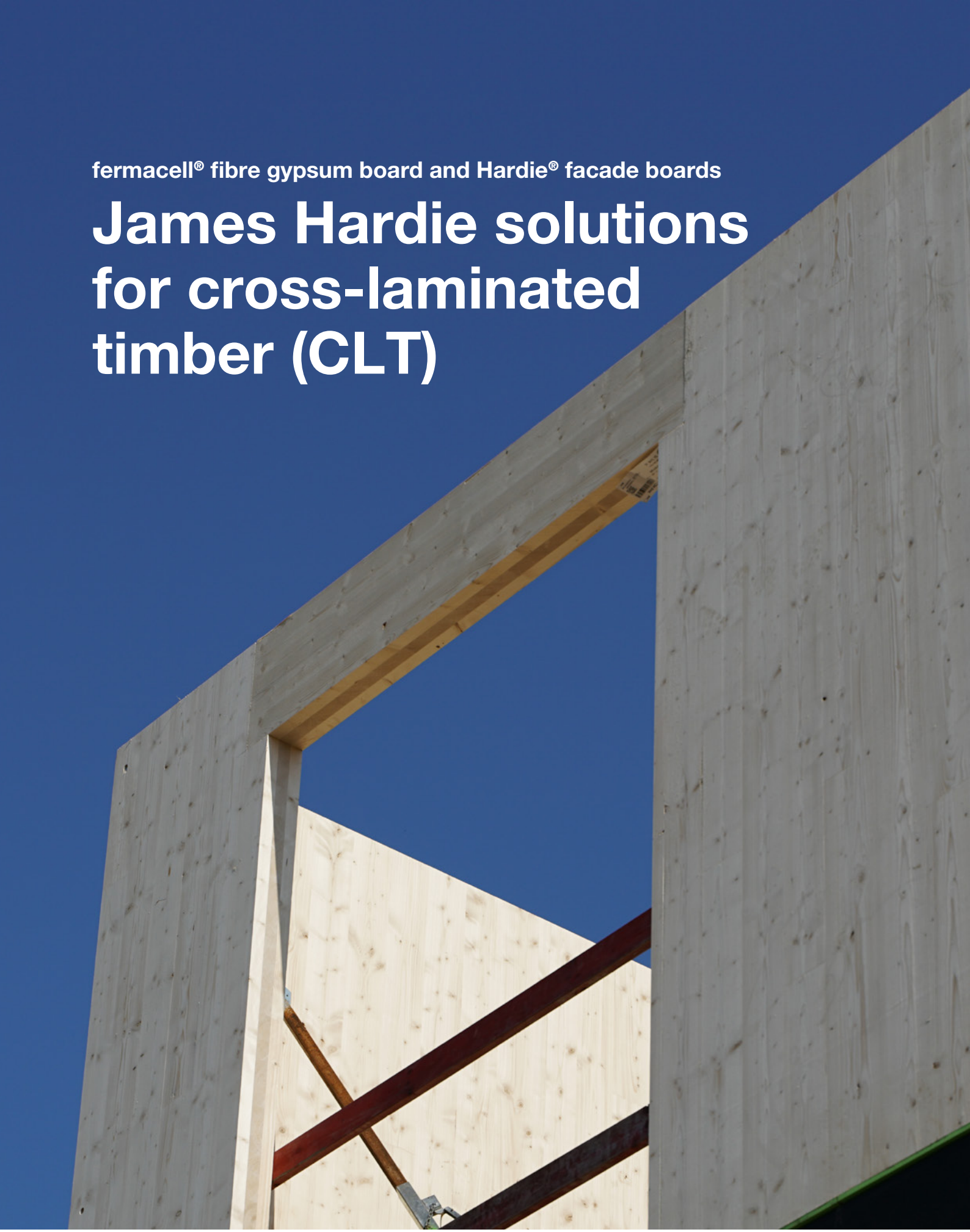
fermacell® fibre gypsum board and Hardie® facade boards

# James Hardie solutions for cross-laminated timber (CLT)



fermacell®

JamesHardie™

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The content is in line with the latest working standards. The most current documents should always be used.
Please note that illustrations of details and drawings are shown schematically and can only be seen in conjunction with the respective dimensions and texts. Subject to technical modifications.

# 1.1 Cross-laminated timber/CLT

Wood has been a proven building material for centuries. Following the Industrial Revolution in the 19th century and taking into consideration the fact that a large number of homes had to be built in a short space of time for the people crowding into the cities in search of work, wood was replaced by new building materials that could be produced in large quantities. Timber construction was a niche market for a long time. Increasing ecological awareness has recently led to the rediscovery of wood as a valuable, resource-efficient and sustainable building material.

The proportion of timber buildings and mixed timber constructions in the total construction volume has been rising steadily for years. This is also due in part to intensive and practice-orientated research, which has clarified many open questions relating to building construction, structural performance and building physics.

The development of cross-laminated timber (CLT), which has been established on the market for just over 10 years, is introducing timber construction to projects that were previously only possible in concrete or steel. In addition to the construction of individual detached and prefabricated houses and individual multi-storey residential buildings, large/high residential and office buildings in urban areas, commercial buildings, production halls and even bridges can now be easily realised.

Architects and planners now have available to them a solid, monolithic product that makes the planning and realisation of large timber construction projects much easier thanks to its defined structural-physical properties.

Cross-laminated timber or CLT, as it is known internationally, is a large-surface solid wood slab consisting of at least three layers of boards glued together at right angles to each other. The solid boards are highly resilient, offer high dimensional stability and with their technical and physical properties are a serious competitor to concrete and steel. In contrast to other construction methods, however, the production of cross-laminated timber requires very little energy. Like all timber building materials, cross-laminated timber stores $CO_2$ and therefore makes a sustainable contribution to climate protection. The high degree of prefabrication of weather-resistant elements manufactured in the factory under ideal conditions ensures short construction times. Openings for windows and doors are simply cut out. There are no prescribed grids to be adhered to. Good diffusion properties create a pleasant indoor climate.

fermacell® fibre gypsum boards clearly support the quality and time advantages of cross-laminated timber construction and are a good addition with their technical and structural-physical properties. Their quick and easy assembly on site and at the factory is a major advantage. They are stable, highly resilient and resistant to mechanical stresses and are just as suitable for wall, ceiling and floor constructions as they are for finishing attractive bathrooms.

**Fire protection**
In combination with fermacell® fibre gypsum boards, cross-laminated timber construction offers further possibilities in multi-storey timber construction. With its high fire protection performance, the cladding of cross-laminated timber elements with fermacell® fibre gypsum boards enables high fire resistance classifications up to F120-B (REI 120) and permissible loads of 200 kN/m with a streamlined wall configuration. Depending on the component requirements, cross-laminated timber can be prevented from igniting for defined periods of time, making it possible to utilise the full structural potential of the cross-laminated timber. With the building material classification A2 as a non-combustible building material in accordance with EN 13501, fermacell® fibre gypsum boards also help to reduce combustible surfaces in building units.

**Sound insulation**
The excellent sound insulation properties of fermacell® fibre gypsum boards have been confirmed by various national/international testing institutes in conjunction with cross-laminated timber construction. Building with conventional solid construction methods provides acoustic properties due to its heavy and inflexible design based on the component mass, which can be easily achieved in cross-laminated timber construction by intelligently combining system components to provide equivalent or better solutions. Depending on the construction variants and the arrangement of the system layers, fermacell® fibre gypsum boards can be used to create high-performance solutions for wall and ceiling structures.

**Healthy living environment**
When it comes to healthy living environments, fermacell® fibre gypsum boards are very beneficial. They regulate indoor climate and humidity. In addition, they can help provide a balanced thermal environment with their thermal mass properties.

**Ecology/sustainability**
fermacell® fibre gypsum boards also make a good addition to cross-laminated timber from an ecological point of view. They are made from natural raw materials gypsum, recycled paper and water and, in conjunction with timber construction, fulfil the requirement for sustainable and healthy building throughout the entire structure. The Institut Bauen und Umwelt e. V. has now confirmed in an EPD that fermacell® fibre gypsum boards and fermacell® flooring elements store $CO_2$. As such, fermacell® fibre gypsum boards make the same sustainable contribution to climate protection as wood. However, EPD verification also means that fermacell® fibre gypsum boards and fermacell® flooring elements can be installed in all buildings that are to be assessed in accordance with the DGNB, BNB, BREEAM and LEED building certification systems.

## Cross-laminated timber with fermacell®:

- short construction times
- dry construction method
- automated production processes
- high standard of quality
- great range of prefabrication options
- large-sized components can be realised
- complex geometries can be implemented
- complements timber frame construction
- low weight enables maximum load capacities
- high level of fire protection
- ecological and climate-friendly solid construction method
- large quantities of $CO_2$ are stored

# 1.2 Technical data

fermacell® fibre gypsum boards are made exclusively from natural materials that have a positive impact on a healthy indoor climate. They offer stability and safety in high-quality timber construction – ideal for timber construction solutions in fire protection, sound insulation, structural performance and domestic bathrooms. fermacell® fibre gypsum boards store $CO_2$* and have an EPD. They help to make the planning and construction of buildings more ecological.

The environmental declarations provide information on products and their use with regard to the environment and health. Our fibre gypsum boards can be reused and recycled after use.

* The storage of $CO_2$ refers to the entire product life cycle of fermacell® fibre gypsum boards and floor elements.

# fermacell® fibre gypsum boards

Homogeneous gypsum-bonded construction board made from gypsum, recycled cellulose fibres and recycled water.

- Board material for timber / dry construction solutions with special requirements regarding fire, sound or moisture protection

Environmental Product Declaration (EPD)

| Characteristics | |
|---|---|
| Gross density $\rho_k$ | 1 150 ± 50 kg/m³ |
| Water vapour diffusion resistance coefficient μ | 13 |
| Thermal conductivity λ | 0.32 W/mK |
| Specific heat capacity c | 1.0 kJ/kgK |
| Brinell hardness | 30 N/mm² |
| Thickness swelling after 24 hours of water storage | < 2 % |
| Thermal expansion coefficient | 0.001 %/K |
| Extension/shrinkage at 30 % change in relative humidity (20 °C) | 0.25 mm/m |
| Moisture content equilibrium at 65 % relative humidity and 20 °C air temperature | 1.3 % |
| pH value | 7–8 |
| Usage class according to EN 1995-1-1 | Type 1 and 2 |

| Dimensional tolerances for standard board sizes at constant humidity | |
|---|---|
| Length, width | +0/-2 mm |
| Diagonal difference | ⩽ 2 mm |
| Thickness: 10/12.5/15/18 | ± 0.2 mm |

| Approvals/Identification | |
|---|---|
| European Technical Assessment | ETA-03/0050 |
| National application document - D | Z-9.1-434 |
| Identification according to EN 15283-2 | GF-I-W2-C1 |
| Building material class according to EN 13501-1 | non-combustible, A2 |
| Component classifications | national/ international |
| National classification (according to DIN 4102-4) | G TSt 2022-04-a |

| Board thickness and weight | | | | |
|---|---|---|---|---|
| Thickness | 10 mm | 12.5 mm | 15 mm | 18 mm |
| Approx. weight per m² | 11.5 kg | 14.5 kg | 17.5 kg | 21 kg |

| Sizes in mm * | | | | |
|---|---|---|---|---|
| 1 500 × 1 000 | ● | ● | ● | ● |
| 2 000 × 1 250 | ● | ● | ● | ● |
| 2 500 × 1 250 | ● | ● | ● | ● |
| 2 540 × 1 250 | ● | ● | ● | ● |
| 2 650 × 1 250 | | ● | | |
| 2 750 × 1 250 | | ● | ● | ● |
| 3 000 × 1 250 | | ● | ● | ● |
| Cut-to-size parts upon request | | | | |

| Sizes with drywall edge (TB edge) in mm | | | | |
|---|---|---|---|---|
| 2 000 × 1 250** | | ● | | |
| 2 540 × 1 250 | | ● | | |
| 2 750 × 1 250 | | ● | ● | |
| Cut-to-size parts upon request | | | | |

* Additional formats and thicknesses upon request ** TB edge all around

# fermacell® Firepanel A1

Homogeneous fibre-reinforced gypsum-bonded wood /dry construction board with paper fibres and additives of non-combustible fibres, made water-repellent at the factory.

- Complies with the highest European building material class A1 (EN13501-1)
- Provides even more efficient and slimmer components in fire protection than the well-known fermacell® fibre gypsum board
- Processing just as simple and quick as the original fermacell® fibre gypsum board


| Characteristics | |
|---|---|
| Gross density $\rho_k$ (dry) | 1 200 ± 50 kg/m³ |
| Flexural strength (dry) | > 5.8 N/mm² |
| Water vapour diffusion resistance coefficient μ according to EN ISO 12572 | 16 |
| Thermal conductivity $\lambda_R$ according to DIN EN 12667 | 0.38 W/mK |
| Extension/shrinkage at 30 % change in relative humidity (20 °C) according to EN 318 | 0.25 mm/m |
| Moisture content equilibrium at 65 % relative humidity and 20 °C air temperature according to EN 322 | 1.30 % |
| Compressive strength perpendicular to surface | > 18 N/mm² |
| Alkalinity (pH value) | 7–8 |
| Elasticity of flexure module | > 4 500 N/mm² |

| Dimensional tolerances for standard board sizes at constant humidity | |
|---|---|
| Length, width | +0/-2 mm |
| Diagonal difference | ≤ 2 mm |
| Thickness | ± 0.2 mm |

| Approvals/Identification | |
|---|---|
| Identification according to EN 15283-2 | GF-I-W2-C1 |
| Building material category according to EN 13501-1 | non-combustible, A1 |
| IMO FTPC part 1 | non-combustible |
| Component classifications | national/European |

| Characteristics in relation to board thickness | | |
|---|---|---|
| Thickness | 12.5 mm | 15 mm |
| Approx. weight per m² | 15 kg | 18 kg |

| Sizes in mm * | | |
|---|---|---|
| 1 500 × 1 000 | | |
| 2 000 × 1 250 | ● | ● |

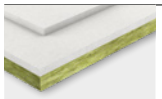
Additional formats and thicknesses upon request

# fermacell® flooring element

Dry screed fibre gypsum boards with and without insulation, for use in new building and renovation.

- Can be walked on immediately after the adhesive has cured.

Environmental Product Declaration (EPD)

| | Thickness | Description<br>Insulating material | Size<br>[mm] | Crowd load<br>(kN/m²) | Thermal resistance<br>(m² K/W) | Building material class according to EN 13501 |
|---|---|---|---|---|---|---|
| **Flooring elements** | | | | | | |
|  | 20 mm | 2 E 11 (EE 20) | 1 500 × 500 | 0.23 | 0.06 | $A2_{fl}$-s1 |
| | 25 mm | 2 E 22 (EE 25) | 1 500 × 500 | 0.29 | 0.08 | $A2_{fl}$-s1 |
| **Flooring elements (HF) with wood fibreboard in 10 mm thickness** | | | | | | |
|  | 30 mm | 2 E 31 (EE 20 HF 10) | 1 500 × 500 | 0.25 | 0.26 | $B_{fl}$-s1 |
| | 35 mm | 2 E 33 (EE 25 HF 10) | 1 500 × 500 | 0.25 | 0.28 | $B_{fl}$-s1 |
| **Flooring elements (MW) with high-grade mineral wool in 10 or 20 mm thickness** | | | | | | |
|  | 30 mm | 2 E 32 (EE 20 MW 10) | 1 500 × 500 | 0.25 | 0.28 | $A2_{fl}$-s1 |
| | 35 mm | 2 E 34 (EE 25 MW 10) | 1 500 × 500 | 0.25 | 0.31 | $A2_{fl}$-s1 |
| | 45 mm | 2 E 35 (EE 25 MW 20) | 1 500 × 500 | 0.33 | 0.31 | $A2_{fl}$-s1 |
| **Flooring elements (PS) with expanded polystyrene rigid foam[1] in 20 or 30 mm thickness** | | | | | | |
|  | 40 mm | 2 E 13 (EE 20 PS 20) | 1 500 × 500 | 0.23 | 0.56 | $B_{fl}$-s1 |
| | 50 mm | 2 E 14 (EE 20 PS 30) | 1 500 × 500 | 0.23 | 0.81 | $B_{fl}$-s1 |
| **Flooring elements (V) with felt fibre insulation panel in 9 mm thickness** | | | | | | |
|  | 29 mm | 2 E 16 (EE 20 V 9) | 1 500 × 500 | 0.24 | 0.29 | $B_{fl}$-s1 |
| | 34 mm | 2 E 26 (EE 25 V 9) | 1 500 × 500 | 0.32 | 0.30 | $B_{fl}$-s1 |

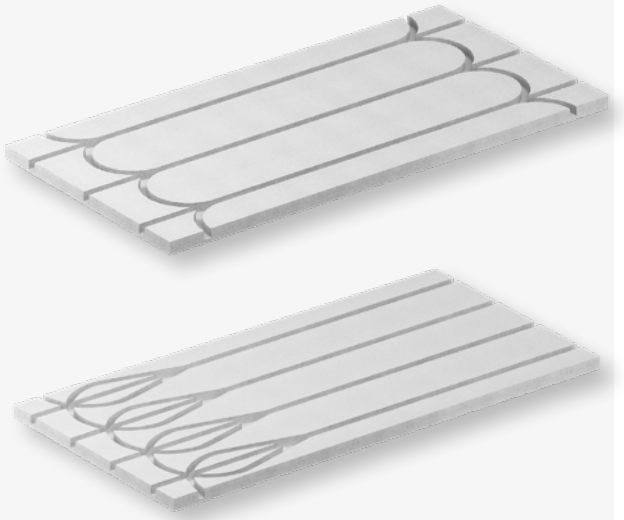
[1] = according to EN13163 EPS DEO100 KPa

| Approvals | |
|---|---|
| European Technical Assessment | ETA-18/0723 |

# fermacell® Therm25™ underfloor heating systems

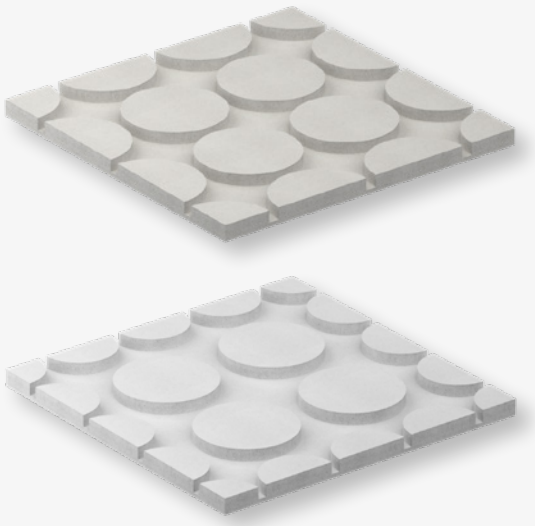
**fermacell® Therm25™ element and fermacell® Therm25™-125 element**

- Standard board with groove patterns for lengthwise installation with deflection grooves
- For use on the surface



**fermacell® Therm25™ round element and fermacell® Therm25™-125 round element**

- Additional element for special floor plans, doorways, when joining pipes and in the area of the heating manifold



| Characteristics fermacell® fibre gypsum boards | |
|---|---|
| European Technical Assessment | ETA-03/0050 |
| Gross density (production specification) $\rho_k$ | 1 150 ± 50 kg/m³ |
| Water vapour diffusion resistance coefficient μ | 13 |
| Coefficient of thermal conductivity λ | 0.32 W/mK |
| specific heat capacity c | 1.1 kJ/kgK |
| Brinell hardness | 30 N/mm² |
| Thickness swelling after 24 hours of water storage | < 2 % |
| thermal expansion coefficient | 0.001 %/K |
| Extension/shrinkage at 30 % change in relative humidity (20 °C) | 0.25 mm/m |
| Moisture content equilibrium at 65 % relative humidity and 20 °C air temperature | 1.3 % |
| Building material class according to EN 13501-1 (non-combustible) | A2 |
| pH value | 7–8 |

| Characteristics fermacell® Therm25™ underfloor heating element | |
|---|---|
| Dimensions | **fermacell® Therm25™ element,** (lengthwise and deflection grooves): 1 000 × 500 mm<br><br>**fermacell® Therm25™ round element,** (round grooves): 500 × 500 mm |
| Element thickness | 25 mm |
| Groove width | 16 mm |
| recommended heating pipe | MKV composite pipe, 16 × 2 mm, with DIN Certco registration |
| Pipe spacing | 167 mm (full occupancy) |
| Weight Therm25™ element | 27 kg/m² |
| Weight Therm25™ round element | 23 kg/m² |

# Levelling Solutions

| **Characteristics fermacell™ floor levelling compound** |  |
|---|---|
| Building material class | A1 (according to EN 13501-1) |
| Coefficient of thermal conductivity $\lambda_R$ | 1.1 W/mK |
| Gross density | 1 700–1 800 kg/m³ |
| max. coating thickness | 20 mm |
| Consumption per m² | approx. 1.7 kg per 1 mm coating thickness |
| Compressive strength (EN 13813) | C25 |
| Flexural strength (EN 13813) | F6 |
| Chair castor strength according to DIN 68131 or EN 12529 | as of minimum 1 mm coating thickness |
| Dead weight for 10 mm coating thickness | 0.17 kN/m² |
| Storage | 9 months dry |

| **Characteristics fermacell™ Dry Levelling Compound** |  |
|---|---|
| Building material class | A1 (according to EN 13501-1) |
| Coefficient of thermal conductivity $\lambda_R$ | 0.09 W/mK |
| Grain size | 0.2 to 4 mm |
| Bulk density | approx. 400 kg/m³ |
| min. filling height | 10 mm |
| max. filling height (loose) | 100 mm area of application 1<br>60 mm area of application 2–4 |
| Fill quantity per m² | approx. 10 litres per 1 cm filling height |
| Dead weight for 10 mm coating thickness | 0.04 kN/m² |
| Storage | dry |

| **Characteristics fermacell™ bonded levelling compound** |  |
|---|---|
| Building material class | A2-s1, d0 (according to EN 13501-1) |
| Coefficient of thermal conductivity λ | 0.12 W/mK |
| Compressive strength | 0.4 to 0.5 N/mm² (according to EN 826) |
| Dry gross density | approx. 350 kg/m³ |
| min. filling height | 30 mm |
| max. filling height | 2 000 mm (in layers up to 500 mm) |
| Fill quantity per m² | approx. 10 litres per 1 cm filling height |
| Vapour diffusion | μ = 7 (according to EN 12086) |
| Dead weight for 10 mm coating thickness | 0.035 kN/m² |
| Storage | 6 months dry and frostfree |

| **Characteristics fermacell™ bonded levelling compound T** |  |
|---|---|
| Building material class | A2-s1, d0 (according to EN 13501-1) |
| Coefficient of thermal conductivity λ | 0.10 W/mK |
| Compressive strength | ≥ 0.5 N/mm² (according to EN 826) |
| Dry gross density | approx. 390 kg/m³ |
| min. filling height | 10 mm |
| max. filling height | 2 000 mm (in layers of max. 300 mm) |
| Fill quantity per m² | approx. 10 litres per 1 cm filling height |
| Vapour diffusion | μ = 5 (according to EN 12086) |
| Dead weight for 10 mm coating thickness | 0.039 kN/m² |
| Storage | 12 months dry and frostfree |

| **Characteristics fermacell™ honeycomb fill** |  |
|---|---|
| Building material class | A1 (according to DIN 4102) |
| Coefficient of thermal conductivity $\lambda_R$ | 0.7 W/mK |
| Grain size | 1 to 4 mm |
| Bulk density | approx. 1 500 kg/m³ |
| min. filling height | 30 mm |
| max. filling height | 60 mm |
| Fill quantity per m² | approx. 10 litres per 1 cm filling height |
| Dead weight | 0.45 kN/m² for 30 mm honeycomb<br>0.90 kN/m² for 60 mm honeycomb |
| Storage | dry |

# fermacell® Powerpanel $H_2O$

Cement bonded lightweight concrete board with laminated structure, reinforced on both sides with alkali-resistant glass fibre mesh.

- Permanently water resistant, also suitable for areas requiring chemical resistance

Environmental Product Declaration (EPD)

| Characteristics | |
|---|---|
| Gross density $\rho_k$ (dry) | 1 000 kg/m³ |
| Flexural strength (following EN 12467) | ≥ 6.0 N/mm² |
| Water vapour diffusion resistance coefficient μ according to EN ISO 12572 | 56 |
| Thermal conductivity $\lambda_R$ according to EN 12664 | 0.17 W/mK |
| Swell/shrinkage at between 30 % and 65 % change in relative humidity (20 °C) according to EN 318 | 0.15 mm/m |
| Swell/shrinkage at between 65 % and 85 % change in relative humidity (20 °C) according to EN 318 | 0.10 mm/m |
| Moisture content equilibrium at 65 % relative humidity and 20 °C air temperature according to EN 322 | ≥ 5 % |
| Compressive strength according to EN 789 | 11.7 N/mm² |
| Alkalinity (pH value) | approx. 10 |
| Flexural elasticity module (following EN 12467) | 4 200 N/mm² |
| Usage category in terms of weather resistance according to EN 12467 | A, B, C, D |

| Characteristics in relation to board thickness | |
|---|---|
| Thickness | 12.5 mm |
| Approx. weight per m² | 12.5 kg |

| Sizes in mm * | |
|---|---|
| 1 000 × 1 250 | ● |
| 2 000 × 1 250 | ● |
| 2 600 × 1 250 | ● |
| 3 010 × 1 250 | ● |

* Additional formats and thicknesses upon request

| Approvals | |
|---|---|
| European Technical Assessment | ETA-07/0087 |
| National application document - D (for indoor use) | AbZ Z-31.20-163 |
| National application document - D (for outdoor use) | AbZ Z-31.4-181 |
| Building material class according to EN 13501-1 | non-combustible, A1 |
| IMO FTPC part 1 | non-combustible |
| Component classification | national/European |

| Dimensional tolerances for standard board sizes at constant humidity | |
|---|---|
| Length, width | ± 1 mm |
| Diagonal difference | ≤ 2 mm |
| Thickness | ± 0.5 mm |

# Hardie® Panel & Hardie® Architectural Panel facade cladding

The durability and our guarantee make Hardie® Panel & Hardie® Architectural Panel an ideal product for cost-effective and attractive facade design.
The low maintenance requirements and high weather resistance allows the cost-effective and intelligent realisation of various projects.

- Combines efficiency and design
- Non-combustible (A2, s1-d0)
- 15-year guarantee on Hardie® Panel & Hardie® Architectural Panel facade claddings

Hardie® Panel Smooth

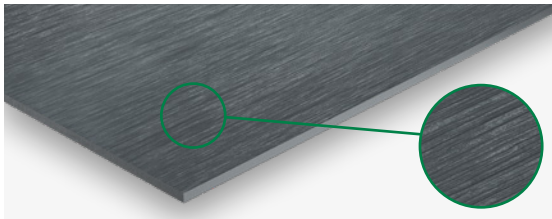
Environmental Product Declaration (EPD)

| Characteristics [2] | Hardie® Panel | Hardie® Architectural Panel |
|---|---|---|
| Thickness in mm | 8 | 8 |
| Length × width in mm | 3 048 × 1 220 | 3 048 × 1 220 |
| Approx. weight per m² | 11.2 kg | 11.2 kg |
| Weight per unit | 41.7 kg | 41.7 kg |
| Gross density $\rho_k$ (dry) | ≈ 1 300 kg/m³ | ≈ 1 300 kg/m³ |
| Bending strength (according to EN 12467) after dry storage | Smooth[1]<br>15.5 MPa perpendicular to the fibre<br>10.1 MPa parallel to the fibre | 14.0 MPa perpendicular to the fibre<br>8.5 MPa parallel to the fibre |
| Bending strength (according to EN 12467) after wet storage | Smooth[1]<br>11.5 MPa perpendicular to the fibre<br>7.5 MPa parallel to the fibre | 10.0 MPa perpendicular to the fibre<br>6.0 MPa parallel to the fibre |
| Thermal conductivity $\lambda_R$ (according to EN 12664) | 0.23 W/mK | 0.23 W/mK |
| Relative linear deformation in the range between 30 % and 90 % (20 °C) change in relative humidity (according to EN 318) | ≤ 0.05 % | ≤ 0.05 % |
| Elasticity modulus | Smooth [1] 6 200 N/mm² | 5 100 N/mm² |
| Category and class (according to EN 12467) | Category A, class 2 | Category A, class 2 |

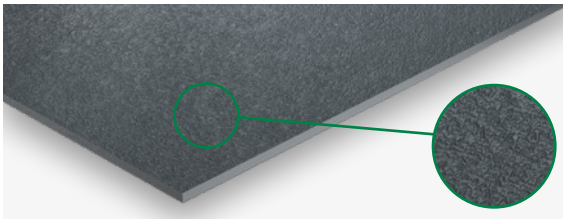
[1] Smooth [2] Values for the static design can be found in the General Design Certification (Z-31.4-193)

| Dimensional tolerances for standard board sizes at constant humidity | Hardie® Panel | Hardie® Architectural Panel |
|---|---|---|
| Length | ± 3.66 mm | ±3.66 mm |
| Width | ±0.8 mm | ±0.8 mm |
| Thickness | ±0.8 mm | -0.8/+1.2 mm |

| Approvals | |
|---|---|
| Building material class according to EN 13501-1 | Non-combustible, A2-s1,d0 |
| National application document (D) | Z-31.4-193 |



Hardie® Architectural Panel – Brushed concrete

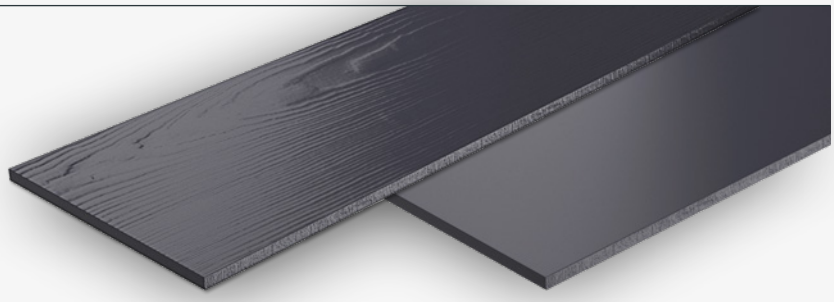


Hardie® Architectural Panel – structured plaster

# Hardie® Plank facade cladding

Hardie® Plank facade claddings offer the natural beauty of wood, but are made of indestructible fibre cement.

- Weather resistant beauty
- 15-year guarantee on Hardie® Plank facade claddings
- One-person installation with the help of the Gecko Gauges
- **ColourPlus**™ Technology



Hardie® Plank Wood structure

Hardie® Plank Smooth

Environmental Product Declaration (EPD)

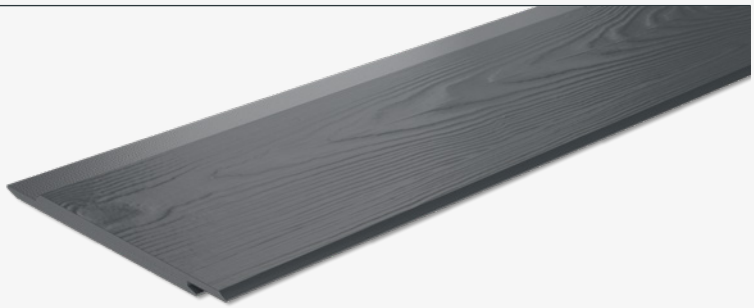
| Characteristics | |
|---|---|
| Thickness in mm | 8 |
| Length × width in mm | 3 600 × 180 |
| Approx. weight per m² | 11.2 kg |
| Weight per unit | 7.4 kg |
| Gross density $\rho_k$ (dry) | ≈ 1 300 kg/m³ |
| Bending strength (following EN 12467) | After dry storage: > 10 MPa<br>After wet storage: > 7 MPa |
| Thermal conductivity $\lambda_R$ (according to EN 12664) | 0.23 W/mK |
| Relative linear deformation in the range between 30 % and 90 % (20 °C) change in relative humidity (according to EN 318) | ≤ 0.05 % |
| Category and class (according to EN 12467) | Category A, class 2 |

| Approvals | |
|---|---|
| Building material class according to EN 13501-1 | Non-combustible, A2-s1,d0 |

# Hardie® VL Plank facade cladding

Hardie® VL Plank facade claddings offer an innovative tongue and groove system and enable non-visible fastening for the construction of curtain-type, rear-ventilated façades.

- Weather resistant beauty
- Maintenance free
- 15-year guarantee on Hardie® VL Plank facade claddings
- **ColourPlus**® Technology



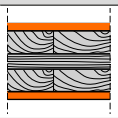
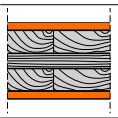
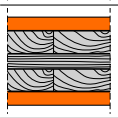
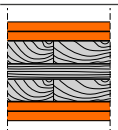
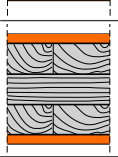
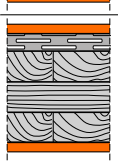
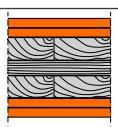
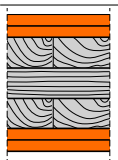
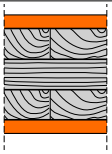
Hardie® VL Plank wood structure

| Characteristics | |
|---|---|
| Thickness in mm | 11 |
| Length × width in mm | 3 600 × 214 |
| Approx. weight per m² | 13.6 kg |
| Weight per unit | 10.5 kg |
| Gross density $\rho_k$ (dry) | ≈ 1 300 kg/m³ |
| Bending strength (according to EN 12467) | 15 MPa perpendicular to the fibre<br>> 11 MPa parallel to the fibre |
| Thermal conductivity $\lambda_R$ (according to EN 12664) | 0.23 W/mK |
| Relative linear deformation in the range between 30 % and 90 % (20 °C) change in relative humidity (according to EN 318) | ≤ 0.05 % |
| Category and class (according to EN 12467) | Category A, class 2 |

| Approvals | |
|---|---|
| Building material class according to EN 13501-1 | Non-combustible, A2-s1,d0 |

# 1.3 fermacell™ design solutions – wall

## fermacell® fibre gypsum boards

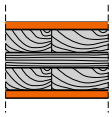
| System reference | System drawing | Wall thickness | Sub-structure[13] CLT | Boarding per side | Mineral wool[1] Thickness/ Gross density | Applied load | Mass per unit | Airborne sound insulation index $R_w$ (C; $C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [kN/m] | [kg/m²] | [dB] | |
| 1 HTM 11 |  | ≥ 100 | ≥ 80 | 10 | – | 160 | ≥ 60 | $R_w$ ≥ 37 (-1;-3)* Tr. No.: 04-01031 | REI 30 |
| 1 HTM 23 |  | ≥ 100 | ≥ 80 | 10 | – | 40 | ≥ 60 | $R_w$ ≥ 37 (-1;-3)* Tr. no.: 04-01030 | REI 60 |
| 1 HTM 28 |  | ≥ 116 | ≥ 80 | 18 | – | 150 | ≥ 83 | $R_w$ ≥ 39 (-1;-3)* Tr. no.: 04-01224 | REI 60 |
| 1 HTM 24 |  | ≥ 130 | ≥ 80 | 2 × 12.5 | – | 160 | ≥ 96 | $R_w$ ≥ 41 (-1;-3)* Tr. no.: 04-01029 | REI 60 |
| 1 HTM 21 |  | ≥ 145 | ≥ 120 | 12.5 | – | 200 | ≥ 87 | $R_w$ ≥ 40 (-1;-3)* Tr. no.: 04-01028 | REI 60 |
| 1 HTM 22 |  | ≥ 172 | ≥ 120 | 12.5 (one-sided on resilient Top Hat) | Glass wool | 200 | ≥ 89 | $R_w$ ≥ 53 (-4;-11)* Tr. no.: 04-01027 | REI 60 |
| 1 HTM 34 |  | ≥ 130 | ≥ 80 | 2 × 12.5 | – | 40 | ≥ 96 | $R_w$ ≥ 41 (-1;-3)* Tr. no.: 04-01026 | REI 90 |
| 1 HTM 32 |  | ≥ 145 | ≥ 120 | 12.5 | – | 120 | ≥ 87 | $R_w$ ≥ 40 (-1;-3)* Tr. no.: 04-01024 | REI 90 |
| 1 HTM 33 |  | ≥ 172 | ≥ 120 | 12.5 (one-sided on resilient Top Hat) | Glass wool | 120 | ≥ 89 | $R_w$ ≥ 53 (-4;-11)* Tr. No.: 04-01023 | REI 90 |
| 1 HTM 31 |  | ≥ 180 | ≥ 120 | 2 × 15 | – | 200 | ≥ 129 | $R_w$ ≥ 44 (-1;-3)* Tr. No.:01-01021 | REI 90 |
| 1 HTM 42 | | | | | | 150 | | | REI 120 |
| 1 HTM 41 |  | ≥ 156 | ≥ 120 | 18 | – | 120 | ≥ 100 | $R_w$ ≥ 41 (-1;-2)* Tr. No.:01-01022 | REI 120 |

* Calculated according to building acoustics software INSUL, Version v.9.0.8

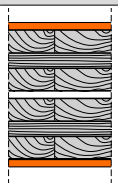
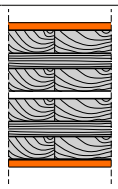
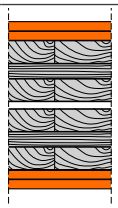
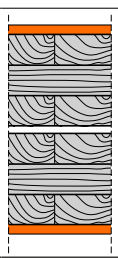
** By calculation according to EN12354-1:2000, p. 143

**Further sound insulation information can be found in section 4 Sound insulation.**

## fermacell® Firepanel A1

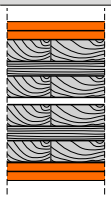
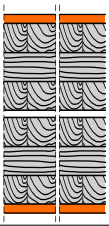
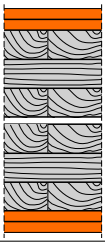
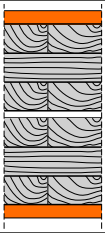
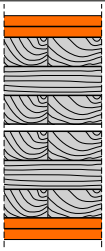
| System reference | System drawing | Wall thickness | Sub-structure[13] CLT | Boarding per side | Mineral wool[1] Thickness/ Gross density | Applied load | Mass per unit | Airborne sound insulation index $R_w$ ($C$; $C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [kN/m] | [kg/m²] | [dB] | |
| 1 HTM 21 A1 |  | ≥ 100 | ≥ 80 mm | 10 | – | 45 | ≥ 61 | $R_w$ ≥ 37<br>(-1;-3)*<br>Tr. No.: 04-01020 | REI 60 |
| 1 HTM 41 A1 |  | ≥ 235 | ≥ 80 mm | 12.5 (CW50)<br>10 | 40/40 | 45 | ≥ 95 | $R_w$ ≥ 71<br>(-6;-14)*<br>Tr. No.: 04-01019 | REI 120 |

## fermacell® fibre gypsum boards – cavity wall

| System reference | System drawing | Wall thickness | Sub-structure[13] CLT | Boarding per side | Mineral wool[1] Thickness/ Gross density | Applied load | Mass per unit | Airborne sound insulation index $R_w$ ($C$; $C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [kN/m] | [kg/m²] | [dB] | |
| 1 HTM 12 |  | ≥ 190 | ≥ 2 × 80 mm<br>10 mm air gap | 10 | – | 160 each wall side | ≥ 96 | $R_w$ ≥ 49<br>(-3;-11)*<br>Tr. No.: 04-01017 | REI 30 |
| | | | 100 mm air gap | | 80/10 | | | $R_w$ ≥ 69<br>(-2;-6)*<br>Tr. No.: 04-01018 | |
| 1 HTM 25 |  | ≥ 190 | ≥ 2 × 80 mm<br>10 mm air gap | 10 | – | 40 each wall side | ≥ 96 | $R_w$ ≥ 49<br>(-3;-9)*<br>Tr. No.: 01-01015 | REI 60 |
| | | | 100 mm air gap | | 80/10 | | | $R_w$ ≥ 69<br>(-2;-6)*<br>Tr. No.: 04-01016 | |
| 1 HTM 26 |  | ≥ 220 | ≥ 2 × 80 mm<br>10 mm air gap | 2 × 12.5 | – | 160 each wall side | ≥ 132 | $R_w$ ≥ 54<br>(-3;-11)*<br>Tr. No.: 04-01014 | REI 60 |
| | | | 100 mm air gap | | 80/18 | | | $R_w$ = 74.5<br>(-2;-4)<br>Tr. No.: 04-00961 | |
| 1 HTM 27 |  | ≥ 275 | ≥ 2 × 120 mm<br>10 mm air gap | 12.5 | – | 200 each wall side | ≥ 143 | $R_w$ ≥ 55<br>(-5;-12)*<br>Tr.No.: 04-01012 | REI 60 |
| | | | 100 mm air gap | | 80/10 | | | $R_w$ ≥ 75<br>(-2;-6)*<br>Tr. No.: 04-01013 | |

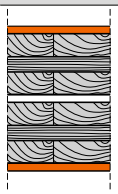
* Calculated according to building acoustics software INSUL, Version v.9.0.8

## fermacell® fibre gypsum boards – cavity wall

| System reference | System drawing | Wall thickness | Sub structure [13] CLT | Boarding per side | Mineral wool [1] Thickness/ gross density | Applied load | Mass per unit | Airborne sound insulation index $R_w$ (C; $C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [kN/m] | [kg/m²] | [dB] | |
| 1 HTM 35 |  | ≥ 220 | ≥ 2 × 80 mm<br>10 mm air gap | 2 × 12.5 | – | 40<br>each wall side | ≥ 132 | $R_w$ ≥ 54<br>(-4;-11)*<br>Tr. No.: 04-01011 | REI 90 |
| | | | 100 mm air gap | | 80/18 | | | $R_w$ = 74.5<br>(-2;-4)<br>Tr. No.: 04-00961 | |
| 1 HTM 36 |  | ≥ 275 | ≥ 2 × 120 mm<br>10 mm air gap | 12.5 | – | 120<br>each wall side | ≥ 143 | $R_w$ ≥ 55<br>(-5;-12)*<br>Tr. No.: 04-01008 | REI 90 |
| | | | 100 mm air gap | | 80/10 | | | $R_w$ ≥ 75<br>(-2;-6)*<br>Tr. No.: 04-01009 | |
| 1 HTM 37 |  | ≥ 310 | ≥ 2 × 120 mm<br>10 mm air gap | 2 × 15 | – | 200<br>each wall side | ≥ 185 | $R_w$ ≥ 60<br>(-5;-13)*<br>Tr. No.: 04-01007 | REI 90 |
| | | | 100 mm air gap | | 80/18 | | | $R_w$ = 74.5<br>(-2;-4)<br>Tr. No.: 04-00961 | |
| 1 HTM 43 |  | ≥ 286 | ≥ 2 × 120 mm<br>10 mm air gap | 18 | – | 120<br>each wall side | ≥ 100 | $R_w$ ≥ 57<br>(-5;-12)*<br>Tr. No.: 04-01006 | REI 120 |
| | | | 100 mm air gap | | 80/18 | | | $R_w$ ≥ 77<br>(-2;-6)*<br>Tr. No.: 04-01010 | |
| 1 HTM 44 |  | ≥ 310 | ≥ 2 × 120 mm<br>10 mm air gap | 2 × 15 | – | 150<br>each wall side | ≥ 185 | $R_w$ ≥ 60<br>(-6;-15)*<br>Tr. No.: 04-01003 | REI 120 |
| | | | 100 mm air gap | | 80/18 | | | $R_w$ = 74.5<br>(-2;-4)<br>Tr. No.: 04-00961 | |

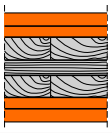
* Calculated according to building acoustics software INSUL, Version v.9.0.8

## fermacell® Firepanel A1 – cavity wall

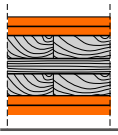
| System reference | System drawing | Wall thickness | Sub-structure [13] CLT | Boarding per side | Mineral wool [1] Thickness/ gross density | Applied load | Mass per unit | Airborne sound insulation index $R_w$ (C; $C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [kN/m] | [kg/m²] | [dB] | |
| 1 HTM 22 A1 |  | ≥ 190 | ≥ 2 × 80 mm<br>10 mm air gap | 10 | – | 45<br>each wall side | ≥ 97 | $R_w$ ≥ 49<br>(-3;-9)*<br>Tr. No.: 04-01004 | REI 60 |
| | | | 100 mm air gap | | 80/10 | | | $R_w$ = 69<br>(-2;-6)*<br>Tr. No.: 04-01005 | |

* Calculated according to building acoustics software INSUL, Version v.9.0.8

## fermacell® fibre gypsum boards – fire walls – load-bearing space-enclosing

| System reference | System drawing | Wall thickness | Sub-structure [13] CLT | Boarding per side | Mineral wool [1] Thickness/ gross density | Applied load max. Stress sc,0,d,R90 | Mass per unit | Airborne sound insulation index $R_w$ ($C; C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [N/mm²] | [kg/m²] | [dB] | |
| 4 HTM 32 |  | ≥ 146 | ≥ 80 | 15 + 18 | – | 3.0 | ≥ 117' | $R_w$ ≥ 42* (-1;-2) Tr. No.: 04-01002 | REI 90-M |

* By calculation according to EN12354-1:2000, p. 28

| System reference | System drawing | Wall thickness | Sub-structure [13] CLT | Boarding per side | Mineral wool [1] Thickness/ gross density | Applied load | Mass per unit | Airborne sound insulation index $R_w$ ($C; C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [kN/m] | [kg/m²] | [dB] | |
| 4 HTM 21 |  | ≥ 130 | ≥ 80 | 2 × 12.5 | – | 150 | ≥ 69 | $R_w$ ≥ 41 (-1;-3)* Tr. No.: 04-01225 | REI 60-M |

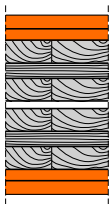
* By calculation according to EN12354-1:2000, p. 28

## fermacell® Firepanel A1 – fire walls

| System reference | System drawing | Wall thickness | Sub-structure [13] CLT | Boarding per side | Mineral wool [1] Thickness/ gross density | Applied load | Mass per unit | Airborne sound insulation index $R_w$ ($C; C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [kN/m] | [kg/m²] | [dB] | |
| 4 HTM 41 A1 |  | ≥ 195 | ≥ 120 | 3 × 12.5 | – | 80 | ≥ 152 | $R_w$ ≥ 46* (-2;-3) Tr. No.: 04-01039 | REI 120-M |

* By calculation according to EN12354-1:2000, p. 28

## fermacell® fibre gypsum boards – fire walls double shell

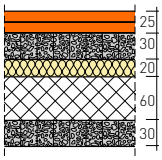
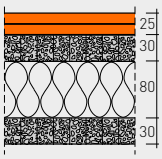
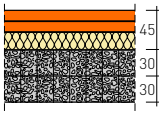
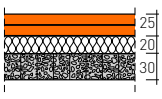
| System reference | System drawing | Wall thickness | Sub-structure [13] CLT | Boarding per side | Mineral wool [1] Thickness/ gross density | Applied load max. Stress sc,0,d,R90 | Mass per unit | Airborne sound insulation index $R_w$ ($C; C_{tr}$) | Fire protection |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm]/[kg/m³] | [N/mm²] | [kg/m²] | [dB] | |
| 4 HTM 31 |  | ≥ 236 | ≥ 2 × 80 mm (Cross-laminated timber) 10 mm air gap<br>100 mm air gap | 18 + 15 | –<br>80/18 | 3 per wall shell | ≥ 152 | $R_w$ ≥ 56 (-5;-13)*<br>$R_w$ = 74.5 (-2;-4) Tr. No.: 04-00961 | REI 90-M |

* Calculated according to building acoustics software INSUL, Version v.9.0.8

# 1.4 fermacell™ design solutions – ceiling

Bare floor
$R_w$ = 39 dB
$L_{n,w}$ = 85 dB

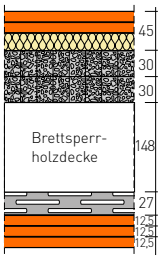
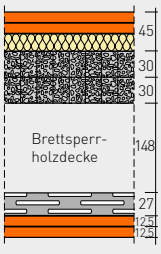
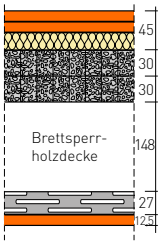
**CLT ceiling**

| System drawing | Construction | Constr. height (Floor) | Sound insulation Impact noise $L_{n,w}$ ($C_{I,100-2500}$ \| $C_{I,50-2500}$) | Airborne sound $R_w$ ($C_{100-3150}$ \| $C_{tr,100-3150}$ $C_{50-3150}$ \| $C_{tr,50-2500}$) | Verification | Area of application |
|---|---|---|---|---|---|---|
| | | mm | dB | dB | | |
|  | **2 E 22**<br>(2 × 12.5 mm fermacell® fibre gypsum boards)<br>on 30 mm fermacell™ honeycomb insulating system<br>on 20 mm Florrock GP<br>on 60 mm EPS 150 kPa<br>on 30 mm fermacell™ honeycomb insulating system | 165 | 46.0<br>(+2 \| +8) | 67.8<br>(-4 \| -12<br>-9 \| -21) | TrNo.:<br>04-00895 | 1 |
|  | **2 E 22**<br>(2 × 12.5 mm fermacell® fibre gypsum boards)<br>on 30 mm fermacell™ honeycomb insulating system<br>on 80 mm Schneider 140 kPa<br>on 30 mm fermacell™ honeycomb insulating system | 165 | 48.4<br>(+1 \| +5) | 68.3<br>(-4 \| -11<br>-9 \| -22) | TrNo.:<br>04-00894 | 1 |
|  | **2 E 35**<br>(2 × 12.5 mm fermacell® fibre gypsum boards + 20 mm mineral wool)<br>on 2 × 30 mm fermacell™ honeycomb insulating system | 105 | 50.2<br>(+0 \| +3) | 66.9<br>(-3 \| -10<br>-8 \| -20) | TrNo.:<br>04-00892 | 1 |
|  | **2 E 35**<br>(2 × 12.5 mm fermacell® fibre gypsum boards + 20 mm mineral wool)<br>on 30 mm fermacell™ honeycomb insulating system | 75 | 51.8<br>(+1 \| +4) | 64.2<br>(-4 \| -11<br>-9 \| -20) | TrNo.:<br>04-00891 | 1 |
|  | **2 E 22**<br>(2 × 12.5 mm fermacell® fibre gypsum boards)<br>on 20 mm wood fibre Steico Therm sd<br>on 30 mm fermacell™ honeycomb insulating system | 75 | 53.6<br>(+1 \| +3) | 64.1<br>(-4 \| -11<br>-9 \| -20) | TrNo.:<br>04-00893 | 1 |

**Further sound insulation information can be found in section 4 Sound insulation.**

Bare floor
no output value
defined

**CLT ceiling**

| System drawing | Construction | Constr. height (Floor) | Sound insulation Impact noise $L_{n,w}$ ($C_{I,100-2500}$ \| $C_{I,50-2500}$) | Airborne sound $R_w$ ($C_{100-3150}$ \| $C_{tr,100-3150}$ $C_{50-3150}$ \| $C_{tr,50-2500}$) | Verification | Area of application |
|---|---|---|---|---|---|---|
| | | mm | dB | dB | | |
|   | **2 E 35**<br>(2 × 12.5 mm fermacell® fibre gypsum boards + 20 mm mineral wool)<br>on 2 × 30 mm fermacell™ honeycomb insulating system<br>with 148 mm CLT<br>with 27 mm sprung track + mineral wool<br>on 3 × 12.5 mm fermacell® fibre gypsum boards | 105 | 38.7<br>(+2 \| +21) | 75.8<br>(-7 \| -16<br>-22 \| -35) | TrNo.:<br>04-00898 | 1 |
|   | 2 E 35<br>(2 × 12.5 mm fermacell® fibre gypsum boards + 20 mm mineral wool)<br>on 2 × 30 mm fermacell™ honeycomb insulating system<br>with 148 mm CLT<br>with 27 mm sprung track + mineral wool<br>on 2 × 12.5 mm fermacell® fibre gypsum boards | 105 | 41.3<br>(+2 \| +18) | 74.2<br>(-9 \| -18<br>-21 \| -34) | TrNo.:<br>04-00897 | 1 |
|   | **2 E 35**<br>(2 × 12.5 mm fermacell® fibre gypsum boards + 20 mm mineral wool)<br>on 2 × 30 mm fermacell™ honeycomb insulating system<br>with 148 mm CLT<br>with 27 mm sprung track + mineral wool<br>on 1 × 12.5 mm fermacell® fibre gypsum board | 105 | 50.0<br>(+4 \| +10)* | 74.2<br>(-9 \| -18<br>-21 \| -34)* | TrNo.:<br>04-00896 | 1 |

* Internal audit and investigation

## 2. Working

# 2.1 Storage/Transport/Building site

fermacell® fibre gypsum boards as well as fermacell® Powerpanel $H_2O$ boards are proven, efficient and economical products for timber construction. Like all building materials, they react to changes in material temperature and moisture with changes in size and shape. This can affect the quality and durability of the materials and the structures that are built from them. Errors during transport and storage can also result in damage. Compliance with the conditions defined here for processing and installation is therefore mandatory.

## Storage

- Boards and equipment must be protected from the effects of moisture, and especially from rain
- Gypsum products must always be stored dry
- To avoid deformation and breakage, these boards must be stored flat, e.g. on dry pallets or on dry wooden supports approx. 35 cm apart
- Improper storage (e.g. set down on edge, exposure to moisture) results in deformation that impair proper installation
- Boards that have become damp for a short time should only be used after they have dried out completely (leave to dry on a flat surface)

**Pallet weights ***

| | | | 10 mm | 12.5 mm | 15 mm | 18 mm |
|---|---|---|---|---|---|---|
| **Gypsum fibre** | One-man board | 1 500×1 000 mm | 1 320 kg | 1 330 kg | 1 340 kg | 1 285 kg |
| | Large format | 2 000×1 250 mm | 1 760 kg | 1 775 kg | 1 785 kg | 1 715 kg |
| | Large format | 2 500×1 250 mm | 2 200 kg | 2 220 kg | 2 230 kg | 2 145 kg |
| | Large format | 2 540×1 250 mm | – | 2 225 kg | 2 265 kg | 2 180 kg |
| | Large format | 2 650×1 250 mm | – | 2 007 kg | – | – |
| | Large format | 2 750×1 250 mm | – | 2 040 kg | 2 155 kg | 1 855 kg |
| | Large format | 3 000×1 250 mm | – | 2 225 kg | 2 350 kg | 2 020 kg |
| **Power-panel HD** | Small format | 1 500×1 000 mm | – | – | 745 kg | – |
| | Large format | 2 600×1 250 mm | – | – | 1 460 kg | – |
| | Large format | 3 000×1 250 mm | – | – | 1 685 kg | – |

* The weights are approx. values.
Refer to the order confirmation for the exact pallet weights

**Observe the load-bearing capacity of the ceilings when storing and transporting boards in the building!**

## Transport of boards

- Wear gloves and suitable protective equipment
- Boards can be transported horizontally by pallet trucks or other board transport trolleys (pallet trucks that lift pallets from the front; can be provided for larger constructions sites by James Hardie after prior arrangement)
- Always carry individual boards vertically, use board lifters/carriers if possible
- Large format boards should be moved with vacuum lifting devices
- Arrange return of wooden pallets with specialised dealer

EURBAN/Batzbergstrasse/CH

## Building site conditions

**Building climate conditions**
Observe the climatic boundary conditions for use (e.g. EN 1995-1-1; Section 2.3.1.3) during working, transport, installation and the construction phase. fermacell® fibre gypsum boards may only be installed at a relative humidity of ⩽ 80 %. The boards must have acclimatised to the ambient climate before installation. Sufficient ventilation must be ensured inside buildings even after installation work has been completed. The elements must be adequately protected from the weather. For larger construction projects, weather protection should also be specified for the construction site.

**Wet plasters/screeds**
These should be put in place and be dry before the fermacell™ systems are installed – especially before the fermacell™ jointfiller joints are filled.

**Hot-rolled/poured asphalt**
This must be placed before the filler is applied, as the joints may crack due to heat/humidity stresses.

**Gas burner heating**
During application, damage may occur due to condensation. This is particularly true for cold interior areas with poor ventilation. Avoid rapid, abrupt heating, as this can cause thermal shock.

**fermacell™ glue joint**
- Room temperature: ⩾ + 5 °C
- Adhesive temperature: ⩾ + 10 °C

After bonding, there may be no significant change in these climatic conditions for at least 12 hours. Lower temperatures and relative humidity extend the curing times.

Frost during transport and storage does not damage the fermacell™ Jointstik adhesive after curing.

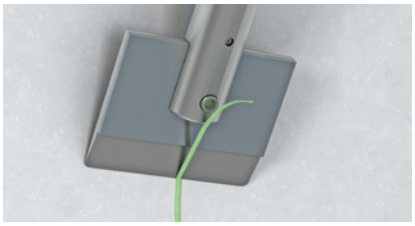
**fermacell™ filler joint**
**fermacell™ TB Tapered Edge joint**
- Relative humidity of: 70 %
- Room temperature: ⩾ + 5 °C (corresponds to a resulting residual panel moisture content of ⩽ 1.3 %)

Filling may be carried out after the wall and ceiling elements have been installed. Filling work on directly sheathed ceiling elements should only be carried out once the imposed load (e.g. floor screed/floor structures) has been applied.

**Fine filling and finishing**
The working conditions described above apply to the fine filling work.

## Transport of prefabricated elements in production and to the building site

- Transport and store wall elements upright
- Back and secure protruding boards with so-called "transport battens"
- The glue joint of with the fermacell™ joint adhesive or greenline joint adhesive must be cured before the element is transported (curing time at ⩾ + 15 °C and ⩾ 50 % relative humidity: approx. 18–36 hours)
- Then – depending on the surface requirements – the joint area and the countersunk fixings are filled in with the fermacell™ joint filler, fine filler or gypsum surface filler



Removing the excess adhesive with fermacell™ scraper

**fermacell™ glue joint**
**The adhesive is hardened after approx. 18 to 36 hours, depending on the room temperature. Do not move prefabricated elements during the critical setting time of the adhesive (4 to 12 hours) after the adhesive has been applied! Afterwards, the excess adhesive is removed completely with the fermacell™ adhesive remover (or spatula, chisel).**

**You will find further information in Section 2.2 on page 22.**

**Further information**

**online at www.gips.de in the manual:**
- Data sheet 1: Building site conditions

# 2. Working

# 2.2 Jointing options

## Jointing options for fastening of fermacell® fibre gypsum boards on CLT

**Joints (surface)**
fermacell® fibre gypsum boards can be fixed directly on cross-laminated timber surfaces. A joint offset of ⩾ 200 mm must be maintained to element joints in the surface. Horizontal joints should be avoided wherever possible. If there is no alternative to horizontal cross joints, they must be arranged with an offset of at least ⩾ 200 mm.

The following solutions are used as jointing options for installing fermacell® fibre gypsum boards, depending on the subsequent use. We recommend the adhesive jointing technique for timber construction. For two-layer lining cladding, the joint details must be applied as follows:

- 1. Layer of fermacell® gypsum fibre–board joint tightly butted (joint width ⩽ 1 mm)
- 2. Layer of fermacell® gypsum fibre–board joint as for single-layer sheathing (see images to the right)
- Joint offset min: ⩾ 200 mm

**Corner Joints**
There are various design options for the joint design in internal/external corners.

It is important that corner designs do not result in three-flank adhesion and that there is a separation so that only two flanks provide the joint design.

Ceilings with Sylomer supports (acoustic isolation) should not have a firm filling (on release paper) when connected to an exposed ceiling. Suitable expansion joint materials must be used here.

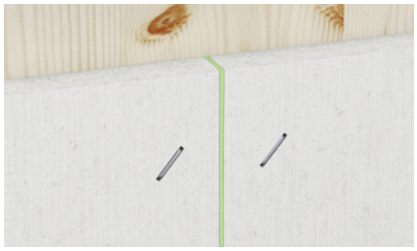
**Board joint tightly butted**

Joint width ⩽ 1 mm. No requirements towards surface design

**fermacell™ filler joint**

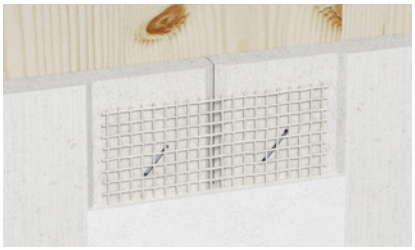
Joint width ½ × board thickness (± 3 mm). For exposed surfaces

**fermacell™ adhesive joint**



Joint width ⩽ 1 mm. For exposed surfaces

**fermacell™ dry lining edge TB**

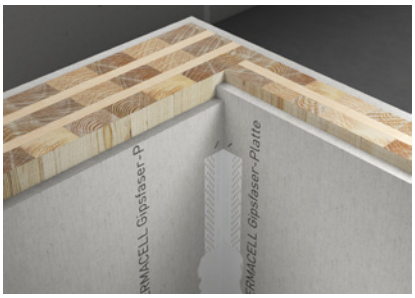


Joint width ⩽ 1 mm (tightly butted). For exposed surfaces

**Board joint tightly butted**

No requirements regarding surface design.
Joint area not visible in the application

**Board joint tightly butted with joint tape**



Joint tape filled in (e.g. composite tapes)

**fermacell™ filler joint**

Filler joint on seperating tape

**fermacell™ adhesive joint**

Joint width ⩽ 1 mm. For exposed surfaces

**You will find further information in the section Element joint formation cross-laminated timber/ CLT on page 23.**

**Further information online at www.fermacell.de:**
Document: Planning and Installing:
fermacell® and Hardie® in timber construction
- In chapter 2.2 Cut-to-size and boarding
- In chapter 2.5 Jointing technique

## Element joint formation cross-laminated timber/CLT

Cross-laminated timber elements can be produced in large dimensions, allowing heights of 3 metres and lengths of up to 20 metres. Owing to logistics and construction site conditions, smaller formats are produced for transport, resulting in element joints in the CLT.

When arranging element joints in CLT, various conditions must be taken into account when lining with fermacell® fibre gypsum boards. The element joints must be joined together in a complete section so no additional forces may act on the fermacell® fibre gypsum boards. No fermacell® board joint should be placed in the area of the element joints.

- Joint offset of the fermacell® joint to the cross-laminated timber element joint ⩾ 200 mm

CLT elements can be joined in various ways. If it is intended to apply subsequent lining, the following element joint designs will be used, which have been proven to be suitable for fire protection in wall constructions lined with fermacell®:

- Butt joint connection
- Step joint connection
  If a filler joint is arranged in the area of the element joint – as described above – the joint must be reinforced with glass fibre tape

To ensure airtight execution of the element joint, sealing tapes are usually inserted in the area of the element joints. Correct jointing of the elements must be carried out using suitable fasteners. Ensure the selection and dimensioning of the fasteners and the overall components must carried out in accordance with the structural conditions and requirements.


CLT element joint – butt joint connection


CLT element joint – step joint connection

## Expansion/movement joints

Expansion/movement joints (continuous separation of the construction) are required in fermacell™ constructions where movement joints are also present in the shell of the building.

They must be adopted with the same movement options.

**Separating the lining**
Because of the different expansion and shrinkage behaviour of cross-laminated timber elements and fermacell™ lining when the humidity changes, the lining must be separated as of defined lengths:

- Separation of lining = open board joint

The open board joint is not filled or bonded.

Ideally, separation should be carried out at non-visible points, e.g. behind a cross-wall connection. The maximum spacing for separating the sheathing can be found in the following table.

**Maximum spacing between the separations of the sheathing in CLT constructions**

| fermacell™ jointing technique | CLT wall construction | CLT ceiling construction |
|---|---|---|
| Filler joint | 8 m | 8 m |
| Adhesive joint | 10 m | 8 m |
| Adhesive joint for fastening board in board (face side) | 12 m | 10 m |

## Switzerland – CH

EURBAN/Batzbergstrasse/CH

# 2.3 Fixing

fermacell® fibre gypsum boards can be fixed to CLT using the following fixings.

- Staples
- Nails
- fermacell™ Drywall screws

Staples are the preferred fixing method for use in conjunction with CLT elements.

When fixing, the distance of the fixing to the edge of the board must be ⩾ 10 mm.

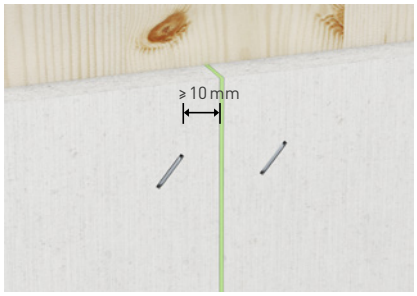
All fixings must be countersunk into the fermacell® fibre gypsum boards to a depth of approx. 1–2 mm. If the surface is to be finished, the fixings must be filled with fermacell™ joint filler or fine filler. If the surface is not to be finished (e.g. non-visible surface, first layer in two-layer constructions), the fixings do not need to be filled.

All fixings must be adequately protected against corrosion.

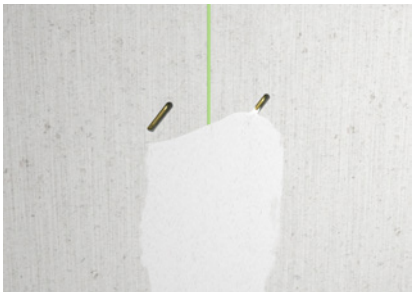
For two- or multi-layer constructions for walls or ceilings, the outer board layer can be stapled or screwed to the lower board without affecting the construction. The joint offset must be ⩾ 200 mm. The row spacing of the fixings in the wall area is ⩽ 400 mm.

For fixing fermacell® fibre gypsum boards (2nd layer) to the underlying layer of fermacell® gypsum fibre (1st layer) screws or specific diverging staples can be used. The length of the staples should be 2–3 mm shorter than the sum of the two board thicknesses.

For fire protection requirements, refer to the relevant verification documents for the fixings/fixing spacing.




Spacing of fasteners to edge



Countersink clamps 1-2 mm


Fastening board in board

**For factory prefabricated elements**

**If board to board fixing is used for multi-layer factory prefabricated components with a total lining thickness ⩾ 30 mm, additional fastenings (e.g. glue line between the boards at a distance of 400 mm) must be used.**

## 1 layer – fermacell® fibre gypsum boards* on cross-laminated timber (CLT)

**Cross-laminated timber – wall**

| | Staples (galvanized and resin-coated) d ≥ 1.5 mm, back width ≥ 10 mm | | | | fermacell™ drywall screws d = 3.9 mm | | |
|---|---|---|---|---|---|---|---|
| | Length [mm] | Spacing [mm] | Row spacing [mm] | Consumption Pce./m² | Length [mm] | Spacing [mm] | Row spacing [mm] |
| CLT 1st layer – 10 mm fermacell® fibre gypsum board | ≥ 30 | 200 | 500 | 32 | 30 | 250 | 500 |
| CLT 1st layer – 12.5 mm fermacell® fibre gypsum board | ≥ 35 | 200 | 625 | 24 | 30 | 250 | 625 |
| CLT 1st layer – 15 mm fermacell® fibre gypsum board | ≥ 45 | 200 | 625 | 24 | 40 | 250 | 625 |
| CLT 1st layer – 18 mm fermacell® fibre gypsum board | ≥ 45 | 200 | 625 | 24 | 50 | 250 | 625 |

**Cross-laminated timber – ceiling**

| | Staples (galvanized and resin-coated) d ≥ 1.5 mm, back width ≥ 10 mm | | | | fermacell™ drywall screws d = 3.9 mm | | |
|---|---|---|---|---|---|---|---|
| | Length [mm] | Spacing [mm] | Row spacing [mm] | Consumption Pce./m² | Length [mm] | Spacing [mm] | Row spacing [mm] |
| CLT 1st layer – 10 mm fermacell® fibre gypsum board | ≥ 30 | 150 | 420 | 30 | 30 | 200 | 420 |
| CLT 1st layer – 12.5 mm fermacell® fibre gypsum board | ≥ 35 | 150 | 500 | 25 | 30 | 200 | 500 |
| CLT 1st layer – 15 mm fermacell® fibre gypsum board | ≥ 45 | 150 | 550 | 21 | 40 | 200 | 550 |
| CLT 1st layer – 18 mm fermacell® fibre gypsum board | ≥ 45 | 150 | 625 | 19 | 50 | 200 | 625 |

* fermacell® Firepanel A1

## 2 layers – fermacell® fibre gypsum boards* on cross-laminated timber (CLT)

**Cross-laminated timber – wall**

| | Staples (galvanized and resin-coated) d ≥ 1.5 mm, back width ≥ 10 mm | | | | fermacell™ drywall screws d = 3.9 mm | | |
|---|---|---|---|---|---|---|---|
| | Length [mm] | Spacing [mm] | Row spacing [mm] | Consumption Pce./m² | Length [mm] | Spacing [mm] | Row spacing [mm] |
| CLT 1st layer – 12.5 mm fermacell® fibre gypsum board | ≥ 35 | 400 | 625 | 12 | 30 | 400 | 625 |
| CLT 2nd layer – 12.5 mm fermacell® fibre gypsum board | ≥ 50 | 200 | 625 | 24 | 40 | 250 | 625 |
| CLT 1st layer – 15 mm fermacell® fibre gypsum board | ≥ 45 | 400 | 625 | 12 | 40 | 400 | 625 |
| CLT 2nd layer – 15 mm fermacell® fibre gypsum board | ≥ 60 | 200 | 625 | 24 | 55 | 250 | 625 |
| CLT 1st layer – 15 mm or 18 mm fermacell® fibre gypsum board | ≥ 45 | 400 | 625 | 12 | 40 | 400 | 625 |
| CLT 2nd layer – 18 mm fermacell® fibre gypsum board | ≥ 65 | 200 | 625 | 24 | 55 | 250 | 625 |

* fermacell® Firepanel A1

## 3 layers – fermacell® fibre gypsum boards* on cross-laminated timber (CLT)

**Cross-laminated timber – wall**

| | Staples (galvanized and resin-coated) d ≥ 1.5 mm, back width ≥ 10 mm | | | | fermacell™ drywall screws d = 3.9 mm | | |
|---|---|---|---|---|---|---|---|
| | Length [mm] | Spacing [mm] | Row spacing [mm] | Consumption Pce./m² | Length [mm] | Spacing [mm] | Row spacing [mm] |
| CLT 1st layer – 12.5 mm fermacell® fibre gypsum board | ≥ 35 | 400 | 625 | 12 | 30 | 400 | 625 |
| CLT 2nd layer – 12.5 mm fermacell® fibre gypsum board | ≥ 50 | 400 | 625 | 12 | 40 | 400 | 625 |
| CLT 3rd layer – 12.5 mm fermacell® fibre gypsum board | ≥ 65 | 200 | 625 | 24 | 55 | 250 | 625 |

* fermacell® Firepanel A1

## Fastening board in board – fermacell® fibre gypsum boards* on cross-laminated timber (CLT)

**Cross-laminated timber – wall** (fixing of the 1**st** board layer as for the 1st layer – fermacell® **fibre gypsum boards on cross-laminated timber (CLT)**

| | Diverging Staples (galvanized and resin-coated) d ≥ 1.5 mm, back spacing ≥ 400 mm | | | fermacell™ drywall screws d = 3.9 mm | | |
|---|---|---|---|---|---|---|
| | Length [mm] | Spacing [mm] | Consumption Pce./m² | Length [mm] | Spacing [mm] | Consumption Pce./m² |
| 10 mm fermacell® fibre gypsum board on 10 or 12.5 mm fermacell® fibre gypsum board | 18–19 | 150 | 43 | 30 | 250 | 26 |
| 12.5 mm fermacell® fibre gypsum board on 12.5 or 15 mm fermacell® fibre gypsum board | 21–22 | 150 | 43 | 30 | 250 | 26 |
| 15 mm fermacell® fibre gypsum board on 15 mm fermacell® fibre gypsum board | 25–28 | 150 | 43 | 30 | 250 | 26 |
| 18 mm fermacell® fibre gypsum board on 15 mm fermacell® fibre gypsum board | 28–30 | 150 | 43 | 40 | 250 | 26 |
| 18 mm fermacell® fibre gypsum board on 18 mm fermacell® fibre gypsum board | 35 | 150 | 43 | 40 | 250 | 26 |

* fermacell® Firepanel A1


1 HTMA 41
fermacell™ cross-laminated timber wall
(F120-B/REI 120)

**For fire protection requirements, observe the fasteners and fastener spacings of the corresponding fire protection certificates.**

## 3. Fire protection

# 3.1 Fire protection with cross-laminated timber/CLT

**The topics covered in this section on design options for building with cross-laminated timber and solutions with James Hardie Europe products are intended to provide a common basis for discussion and exchange for designers, planners, installers and builders involved in timber construction. They demonstrate the wide range of possible solutions in timber construction and provide examples for defining project-related solutions can be achieved:**

- **Fire protection cross-laminated timber**
- **Performance and verifications**
- **Wall constructions**
- **Ceiling constructions**
- **Firestopping solution for CLT**
- **Details and junctions**

The cross-laminated timber construction method has numerous possible solutions for the building requirements of the future. This often involves topics such as:

- Consolidation in urban construction
- Multi-storey buildings
- Gained living space
- Reduced construction times
- Static/loaded solutions
- Fire protection

Building with cross-laminated timber allows construction projects to be built quickly thanks to the high level of prefabrication options, including modular construction. At first glance, cross-laminated timber construction has advantages in terms of structural fire protection in multi-storey buildings, such as avoiding the risk of fire spreading in cavities and high load transfer with a slim cross-section.

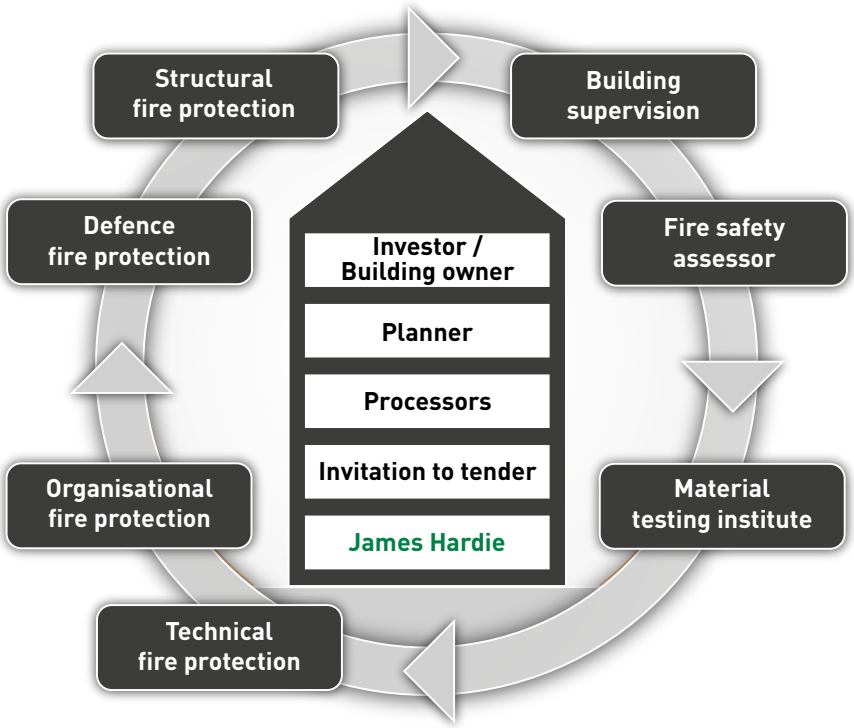
Nevertheless, a holistic view should not be disregarded. Unprotected wood surfaces increase the fire load and must therefore be well planned with regard to building code requirements. It is therefore all the more important to use the correct individual characteristics and terms in fire protection, such as building material class, fire development, fire spread and fire resistance, and to define the possibilities with regard to these requirements. A high level of care is therefore required at the planning stage in order to fully utilise the potential of CLT for multi-storey buildings.

James Hardie Europe has in recent years developed extensive fire protection solutions for building with CLT. These are construction solutions for the protection of CLT. fermacell® fibre gypsum boards simultaneously take on several functions in combination with the cross-laminated timber elements.

The aim is to increase the decorative possibilities of surface design and the proportion of non-combustible surfaces. This is essentially about optimising the fire protection of the wall elements with a high load transfer and also realising slim wall structures. More living and usable space can therefore be made available in the face of increasing urbanisation.

**Further information**

**online at www.informationsdienst-holz.de**
Guidance details for component connections in building classes 4 and 5




James Hardie Europe will provide support as a partner in all phases of the project.

Options for structural fire protection solutions with different requirements:

- Single-layer lined constructions from F30-B to F120-B (REI 30 to REI 120)
- Firewalls (REI 90-M, REI 120-M)
- Single-sided and double-sided wall systems F30-B to F120-B (REI 30 to REI 120)
- Streamlined fire protection solutions with permissible loads of up to 200 kN/m
- Element joint designs
- Integration of steel components
- Connection joint solutions
- Implementations of firestopping systems

## England – UK


EURBAN/Newington Butts/UK

## 3. Fire protection

# 3.2 fermacell® fibre gypsum boards – fire protection lining

In terms of fire protection and load-bearing capacity, cross-laminated timber offers many possibilities for multi-storey buildings. James Hardie Europe has carried out extensive component/fire tests to optimise building with cross-laminated timber in order to optimise the performance of solid timber construction and to realise slimmer constructions integrating high load transfer. This achieves various protection goals that significantly affect the property/project business.

As a building material, wood is also known to be combustible and therefore differs in many ways from other building materials in multi-storey buildings. Unlike other building materials such as steel, timber behaves more favourably in terms of load-bearing behaviour. Wood itself is a poor conductor of heat and the effect of the fire (corresponding heat energy on the surface) results in pyrolysis and the formation of a charred layer. This resulting charred layer has a decreasing density and provides better thermal insulation, which in turn protects the area of the wood that is not exposed to high temperatures. However, wood as a building material does represent an additional fire load at the exposed surface and normally usable wood cross-sections cannot be considered as a load-bearing layer in the event of fire. In many countries, the additional fire load due to exposed timber surfaces is taken into account for high-rise buildings and complex timber constructions and a so-called "proof of self-extinguishing" is required.

Protecting the surface of the cross-laminated timber with fermacell® fibre gypsum boards therefore offers several advantages for the supporting structure at the same time.

### fermacell on CLT

- Non-combustible surface
  → Reduction of visible fire load in the room
- Protection of the supporting structure before burning combustion
  → No additional fire contribution
- Optimisation of the timber cross-sections
  → Streamlined wall constructions
- High loads can be realised
  → Due to reduced or no burning combustion, higher loads can be taken into account

## Requirements for fire protection linings

Fire protection linings can be used for different performance characteristics depending on the definition of the requirements. Essentially, the objective is to protect the supporting structure (wood) from ignition, i.e. to delay the start of the burning combustion by using fire protection lining.

The respective country-related (national/European) or project-related requirements must be defined in advance of project planning.

**Protective action of fire protection lining (EN 1995-1-2)**

As described above, fire protection lining contributes positively to the behaviour of building components in the event of fire. Eurocode 5 (EN 1995-1-2), which takes into account the protective action of fire protection lining in the design, also gives further guidance. Two key features are considered here. On the one hand, the components are optimised so as to prevent the involvement of the timber components in the fire ($t_{ch}$). In EN 1995-1-2, the limit temperature is standardised at 300 °C. In this context, this is referred to as the burning rate limit. I.e. the layer between the charred layer and the unburnt cross-section.

- Limit temperature: ⩽ 300 °C ($t_{300}$)

On the other hand, the properties of the protective lining: At what point does the cladding begin to fail/fall off ($t_f$).

**Encapsulation (England/STA guide)**

England (UK) has specific regulations for building with CLT. Buildings with a height of > 18 m must take into account the CLT as an additional fire load. There are two options that can be considered in this context:
1. complete encapsulation of the timber construction and,
2. the self-extinguishing property, which can be included in the holistic view for the overall project.

The criteria of encapsulation and the onset of charring is an important parameter. Complete encapsulation is therefore, one way of verifying fire protection requirements. As opposed to the protective effect of the cladding (EN 1995-1-2), the requirements for the permissible limit temperatures in the UK between the cladding and CLT are defined as ⩽ 200 °C.

- Limit temperature: ⩽ 200 °C ($t_{200}$)

**Further information**

**online at www.fermacell.de:**

- In chapter 1.10 Cross-laminated timber of the document fermacell® and Hardie® constructions

$K_2$60 component test: two-layer fermacell® – after 60 minutes)

$K_2$60 component test: two-layer fermacell® – Inspection of the base support (indicator board)

**Fire protection cladding (EN 13501-2)**
EN 13501-2 specifies the fire protection function K, which defines a fire protection cladding that protects an underlying layer from ignition, charring or other damage for a defined period of time. The test procedure is a fire test for a ceiling component (EN 14135) which defines classification periods of 10 minutes (K10), 30 minutes (K30) and 60 minutes (K60).

Depending on the base support located behind the fire protection cladding, a substrate (indicator plate) of classification $K_1$ or $K_2$ is assigned, whereby only classification $K_1$ is provided for $K_1$10. A wood-based panel (ρ 680 kg/m³ ± 50 kg/m³) serves as a base support (indicator panel) for use in multi-storey timber construction and the classifications $K_2$10, $K_2$30 and $K_2$60 can be assigned.

At the time of classification, the following protection targets must be met:

- No charring, ignition, damage to the base support (indicator panel)
- $\Delta T_{average\ value}$: ⩽ 250 °C
- $\Delta T_{maximum\ value}$: ⩽ 270 °C

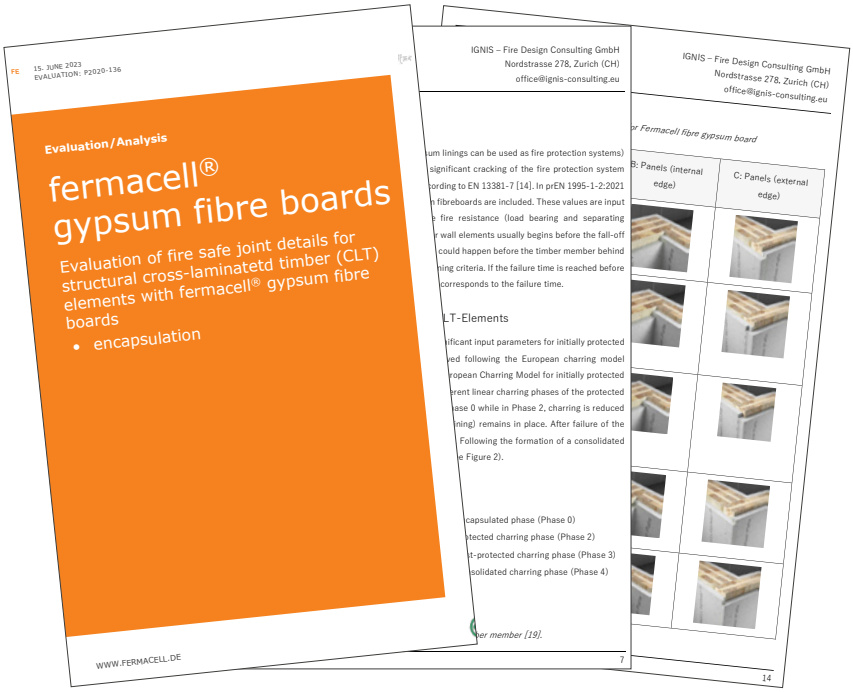
## 3. Fire protection

# 3.3 Joint design and fire protection Lining – project solution

James Hardie Europe in recent years has carried out extensive component tests with cross-laminated timber components in order to further develop solutions for CLT buildings. This involved the load-bearing capacity and optimisation of the component performance as well as the properties with regard to temperature behaviour.

The design of the joints in the area of the fire protection lining is a special feature for planning and application. Numerous investigations have also been conducted recently, which have expanded the solutions for CLT.

To demonstrate the possibilities, engineering firm IGNIS - Fire Design Consulting GmbH (based in Zurich/CH and Munich/D) has analysed and assessed various joint designs at the surface and also in the corner areas based on national/international studies and research activities.




The following performance features have been taken into account:

Classification period (minutes)

- 30, 60, 90

Temperature criterion/
Limit temperature (°C)

- $t_{300}$, $t_{200}$

Joint locations

- Surface joints, inside corners

**This analysis/assessment "Analysis of fire safe joint details for cross-laminated timber elements fire protected with fermacell® fibre gypsum boards" can be applied to construction projects within the framework of fire protection projects and must be clarified in coordination with the respective interfaces involved.**

The following configurations can be shown as fire protection linings for sheathing on cross-laminated timber elements with regard to temperature behaviour.

| Limit temperature | > 30 minutes | > 90 minutes |
|---|---|---|
| $t_{200}$ | 18 mm fermacell® | 2 × 18 mm fermacell® |
| $t_{300}$ | 18 mm fermacell® | 2 × 18 mm fermacell® |

## Corner designs

Depending on the structural conditions and the respective construction processes in conjunction with the amount of prefabrication, different options for corners may be required. However, the junction interfaces are an essential feature for the overall building structure and the required protection performances. Various corner designs have therefore been assessed in the fire protection assessment with regard to their suitability for the required protection.

## Single-layer lining/ Corner design

The corner design for single-layer lining is based on the corner designs already described in section 2.2. There is also a further solution that can be used if the joint widths are larger due to the construction site/production installation process.

**Board joint tightly butted**

Joint width ≤ 1 mm
No requirements regarding surface design/finishing.
Joints in non visible locaitons

**Corner joint with Aestuver™ FB FPM mastic**

Intumescent joint material
Joint widths of 4–35 mm

**fermacell™ filler joint**

Filler joint on open joints - width 1/2 board width +3 mm

## Multi-layer lining/ Corner design

The corner can be designed in a variety of ways that are assessed in terms of fire protection. Numerous national/international research activities, such as "fire resistance testing of encapsulation to CLT walls and ceiling elements" (OFR FIRE+RISK CONSULTANTS), in which corner designs were evaluated or tested as part of trials, were also included in the assessment.

**Corner joint tightly butted**

Double offset

**Corner joint tightly butted**

Single offset

**Corner joint tightly butted**

Tight joint
Joint width ≤ 1 mm

**Corner joint**

Intumescent joint material
Joint widths of 4–35 mm

**Corner joint – Filler joint**

Two-layer filler joint on seperating tape

**Corner joint – Filler joint**

Single-layer filler joint on seperating tape

## England – UK

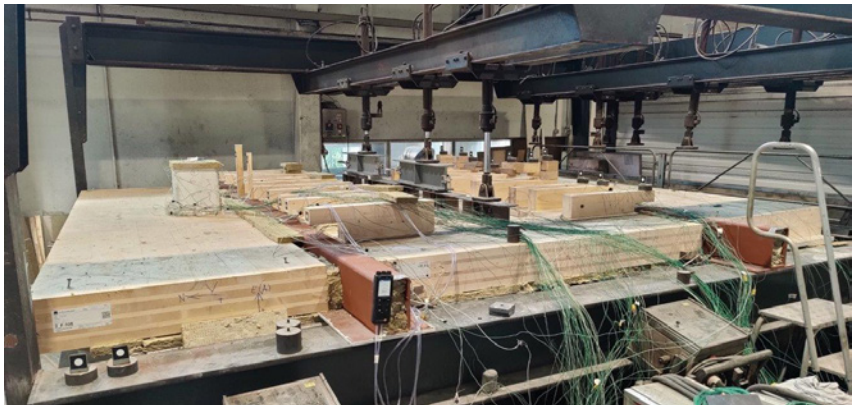
EURBAN/Press House/UK

## 3. Fire protection

# 3.4 Steel components/steel beam and cross-laminated timber ceilings – project solution

The optimum combination of materials - to maximise their respective performance - is a high priority in modern construction. When there are large span widths or special static/loaded framework conditions, a combination of timber and steel is often used as a solution for ceiling structures. In particular, Multi-storey buildings, require solutions that can combine materials to fulfil very different material properties in terms of fire protection. In this case, the engineering firm IGNIS - Fire Design Consulting GmbH (based in Zurich/CH and Munich/D) has carried out tests based on the findings from national/international research projects in order to develop possible solutions for the application of material combinations of steel beams/ cross-laminated timber ceiling. Finally, a ceiling structure was examined as an example in a large-scale fire test under load at the IBS Linz. As part of the component test, cross-laminated timber ceiling elements laid on steel beam components were examined with regard to the behaviour of the steel cross-laminated timber support in the event of fire.

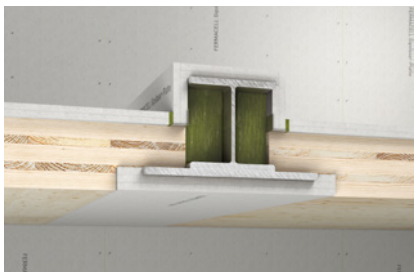
The steel flanges were clad with 2 × 18 mm fermacell® fibre gypsum boards, so that the ceiling construction was protected for more than 90 minutes. Thanks to the extensive acquisition of integrated measurement data, customised solutions can be developed and evaluated on a project-specific basis, enabling safe construction using a combination of cross-laminated timber and steel components. IGNIS – Fire Design Consulting is available for advice on the development of support details for compliance with project-specific protection targets in the event of fire.



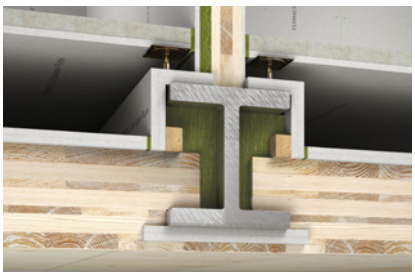
IGNIS - Fire test cross-laminated timber ceiling/steel girder (IBS Linz)

IGNIS - Fire test cross-laminated timber ceiling/steel beam (IBS Linz)

Project solution: elliottwood – 38 Berkeley Square/London – UK



Project solution: Encapsulation ceiling component – Cross-laminated timber/steel beam



Project solution: Encapsulation ceiling component with raised floor – cross-laminated timber/steel beam

## France – F


Hotel Jo & Joe/Gentilly (Paris)/F

## 3. Fire protection

# 3.5 Bulkhead systems/implementations – project solution

**Aestuver™ FireShield**
The question of how to implement installations through separating components (ceiling/wall) often arises, particularly in multi-storey buildings or when separating building units. James Hardie Europe has recently carried out extensive development work in this area and has developed a new system for ceiling installations, which has an ETA (ETA-22/0248) and can be used on a project-specific basis depending on the respective national requirements.

When planning projects, Aestuver™ FireShield can be taken into account at an early stage, as the opening dimensions can be specified at the factory for possible prefabrication on a project-specific basis.

**The Aestuver™ FireShield offers five key advantages for planning, implementation and utilisation:**

**Safety at work**
+ Fall protection
+ Penetration-resistant ceiling closure
+ Trip-free cover
+ Scaffold-free fire protection installation from above

**Waterproof**
+ Waterproof bare floor/ weatherproof building site
+ Dry installation shafts

**Economical**
+ Surveillance-free fall arrest system
+ No additional protective equipment
+ No work on formwork
+ No disposal of formwork material

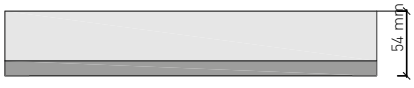
**Time efficient**
+ Prefabricated formwork element
+ Can be planned precisely in the preliminary planning phase for joining the CLT elements
+ Planning security
+ Scaffold-free installation from above

**Fire protection**
+ Safety rights from the building shell and finishing stages
+ EN-tested/EN-classified/ CE-marked
+ Pipes (combustible/non-combustible)
+ Cables and cable lines
+ Ventilation systems

AESTUVER®

**Maximum ceiling opening in cross-laminated timber***

| Aestuver™ FireShield composite board | Min. ceiling thickness | Max. width | Max. length |
|---|---|---|---|
| 54 mm | 140 mm | 1 250 mm | 2 600 mm |

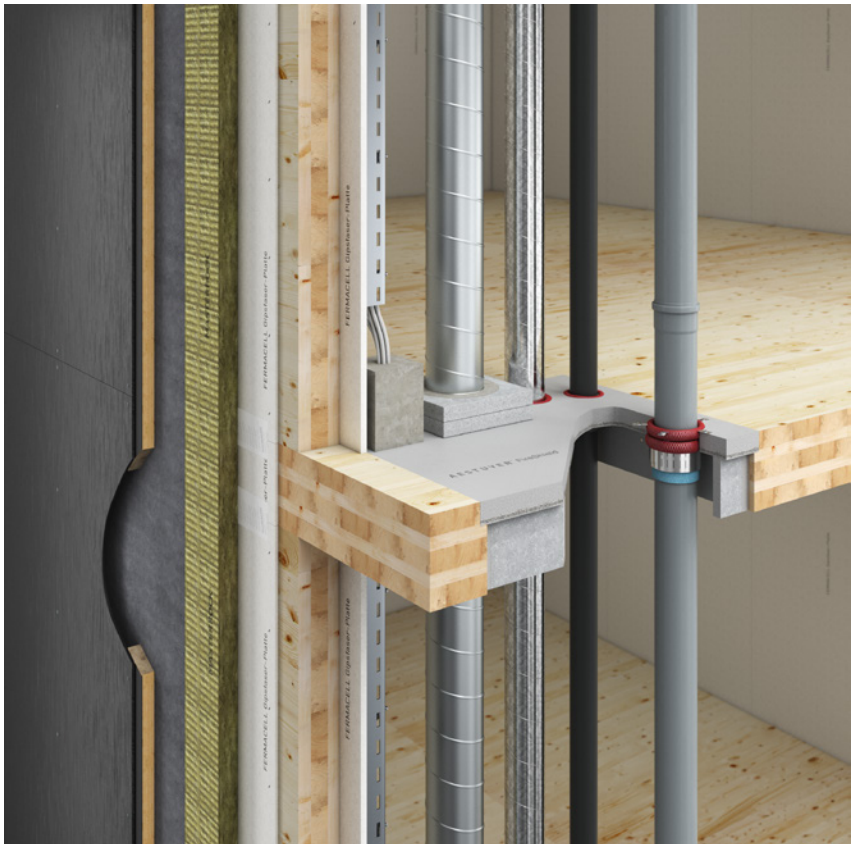



54 mm thick Aestuver™ FireShield are usually one-piece.

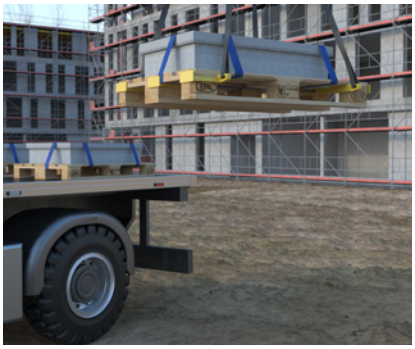
The length, width and thickness of the Aestuver™ FireShield are customised ex works to the recess dimensions.

* On customer request, rounded corners can also be produced to match the working tools of the joinery systems.

This allows for coordination with junctions of the cross-laminated timber ceilings and assembly of the Aestuver™ FireShield during the planning stage, ensuring smooth operation on the construction site. This provides planning security for the execution, both during construction and during in use. The simple design allows for easy retrofitting during subsequent use. The operator benefits from the fact that the top of the ceiling can easily be retrofitted.

Aestuver™ FireShield – ceiling damming/cross-laminated timber ceiling (project solution)



**Delivery**:
Aestuver™ FireShield elements are delivered by storey or in stages

**Aestuver™ FireShield can be used on a property-specific basis as part of fire protection planning projects and must be clarified in consultation with the respective interfaces involved.**

## 4. Sound insulation

# 4.1 Sound insulation with cross-laminated timber

**The following information on sound insulation is intended to provide designers, processors and building owners involved in timber construction with a common basis for discussion and design:**

- **Typical acoustic parameters Requirements and verifications**
- **Constructions of lined ceiling**
- **Prediction method for Ceilings & wall Constructions**
- **Installations and fixings**
- **Building separating walls**

## Typical acoustic parameters

The sound insulation of building components is measured in accordance with EN ISO 10140. As a rule, 16 measured values of one-third octave bands are available. To simplify working with these values, an evaluation procedure was introduced in accordance with EN ISO 717, which summarises the 16 measured values into a single figure. This single figure reference will then be used in the following. Dimensions for airborne and impact sound insulation requirements in accordance with DIN 4109, edition 2018:

**$R'_w$:** weighted sound reduction index in dB including flanking sound transmission (installed condition)

**$R_w$:** weighted sound reduction index in dB without flanking sound transmission as a laboratory test of the sample component itself.

**$L'_{n,w}$:** weighted standardised impact sound level in dB, taking into account all secondary sound paths

**$L_{n,w}$:** weighted standardised impact sound level in dB without taking into account the secondary sound paths determined in the test rig – corresponds to the calculated value for the basic construction

Parameters will also be important when it comes to the verification of components:

**$D_{n,f,w}$:** weighted standard flanking sound level difference in dB - including flanking transmission

The following spectrum correction values serve to better compare the single-number data obtained by from the evaluation (EN ISO 717) of a sound measurement with the subjective human perception. These are not standardised in Germany (DIN 4109) as requirements, but are used in other European countries where stated.

**C:** Correction factor value for sounds that can occur within a building (airborne sound insulation)

**$C_{tr}$:** Correction factor value for traffic noise, usually from outside (airborne sound insulation)

**$C_I$:** Correction factor value for ceilings, which evaluates level peaks in the low-frequency range (impact sound insulation)

The single-number values of the sound reduction index are determined from the level curves of the one-third octave bands between the frequencies of 100 to 3 150 Hz. Increased user comfort requirements, increased noise levels outdoors and the lowering of indoor noise levels, especially in living rooms, have shown that a modern assessment of the situation using the previously established single-number method from 100 Hz is not always sufficient. In line with current technology technology, the frequency range weighted by a single number was extended down to 50 Hz and supplemented by an additional value. Corresponding indices, which are attached to the letter C, further define the weighted area.

**Further information**

**online at www.fermacell.de:**

- On page 70 of the document Planning and working fermacell® and Hardie® in timber construction


**Example:**

$R_w + C_{50-2\,500} = 68\,dB - 20\,dB$

$R_w$: in this case stands for the single-number sound reduction index

**C** factor: stands for the correction (-20 dB) if the sound insulation of the construction is to be weighted from as low as 50 Hz

**Further sound insulation information can be found in section 1.3 fermacell™ construction solutions - wall and 1.4 fermacell™ construction solutions - ceiling.**

## Requirements and verifications

**Requirements**

In Germany, the definition of sound insulation requirements for a building project is regulated by the building authorities in the MVV TB (model administrative regulation for technical building regulations). In this case,
it refers to
DIN 4109-1:2018-01. However, the different implementation status of the MVV TB in the respective federal states must always be taken into account. Minimum requirements, which are binding under building law, are specified here for the respective areas. Under civil law, however, a different construction method is usually taken as a basis, which has either been clearly agreed in writing beforehand with regard to the expected level of sound insulation or must at least comply with the generally recognised rules of technology. Corresponding rulings in current case law, e.g. from the German Federal Court of Justice, must be observed.

German Federal Court of Justice rulings:
· VII ZR 184/97 dated 14.05.1998
· VII ZR 54/7 dated 04.06.2009

With the introduction of DIN 4109-5:2020 in 2020, there is once again a DIN-based set of rules for increased requirements for sound insulation in building construction. It is the replacement for DIN 4109 Insert 2:1989-11. Regardless of the requirements of DIN 4109-1:2018-01 (minimum requirements) or DIN 4109-5:2020-08, the preferred sound insulation can also be agreed individually. The regulations VDI 4100 (2012 edition), DEGA recommendation 103 (2018 edition) or Informationsdienst Holz can provide support here: "Sound insulation in timber construction - basics and preliminary design" (2019 edition).

**Further information**

**online at www.informationsdienst-holz.de**
Sound insulation in timber construction:
Basics and preliminary dimensioning


**Airborne and impact sound insulation to protect against sound transmission from an external living or working area**

| Components | Minimum requirements \| increased requirements DIN 4109-1:2018-01 \| DIN 4109-5:2020-08 | |
|---|---|---|
| | Airborne noise req. $R'_w$ dB | Impact noise req. $L'_{n,w}$ dB |
| **Apartment blocks, office buildings and mixed-use buildings** | | |
| Apartment separating ceilings | ≥ 54 \| 57 | ≤ 50* \| 45 |
| Ceilings under bathrooms/WCs | ≥ 54 \| 57 | ≤ 53 \| 47 |
| Apartment separating walls | ≥ 53 \| 56 | – |
| **Hotels and accommodation** | | |
| Ceilings including ceilings under corridors | ≥ 54 \| 57 | ≤ 53 \| 45 |
| Walls between overnight rooms, corridors and overnight rooms | ≥ 47 \| 52 | – |
| Ceilings under bathroom and WC without/with floor drainage | ≥ 54 \| 57 | ≤ 53 \| 47 |
| **Schools and similar institutions** | | |
| Ceilings between classrooms or similar rooms | ≥ 55 | ≤ 53 |
| Walls between classrooms or similar rooms | ≥ 47 | – |

Following DIN 4109-1:2018-01 Tab. 1 to 6 and DIN 4109-5:2020-08 Tab. 1 to 4
* For new buildings with ceiling constructions, DIN 4109-33:2016-07, Sound insulation in buildings - Part 33: data for the mathematical verification of sound insulation (component catalogue) - timber, lightweight and dry construction, the requirement for $L'_{n,w}$ ≤ 53 dB

**Airborne sound insulation to protect against sound transmission between detached houses - house partition walls**

| Components | Minimum requirements DIN 4109-1:2018-01 \| DIN 4109-5:2020-08 | |
|---|---|---|
| | Airborne noise req. $R'_w$ dB | Impact noise req. $L'_{n,w}$ dB |
| **Single-family houses, terraced houses and semi-detached houses** | | |
| Building partition walls to common rooms located on the lowest floor (whether or not in contact with the ground) of a building | ≥ 59 \| 62 | – |
| Building partition walls to habitable rooms under which at least one storey of the building is present (whether or not in contact with the ground) | ≥ 62 \| 67 | ... |

Following DIN 4109-1 01/18 Tab. 3

**Verification method for airborne sound - directly lined CLT wall element**

Cross-laminated timber elements are not dissimilar to classic solid construction elements in terms of their structural acoustic behaviour, which is why elements lined directly with fermacell® fibre gypsum boards can be calculated approximately using the following formula:

$$R_w = 25\,\lg \times \frac{m'_{ges}}{m'_0} - 7\,(dB)^*$$

The formula may be used for components with a total thickness of 80 to 160 mm and a total weight of 35 to 160 kg/m². The formula represents the state of technology and is not secured by a standardised procedure under building law.

**Verification method for airborne sound - independent lining**

In a further step, based on DIN 4109, Part 34, 2016 edition the calculation method for independent linings listed therein can be used. The weighted airborne sound improvement $\Delta R_w$ (applies to the resonance frequency $f_0$ between 30 and 160 Hz) is calculated as follows:

$$\Delta R_w = 74.4 - 20\,\lg \times f_0 - 0.5\,R_w$$

The double wall resonance $f_0$ is calculated as follows:

$$f_0 = \frac{1}{2\pi} \times \sqrt{s' \times \left(\frac{1}{m_1} + \frac{1}{m_2}\right)}$$

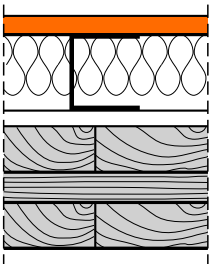
With:

$f_0$: Double wall resonance frequency in Hz
$m_1$: Total mass of the base wall in kg/m²
$m_2$: Total mass of the independent lining in kg/m²
$s'$: Spring rigidity of the layer between base wall and independent lining in MN/m³.

The following applies to free-standing independent linings:

$$s' = \frac{0.111\,MPa \times 10^6}{d\,[m]}$$

**Calculation example:**



| | | |
|---|---|---|
| fermacell® fibre gypsum board | 12.5 mm | **$R_w$ = 56 dB** |
| CW/UW profile | 50 mm | $C_{100-3150}$ = -3 dB |
| Rock wool insulation | 40 mm | $C_{tr\ 100-3150}$ = -9 dB |
| Air layer/cavity | 10 mm | $C_{50-3150}$ = -5 dB |
| Cross-laminated timber | 80 mm | $C_{tr\ 50-3150}$ = -15 dB |

**Base wall:**

$$R_w = 25\,\lg \times \frac{m'_{ges}}{m'_0} - 7\,(dB) = 25\,\lg \times \frac{40\,kg}{m^2} - 7\,(dB) = 33.0\ dB$$

**Double wall resonance frequency $f_0$:**

$$f_0 = \frac{1}{2\pi} \times \sqrt{s' \times \left(\frac{1}{m_1} + \frac{1}{m_2}\right)} = 160 \times \sqrt{\frac{0.111}{0.06} \times \left(\frac{1}{40} + \frac{1}{14.7}\right)} = 66.0\,Hz$$

**Improvement measure:**

$$\Delta R_w = 74.4 - 20\,\lg \times f_0 - 0.5\,R_w = 74.4 - 20\,\lg \times 66\,Hz - 0.5 \times 33.0\,dB = 21.5\,dB$$

$$R_w = 33.0\,dB + 21.5\,dB = 54.5\,dB$$

**Measured according to Tr. No. 04-00489:**

$R_w$ = 56 dB

**Further sound insulation solutions**

**online at www.fermacell.de in the manual:**

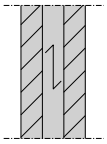
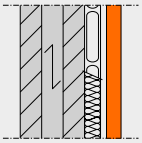
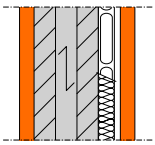
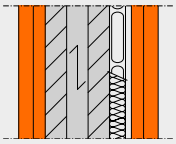
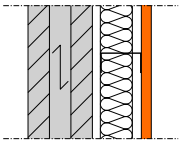
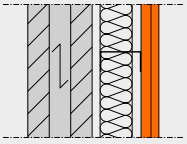
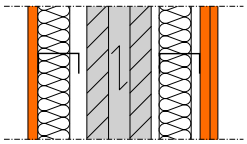
- fermacell® and Hardie® constructions


* Rabold, A. et all. Vertical flank transmission of timber stud walls, ift Rosenheim, Dec. 2022

## Italy – I

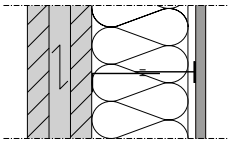
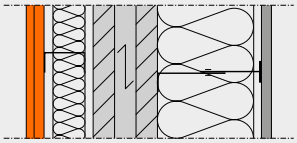
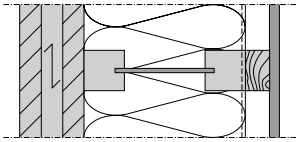
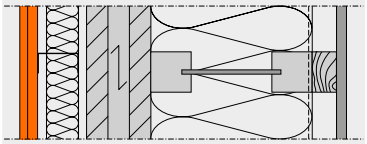
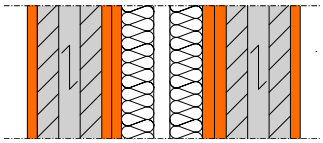

Hotel Nautilus/Pesaro/I

# 4.2 Examples of sound insulation values wall constructions/cross-laminated timber

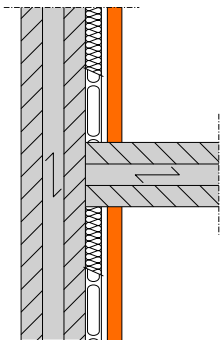
| System drawing | Description | $R_w$ [1] |
|---|---|---|
|  | 80 mm cross-laminated timber | 33 dB<br>$C_{100-3150}$ = -1 dB<br>$C_{tr.100-3150}$ = -3 dB<br>$C_{50-3150}$ = -1 dB<br>$C_{tr.50-3150}$ = -4 dB<br>Tr No.: 04-00486 |
|  | 80 mm cross-laminated timber<br>27 mm Top Hat profile<br>20 mm mineral fibre<br>18 mm fermacell® fibre gypsum board | 49 dB<br>$C_{100-3150}$ = -2 dB<br>$C_{tr.100-3150}$ = -9 dB<br>$C_{50-3150}$ = -3 dB<br>$C_{tr.50-3150}$ = -10 dB<br>Tr No.: 04-00495 |
|  | 18 mm fermacell® fibre gypsum board<br>80 mm cross-laminated timber<br>27 mm Top Hat profile<br>20 mm mineral fibre<br>18 mm fermacell® fibre gypsum board | 55 dB<br>$C_{100-3150}$ = -4 dB<br>$C_{tr.100-3150}$ = -11 dB<br>$C_{50-3150}$ = -5 dB<br>$C_{tr.50-3150}$ = -13 dB<br>Tr No.: 04-00496 |
|  | 18 + 15 mm fermacell® fibre gypsum board<br>80 mm cross-laminated timber<br>27 mm Top Hat profile<br>20 mm mineral fibre<br>18 + 15 mm fermacell® fibre gypsum board | 62 dB<br>$C_{100-3150}$ = -3 dB<br>$C_{tr.100-3150}$ = -10 dB<br>$C_{50-3150}$ = -5 dB<br>$C_{tr.50-3150}$ = -15 dB<br>Tr No.: 04-00497 |
|  | 80 mm cross-laminated timber<br>10 mm spacing<br>50 mm CW profile<br>40 mm mineral fibre<br>12.5 mm fermacell® fibre gypsum board | 56 dB<br>$C_{100-3150}$ = -3 dB<br>$C_{tr.100-3150}$ = -9 dB<br>$C_{50-3150}$ = -5 dB<br>$C_{tr.50-3150}$ = -15 dB<br>Tr No.: 04-00489 |
|  | 80 mm cross-laminated timber<br>10 mm spacing<br>50 mm CW profile<br>40 mm mineral fibre<br>12.5 + 10 mm fermacell® fibre gypsum board | 61 dB<br>$C_{100-3150}$ = -2 dB<br>$C_{tr.100-3150}$ = -9 dB<br>$C_{50-3150}$ = -6 dB<br>$C_{tr.50-3150}$ = -18 dB<br>Tr No.: 04-00490 |
|  | 12.5 mm fermacell® fibre gypsum board<br>50 mm CW profile<br>40 mm mineral fibre<br>10 mm spacing<br>80 mm cross-laminated timber<br>10 mm spacing<br>50 mm CW profile<br>40 mm mineral fibre<br>12.5 + 10 mm fermacell® fibre gypsum board | 71 dB<br>$C_{100-3150}$ = -8 dB<br>$C_{tr.100-3150}$ = -16 dB<br>$C_{50-3150}$ = -13 dB<br>$C_{tr.50-3150}$ = -26 dB<br>Tr No.: 04-00492 |

[1] $R_w$: Calculated value of the weighted sound reduction index without sound transmission via flanking components in accordance with DIN 4109

**Further sound insulation information can be found in section 1.3 fermacell™ construction solutions - wall and 1.4 fermacell™ construction solutions - ceiling.**

| System drawing | Description | $R_w$ [1] |
|---|---|---|
|  | 80 mm cross-laminated timber<br>140 mm Alu BWM<br>120 mm mineral fibre<br>12.5 mm fermacell® Powerpanel $H_2O$<br>HD lightweight mortar | 48 dB<br>$C_{100-3150}$ = -5 dB<br>$C_{tr.100-3150}$ = -10 dB<br>$C_{50-3150}$ = -5 dB<br>$C_{tr.50-3150}$ = -11 dB<br>Tr No.: 04-00506 |
|  | 10 + 12.5 mm fermacell® fibre gypsum board<br>50 mm CW profile<br>40 mm mineral fibre<br>10 mm spacing<br>80 mm cross-laminated timber<br>140 mm Alu BWM<br>120 mm mineral fibre<br>12.5 mm fermacell® Powerpanel $H_2O$<br>HD lightweight mortar | 65 dB<br>$C_{100-3150}$ = -5 dB<br>$C_{tr.100-3150}$ = -11 dB<br>$C_{50-3150}$ = -8 dB<br>$C_{tr.50-3150}$ = -19 dB<br>Tr No.: 04-00507 |
|  | 80 mm cross-laminated timber<br>200 mm Steicowall<br>200 mm Steicoflex<br>Steico multi UDB<br>30/50 mm lathing<br>12.5 mm fermacell® Powerpanel $H_2O$<br>HD lightweight mortar | 43 dB<br>$C_{100-3150}$ = -2 dB<br>$C_{tr.100-3150}$ = -7 dB<br>$C_{50-3150}$ = -2 dB<br>$C_{tr.50-3150}$ = -7 dB<br>Tr No.: 04-00506 |
|  | 10 + 12.5 mm fermacell® fibre gypsum board<br>50 mm CW profile<br>40 mm mineral fibre<br>10 mm spacing<br>80 mm cross-laminated timber<br>200 mm Steicowall<br>200 mm Steicoflex<br>Steico multi UDB<br>30/50 mm lathing<br>12.5 mm fermacell® Powerpanel $H_2O$<br>HD lightweight mortar | 65 dB<br>$C_{100-3150}$ = -4 dB<br>$C_{tr.100-3150}$ = -10 dB<br>$C_{50-3150}$ = -6 dB<br>$C_{tr.50-3150}$ = -16 dB<br>Tr No.: 04-00505 |
|  | 12.5 mm fermacell® fibre gypsum board<br>80 mm cross-laminated timber<br>2 × 12.5 mm fermacell® fibre gypsum board<br>40 mm mineral fibre<br>20 mm air layer<br>40 mm mineral fibre<br>2 × 15 mm fermacell® fibre gypsum board<br>80 mm cross-laminated timber<br>12.5 mm fermacell® fibre gypsum board | 75 dB<br>$C_{100-3150}$ = -1 dB<br>$C_{tr.100-3150}$ = -6 dB<br>$C_{50-3150}$ = -3 dB<br>$C_{tr.50-3150}$ = -13 dB<br>Tr No.: 04-00963 |

## Connection to walls

| Connection structure | Description of the inside of the flanking component | $D_{n,f,w}$ [2] |
|---|---|---|
|  | 12.5 mm fermacell® fibre gypsum board<br>27 mm Top Hat profile<br>20 mm mineral fibre<br>80 mm cross-laminated timber | 65 dB<br>$C_{100-3150}$ = -2 dB<br>$C_{tr.100-3150}$ = -7 dB<br>$C_{50-3150}$ = -3 dB<br>$C_{tr.50-3150}$ = -11 dB<br>Tr No.: 04-00755 |

[1] $R_w$: Calculated value of the weighted sound reduction index without sound transmission via flanking components in accordance with DIN 4109
[2] $D_{n,f,w}$: Calculated value of the weighted longitudinal sound reduction index without sound transmission via the separating component

The specified values only apply apply in conjunction with the respective general building authority test certificate or the acoustic test report and their design specifications.

## 4. Sound insulation

# 4.3 Building separating walls

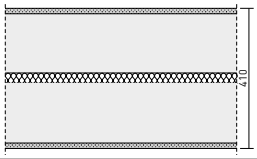
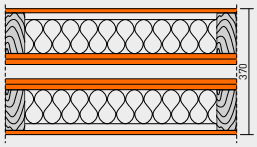
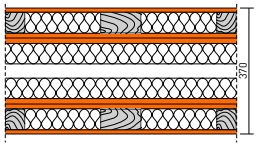
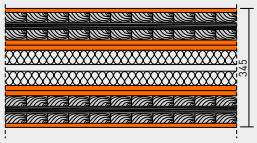
Building party walls in timber construction are generally used for the boundary development of properties. Due to the different building units, sound insulation requirements must be met in addition to the fire protection requirements. In timber construction, these building party walls are usually designed as a double stud wall system. This structure offers very good sound insulation values in the medium and high frequency range. There are good options for counteracting the noise in the lower frequency range, which is perceived by residents as booming or rumbling.

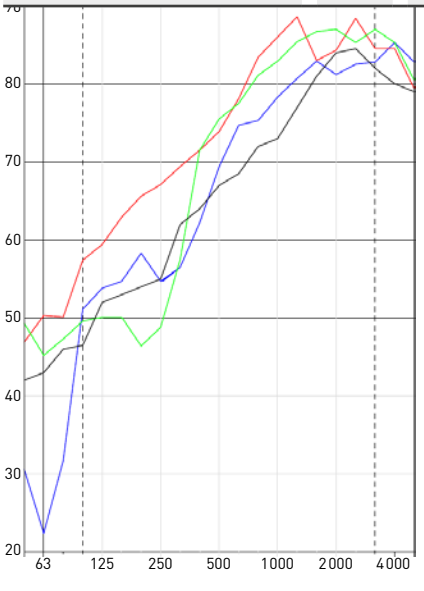
Influence options (examples):

- Increased separating joint between building party walls
- Increase the number of lining layers on the room side
- Reduction of the substructure spacing for timber frame constructions

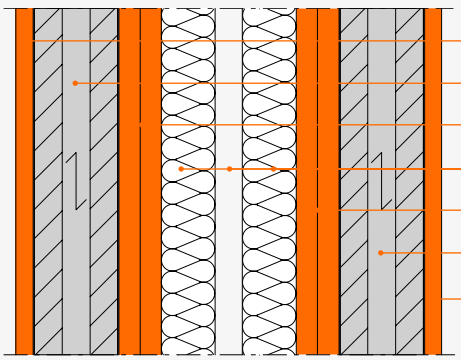
Among other things, such measures result in damping of the natural vibration behaviour of the linings and thus help improve sound insulation in the lower frequency range.

The extent to which these measures influence the airborne sound reduction index, particularly in the low-frequency range, is shown in the following comparison of superstructures measured in the laboratory with the corresponding curves:

| System drawing | Colour code | Thickness | Weight | Sound insulation Airborne sound $R_w$ ($C_{t\,r,50\text{-}5000}$) | Type of Measurement | Source |
|---|---|---|---|---|---|---|
| | | mm | kg/m² | dB | | |
|  | | 410 | | 68(-9) dB = **59 dB** | Average value from four quasi flank-free construction site measurements | Holtz et.al.: Acoustic optimisation of timber construction, Stephanskirchen 2004 |
|  | | 370 | | 71(-30) dB = **41 dB** | Laboratory measurement | Holtz et.al.: Acoustic optimisation of timber construction, Stephanskirchen 2004 |
|  | | 370 | | 66(-8) dB = **58 dB** | Laboratory measurement | Holtz et.al.: Acoustic optimisation of timber construction, Stephanskirchen 2004 |
|  | | 350 | 180 | 78(-12) dB = **65 dB** | Laboratory measurement | Laboratory measurement of James Hardie Europe GmbH am ift Rosenheim, 2017 |




**Wall representation**



12.5 mm fermacell® fibre gypsum board
≥ 80 mm solid wood wall
2 × 15 mm fermacell® fibre gypsum board
100 mm air space (with 2 × 40 mm insulation)
2 × 15 mm fermacell® fibre gypsum board
≥ 80 mm solid wood wall
12.5 mm fermacell® fibre gypsum board

$R_w$ (C;$C_{tr}$) in dB = 78 (-1; -6)

Building party wall – low-frequency application (example)

$C_{100\text{-}3150}$ = -1 dB
$C_{tr,100\text{-}3150}$ = -6 dB
$C_{50\text{-}3150}$ = -3 dB
$C_{tr,50\text{-}3150}$ = -12 dB
Tr No.: 04-00502

# Notes

The latest version of this brochure applies, which you can download from our website. Subject to technical modifications. Should you require additional information, pleasecontact our customer service.
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JamesHardie™

**James Hardie Europe GmbH**
Bennigsen-Platz 1
40474 Düsseldorf
www.jameshardie.de

**Technical Customer Information (freecall)**
Phone 0800 3864001
Email kontakt@jameshardie.com

**Service Centre (order management)**
Phone +49 211 54236-200
Fax +49 211 54236-299

Email auftraege@jameshardie.com
www.jameshardie.de
www.fermacell.de

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