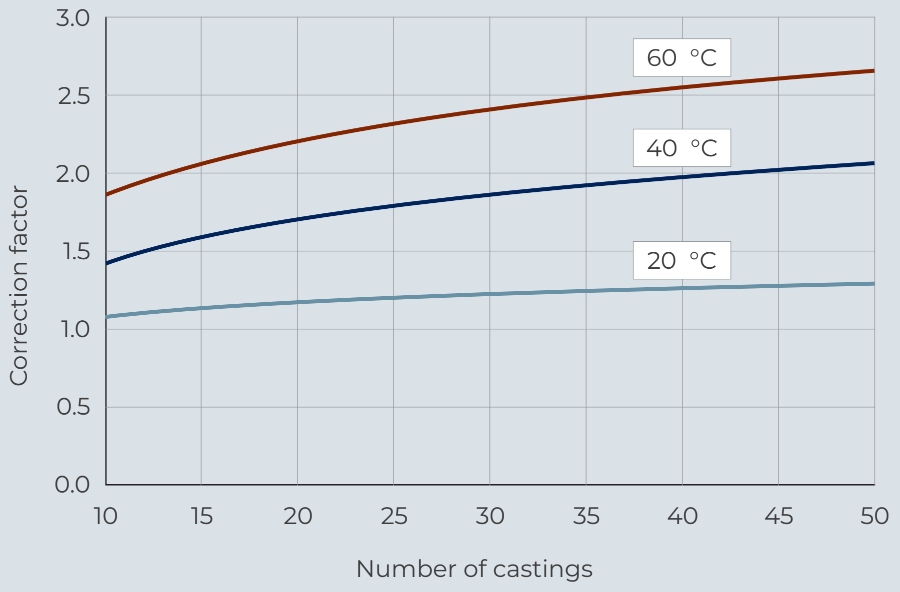


Short-term loading
Service class 3
$k_{mod}$ = 0.70
$k_{def}$ = 0.40
$\gamma_q$ = 1.2
$\gamma_m$ = 1.3
q given in kN/m²
u given in mm
⟷ grain direction of surface veneers

## PLYWOOD FORMWORK IN COLD CONDITIONS

In colder climates it is necessary to heat concrete formwork when in use to avoid frost problems. When the concrete mass casting temperature is above +20°C (for example in winter concreting) increased temperature can cause additional deflection of the plywood. The deflection of birch plywood as a function of castings can be calculated using the correction factor $k_{temp,\ corr}$ as shown in the figure below.

Deflection correction factor ($k_{temp,\ corr}$) for birch plywood in winter concreting




The final deflection $u_{fin}$ in winter concreting is given by the formula $u_{fin} = u \cdot k_{temp,\ corr}$
where u is the deflection from Tables 4-39 to 4-48.

# 5. Applications

## 5.1 APPLICATIONS

**BIRCH PLYWOOD**
Birch plywood is characterised by its excellent strength, stiffness and resistance to creep. Birch plywood has a high planar shear strength, which makes it significantly better for heavy-duty floor structures than other plywood products. Birch plywood has excellent surface hardness and damage resistance. Sanded birch plywood has a light-coloured, beautiful and durable surface. Birch plywood is highly suitable for coating, and properly coated and edge sealed birch plywood also offers excellent weather and moisture resistance.

Typical end uses of birch plywood are concrete formwork, transport vehicle floors, walls and roofs, container floors, floors subjected to heavy loads in various buildings and factories, demanding scaffolding and shelves, load bearing special structures, traffic signs and signage boards, and furniture and fixtures.

**COMBI PLYWOOD**
Combi plywood is characterised by its strength and stiffness properties which are virtually the same as those of birch plywood. The strength and stiffness properties on its major axes are quite similar. An exception to this is planar shear, where the strength in the cross-grain direction of the face veneer is clearly inferior to the strength in the grain direction. Combi plywood has a surface hardness and damage resistance comparable to those of birch plywood. Sanded combi plywood has a light-coloured, beautiful and durable surface. Combi plywood is suitable for coating, and coated and edge sealed combi plywood also offers excellent weather and moisture resistance. Combi plywood is lighter weight than birch plywood and easier to machine.

Typical end uses of combi plywood are concrete formwork, floors, walls and roofs of buildings, farm buildings, vehicle floors, walls and roofs, scaffolding and shelves and furniture and fixtures.

## 5.2 TRANSPORT

Panels must be properly protected during storage and transport from the mill to the customer. Panels must be stored at all times under dry conditions to protect the panels from rain and splashing. When a forklift truck is used to handle panel stacks, care must be taken to prevent them or the packaging material being damaged. Plywood stacks must not be pushed by the tines of the forklift truck. Plywood stacks must be transported and stored in a horizontal position.

## 5.3 HANDLING

The cargo must be unloaded without damaging the plywood stacks. Unloading usually takes place using a forklift truck. In other cases, using a sling is preferable to cables or chains. When lifting, the lifting equipment must not damage the panels being moved.

The panels should be unloaded by hand, taking care not to damage faces, edges or corners. Individual panels must be moved by lifting or carrying. Panels must not be dragged along the ground.

Note! Film-faced plywood is slippery. When the panels are later moved or stored in other packaging than the original, the proper strapping of panel bundles must be ensured.

## 5.4 STORAGE

Panels should be stored in a dry and covered space. The panels must be stored horizontally on their sides in their original packaging. Stack panels on a straight, firm base, with enough bearers to prevent sagging. Plywood stacks of same size must be stored in a straight, tower-like formation with the bearers aligned. In long-term storage, it will be necessary to loosen the original strappings or switch them out for plastic strappings, for example the strappings may leave a mark on the top and bottom panels in the stack if the panel stacks swell.

Before installation and surface treatment, panels should be stored in conditions of moisture and temperature similar to those in which they are to be used. In spaces with central heating, a suitable conditioning time for panels is approximately one week. For conditioning purposes, the panels must be placed standing on their edges. Sticks are placed underneath and between panels to allow air to circulate around them.

If film-faced formwork panels need to be stored temporarily outdoors, cover them with tarpaulins. Care must be taken to prevent the panel edges being subjected to rain or splashing.

## 5.5 DISPOSAL OF PLYWOOD

The service life of plywood is long and it can be disposed of in many ways. Instructions for the disposal of plywood may vary in different countries depending on the legislation.

Recycling is the preferred way to dispose of plywood. Used plywood can be reused in multiple applications. This recycling must not burden the environment more than any other method of disposal.

If the fuel value of plywood can be utilised, the burning of plywood is equivalent to recycling. At a combustion temperature of at least +850°C, uncoated plywoods and plywoods coated with phenol or melamine resin films or with commonly used paints do not produce any more hazardous combustion residues than those produced by wood. It is not recommended to burn plywood in an open fire, because burning at a lower temperature releases more harmful combustion residues. When plywood is burnt, its higher density compared with unprocessed wood means a higher fuel value is achieved.

Almost all plywood can be composted. Panels have to be chipped prior to composting.

Nearly all plywood products can be taken to the refuse dump. Check whether the substances used for treating or coating the plywood can be taken to the dump. Plywood products rot very slowly.

Standard Finnish plywoods contain nothing classified as hazardous waste.

## 5.6 CE MARKING

The Construction Product Directive (CPD) steers national legislation and regulations. The key aim of the CPD is to create a single EU and EFTA market for construction and especially for construction products. The technical barriers to trade of construction products across borders are abolished by harmonising the requirements set for member states' construction projects and products and the procedures for proving conformity.

The CPD requires that all construction products shall bear the CE marking before being placed on the EU and EFTA market. The product must show compliance with all technical requirements outlined in the technical specification. The technical specification usually means harmonised standards or European technical approvals. The burden of proof to show compliance with specifications lies with the manufacturer even if an approved assurance, audit or testing facility participates in the procedure. The CE marking of wood-based panels takes place through the harmonised product standard EN 13986.

The member states are expected to arrange sufficient market surveillance to ensure that the products on the market are fit for purpose and that the CE marking is used correctly. Border control is only permitted for products arriving from outside the EU and EFTA.

## 5.7 EN STANDARDS

**FINNISH PLYWOOD COMPLIES WITH THE FOLLOWING EUROPEAN STANDARDS:**

| | |
|---|---|
| EN 310 | Wood-based panels - Determination of modulus of elasticity in bending and of bending strength |
| EN 313-1 | Plywood - Classification and terminology<br>– Part 1: Classification |
| EN 313-2 | Plywood - Classification and terminology<br>– Part 2: Terminology |
| EN 314-1 | Plywood - Bonding quality<br>– Part 1: Test methods |
| EN 314-2 | Plywood - Bonding quality<br>– Part 2: Requirements |
| EN 315 | Plywood - Tolerances for dimensions |
| EN 318 | Wood-based panels - Determination of dimensional changes associated with changes in relative humidity |
| EN 321 | Wood-based panels - Determination of moisture resistance under cyclic test conditions |
| EN 322 | Wood-based panels - Determination of moisture content |
| EN 323 | Wood-based panels - Determination of density |
| EN 324-1 | Wood-based panels - Determination of dimensions of boards<br>– Part 1: Determination of thickness, width and length |
| EN 324-2 | Wood-based panels - Determination of dimensions of boards<br>– Part 2: Determination of squareness and edge straightness |
| EN 325 | Wood-based panels - Determination of dimensions of test pieces |
| EN 326-1 | Wood-based panels - Sampling, cutting and inspection<br>– Part 1: Sampling and cutting of test pieces and expression of test results |
| EN 326-2 | Wood-based panels - Sampling, cutting and inspection<br>– Part 2: Quality control in the factory |
| EN 326-3 | Wood-based panels - Sampling, cutting and inspection<br>– Part 3: Inspection of a consignment of panels |
| EN 635-1 | Plywood - Classification by surface appearance<br>– Part 1: General |
| EN 635-2 | Plywood - Classification by surface appearance<br>– Part 2: Hardwood |
| EN 635-3 | Plywood - Classification by surface appearance<br>– Part 3: Softwood |
| ENV 635-4 | Plywood - Classification by surface appearance<br>– Part 4: Parameters of ability for finishing |
| EN 635-5 | Plywood - Classification by surface appearance<br>– Part 5: Methods for measuring and expressing characteristics and defects |
| EN 636-1 | Plywood - Specifications<br>– Part 1: Requirements for plywood for use in dry conditions |
| EN 636-2 | Plywood - Specifications<br>– Part 2: Requirements for plywood for use in humid conditions |
| EN 636-3 | Plywood - Specifications<br>– Part 3: Requirements for plywood for use in exterior conditions |
| ENV 717-1 | Wood-based panels - Determination of formaldehyde release<br>– Part 1: Formaldehyde emission by the chamber method |
| EN 717-2 | Wood-based panels - Determination of formaldehyde emission<br>– Part 2: Formaldehyde release by the gas analysis method |
| EN 717-3 | Wood-based panels - Determination of formaldehyde emission<br>– Part 3: Formaldehyde release by the flask method |
| EN 789 | Timber structures - Test methods - Determination of mechanical properties of wood based panels |
| EN 1058 | Wood-based panels - Determination of characteristic values of mechanical properties and density |
| EN 1072 | Plywood - Description of bending properties for structural plywood |
| EN 1084 | Plywood - Formaldehyde release classes determined by the gas analysis method |
| ENV 1099 | Plywood - Biological durability - Guidance for the assessment of plywood for use in different hazard classes |
| ENV 1995-1-1 | Eurocode 5 - Design of timber structures<br>– Part 1-1: General rules and rules for buildings |
| EN 13986 | Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking |
| SFS 2413 | Quality requirements for appearance of plywood with outer plies of birch |

# 6. Environmental aspects

Plywood contains some 93% wood and just under 7% adhesive mixture of the dry matter. Plywood is a carbon store and the carbon contained in the timber is retained in the panel as long as the panel is used. Carbon is freed up if the panel is disposed of by burning or composting. Plywood binds wood carbon for much longer than other wood products such as paper and cardboard.

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

EPD – KoskiStandard

EPD – Phenol-coated plywood

KOSKISEN

Quality has a name.

Koskisen | Tehdastie 2 | 16600 Järvelä
tel. 020 553 31

koskisen.com