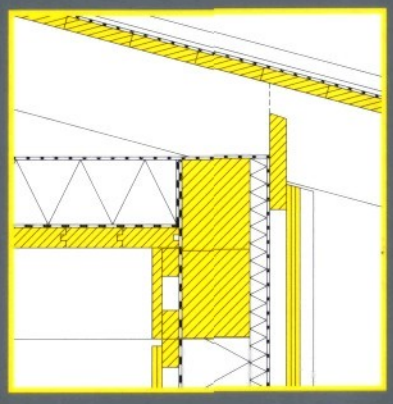
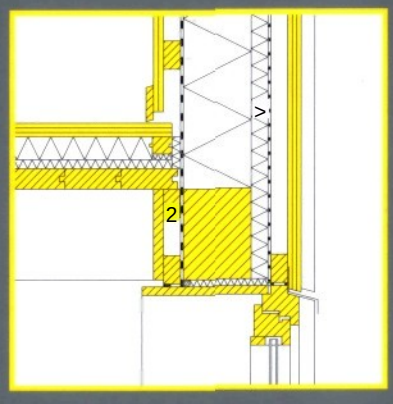
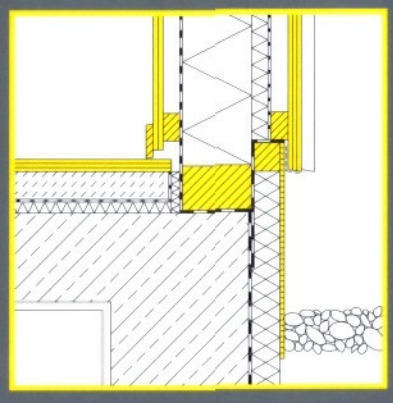
DETAIL Praxis

Timber Construction

Details
Products
Case studies







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DETAIlPraxis
Timber Construction

Theodor Hugues
Ludwig Steiger
Johann Weber

Contents

The *Arbeitsheft Holzbau,* the precursor of this book, arose at the suggestion of the Bayerisches Zimmerer- und Holzbaugewerbe and was sponsored by the Stiftung des Bayerischen Zimmerer- und Holzbaugewerbes Donat Miiller.

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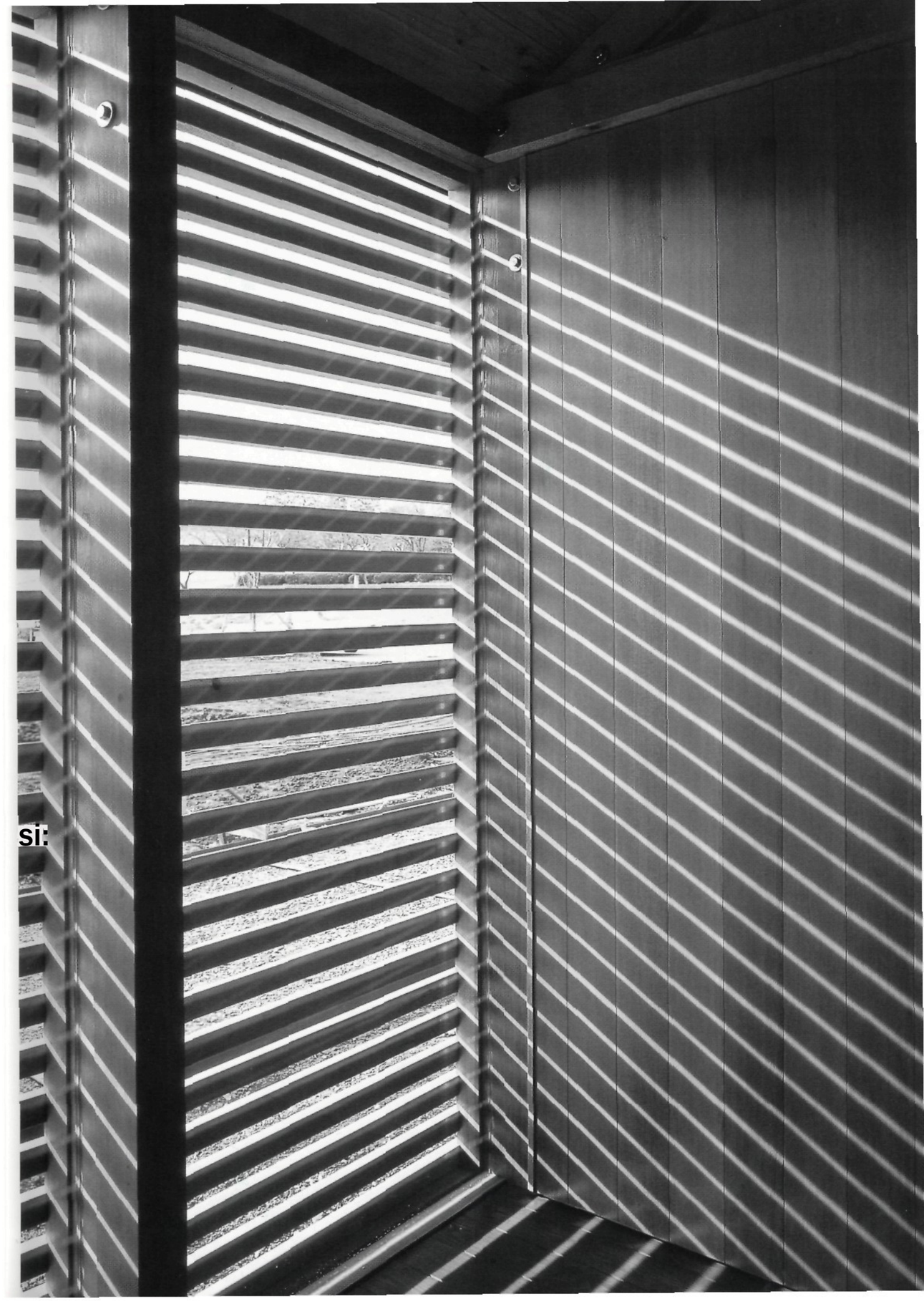
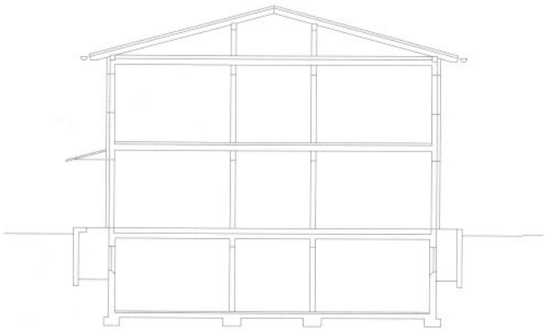
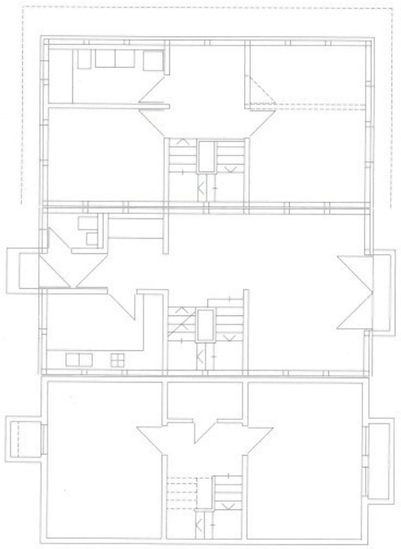
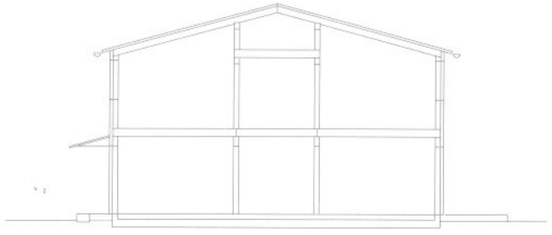


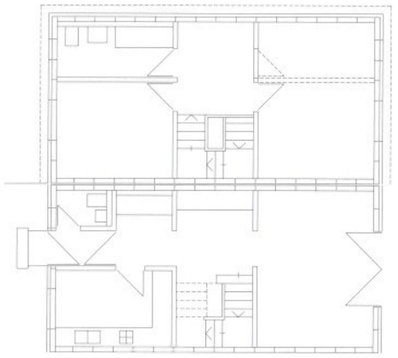
House A





House B





Introduction

The *Arbeitsbeft Holzbau* is intended as an aid to all those working in the field of construction. However, it is neither a construction manual nor an encyclopaedia of materials. It aims to show the relationship between design, detail work and the built product. What has emerged is a very handy book which summarises, in a user-friendly manner, all the material found in offices and enterprises that deals with building with wood. To avoid the selection presenting here falling prey to rapid obsolescence and, above all. premature obsolescence, it has been limited to basic designs and proven materials.

Part 1
The first part provides an overview of fhe exemplary use of building components, component layers and building materials and their integration into the overall structure of two prototypical limber houses of different design. Questions concerning building physics, such as heat, and sound insulation, vapour and fire protection, draught proofing and jointing are briefly explained and presented in graphic examples of details and joints typical of wooden construction.
Two simple, common types of terraced house have been designed and constructed to illustrate the interconnections and the problems. Common to both types is the relatively low roof pitch permitting the use of light roofing materials, Both houses can be heated with gas.

House A\sa craft-built timber-framework house standing on a cellar, its lattice-work walls rest on the cellar walls and the floor above the cellar and bear a wooden joist ceiling as well as a doubly supported roof structure which has not been fitted out. The distance between the post axes and the ceiling joists is 125 cm, making it a multiple of the module of 62.5 cm, which many of the building materials observe, The disadvantage of using thicker boarding on the visible joists has to be weighed up against the spatial (hall width, cubic measure) and the design advantages (door and window openings without trimming). It could be reduced to 83.33 cm (250 cm: 3).
To improve the dimensions of the roof overhang at the eaves and the verge, the rafter spacing between was halved to 62.5 cm.

The greater part of *House B* is designed to be produced in the workshop and assembled from prefabricated wall elements, floors and a roof on a floating foundation, assuming that the subsoil is suitable. The roof has been fitted out and integrated into the interior.
The design is based on a dimensional co-ordination of 62.5 cm, corresponding to the basic elements of panel construction such as the panel dimensions of the plywood, chipboard and, above all, plasterboard / gypsum-fibre board. This dimensional co-ordination has proven to be a useful standard for partial and full prefabrication.

The development of the skin and its material implementation has been executed in accordance with the different goals of the two projects.

Part 2
The generic terms of building materials and joints and fasteners have been italicised in the commentary on the details. In part 2 they are listed in the sub|ect index under the marked generic term along with products, specifications and manufacturers.

Part3
The brief illustrated documentation of the nine completed projects is intended to convey an impression of the diverse types of wooden buildings, showing the designs chosen, the specific ways in which the details have been elaborated, and the materials used.

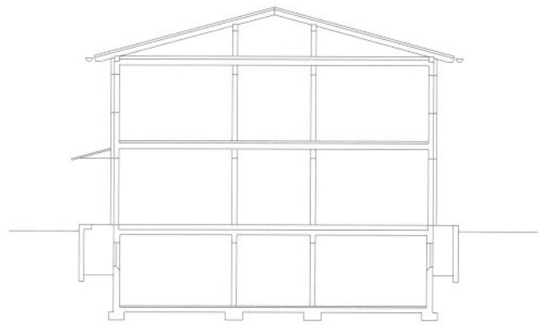
Part 4
The appendix contains technical information, a summary of the pertinent guidelines and standards together with a bibliography and a list of manufacturers, also includes cross-references that allow readers to follow the path from the manufacturer to the product and its use and vice versa, as well as a subject index and list of names,

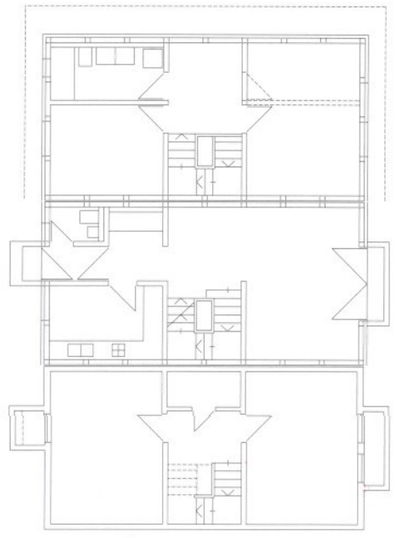
All of the detail drawings are drawn to a scale of 1:10.
The yellow squares refer to specific texts. The diverse building components have been developed as variations and represent exemplary solutions that must be adapted to specific marginal conditions, prevailing legislation, standards and manufacturers' recommendations. The authors shall not be liable for any claims made against them on the basis of the material presented here.

House A

House A

12 Exterior wall, plinth
13 Interior wall, floor above basement
14 Exterior wall, floor/ceiling, window
15 Interiorwall, floor/ceiling, door
16 Exterior wall, ceiling, eaves
17 Exterior wall, ceiling, verge
18 Exterior wall, services installation shaft
19 Party wall





a

Under DIN 18195, and to ensure that the wood is protected, a plinth height of 30 cm must be observed. Although a plinth can be lower in principle, special measures must be taken where this is the case, for example: a roof overhang, offsets, weather-protected sides, and coarse gravel strips to reduce water splashing.

The *perimeter insulation* of the exterior basement wall is covered on the outside for aesthetic reasons and to offer protection against any mechanical damage, for instance, with a fibre-cement slab.

Lib

The *perimeter insulation* and the wall structure must be made to harmonise with one another at the transition of the *perimeter insulation* to the facade. The cross-section for the *ventilation* must not be obstructed in any way. If banked-up coarse gravel is used to push the lower panel edge against the *insulating board,* the *fibre-cement slab* need only be fastened with a batten along its upper edge. The vertical panel joint must be executed in a way that prevents moisture from seeping behind the panel.

U c

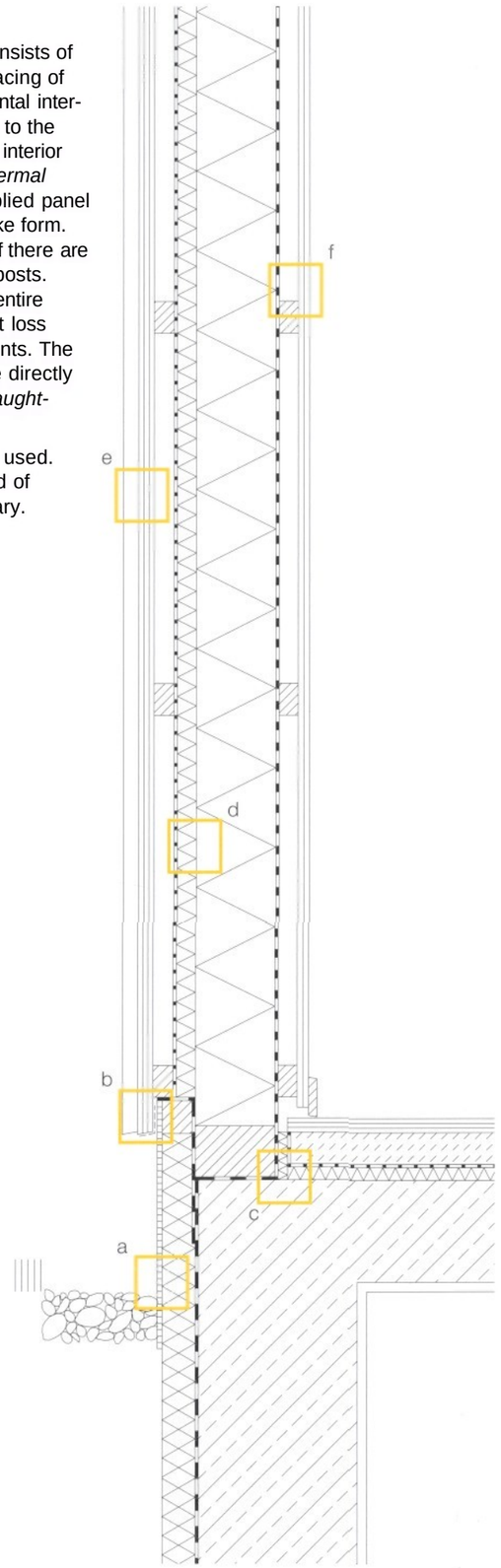
The wooden sill plate must take up the tolerances of the concrete floor above the basement, The joint is sealed with high-expansion cement mortar. The *wooden sill* plate must be impregnated both to protect it and insulate it from the concrete floor. *Chemical wood preservative* is not necessary if timber species with a high *resistance class* are used. To attach the bar-reinforced sill plate to the floor, the plate is drilled through and then anchored with a heavy-duty bolt, taking care that a safe distance is maintained to the edge of the concrete.

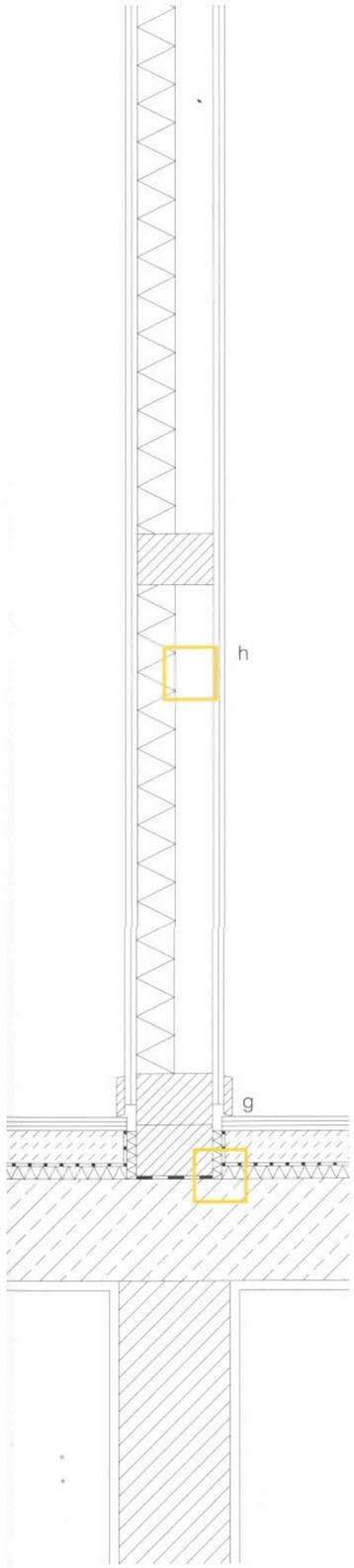
(Alternatively, the sill plate can be fixed with an angle attached to the side or with a ragbolt cast in concrete,)

d

The *exterior wall* construction consists of 12 x 12 cm posts with a unit spacing of 125 cm, and a vertical or horizontal intermediate structure adapted both to the substructure of the exterior and interior lining and to the format of the *thermal insulation.* Insulation can be applied panel or roll form, or sprayed on in flake form. Flakes should only be injected if there are sealed chambers between the posts.
A softboard is fixed across the entire bearing structure to reduce heat loss through the structure and the joints. The panels, to which battens can be directly fixed, are rebated to provide *draught-proofing.*

If a fibrous insulating material is used. vertical battening and some kind of draughtproofing will be necessary.





e

The ventilation cross-section between the weatherboarding and the inner board is sufficient to ensure *ventilation* of the exterior skin.

If more resistant and well-patinated wood species such as larch, cedar and Douglas fir are used, the surface *boarding* need not be treated. However, this will not prevent the wood from greying, which is harmless in any case. If other woods are used, a weather-protective layer, such as a glaze or a coat of paint, will be necessary - depending on the resistance class.

f

The interior lining comprises vertical matchboards attached to a horizontal batten substructure. If the post spacing is 125 cm, the substructure should have a cross-section of at least 30 x 50 mm or - better still-40x60 mm.
In this area, dimensional tolerances can be compensated for and electrical cables laid. However, there is too little space to fit electric sockets here without piercing the *vapour retarding layer* inside the thermal insulation. As it is difficult to mount connections on the *vapour retarding layer,* electric sockets and switches should be installed on the Interior walls whenever possible.

g

The load-bearing interior walls also consist of 12 x 12-cm post with horizontal rails. The *sill* plate must be anchored in the same way as the exterior wall to the floor above the basement. It is not necessary to observe minimum distances (the *stairwell* being an exception) between the heavy-duty bolt and the concrete edge here.

When constructing the floor, care must be taken that the *sill* plate is high enough to ensure that the floating screed terminates at an edge insulating strip. Although flush skirting boards offer a more elegant solution, they are also more expensive.

Dh

The electrical installations are routed through the cavity in the interior wall, which is soundproofed with a *mineral-* or *coconut-fibre* panel. If stable load-bearing structures are used (for example, solid structural timber with additional horizontal rails), the *boarding* can be mounted directly. Alternatively, plywood or *OSB panelling* can be used.

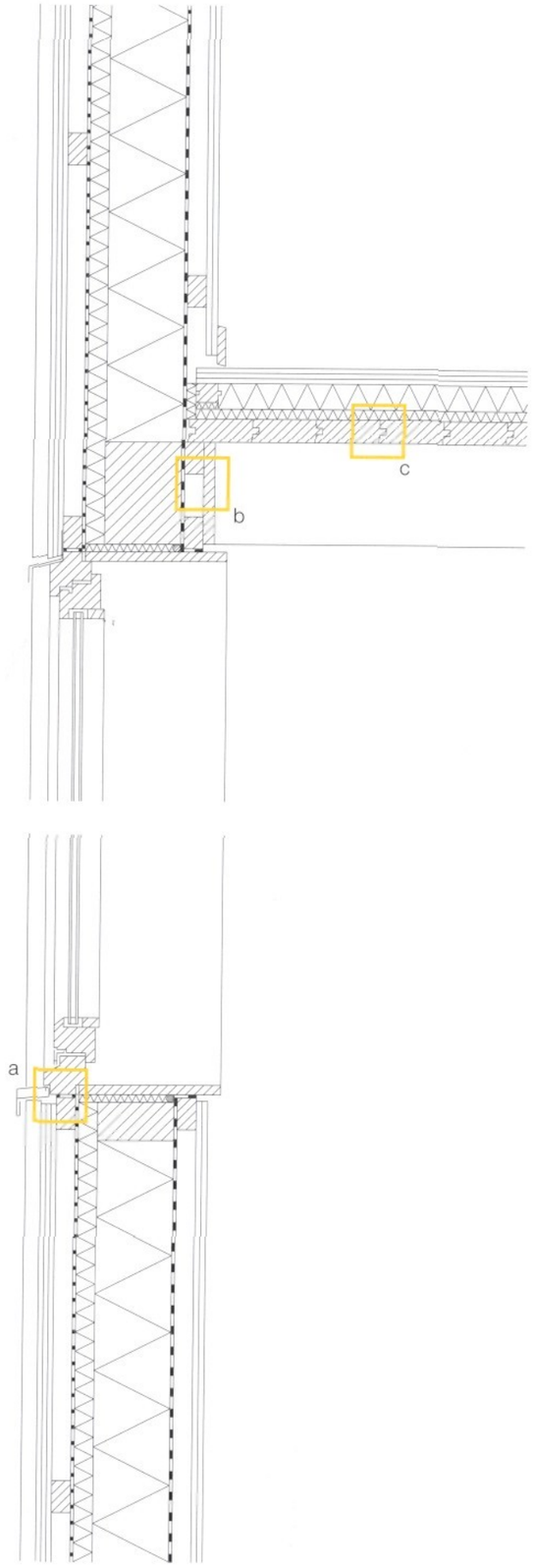
a

The window, which is mounted flush with the wall and tixed to the rail at sill level with a metal angle, provides a simple transition to the overlapping vertical *weatherboards.* Care must be taken that the angle is mounted on the bearing structure in front of the soft particleboard. The *draughtproofing* can be fixed to a batten beneath the outer window frame.
A similar procedure is adopted on the inside when connecting the *vapour retarding layer* to fhe prefabricated window frame, which is fixed to the outer frame. Before the *vapour retarding layer* is mounted, the joint between the window frame and the bearing structure must be carefully filled out or foam-filled with insulating material.

Joint sealing tape must also be applied to ensure that the window is airtight.
In January 2002, the Ordinance on Energy Saving came into effect, which tightened up the requirements for *exterior walls.* Under the ordinance, these walls must be constructed and verified as totally draught-proof enclosures. This applies, in fact, to all junctions, especially for those at the window surrounds.

b

The exposed transverse joists in the floors are fixed to the posts with galvanised steel sheet *Joist hangers.* To ensure that vapour is fully retarded, a section of foil - to which the *vapour retarding layer* is subsequently attached - is attached to the bearing structure when the beam is fixed.
A board is fitted between the beams to a batten substructure to create a flush connection to the interior wall cladding and cover the underside of the joint between the panelling and the bearing structure. This step is necessary as swelling may cause movement in the panelling.
To prevent airborne noise entering at the edge of the ceiling, the joint between the floor and the wall must be carefully filled in with insulating material.



c

As a structural grid of 125 cm has been chosen for the building, tongued-and-grooved floor covering is required. A floor comprising plain floorboards on timber bearing strips laid loose and filled with insulating material will suffice for a detached house. If prefabricated parquet or sheet flooring is preferred, it is advisable to lay the flooring on a load-bearing surface of ready mixed *dry screed.* Airborne-sound insulation can be optimised by putting loose fill beneath the impact-sound insulation or by ballasting the floor structure with, for example, paving flags attached with adhesive to give a shear-resistant bond.

d

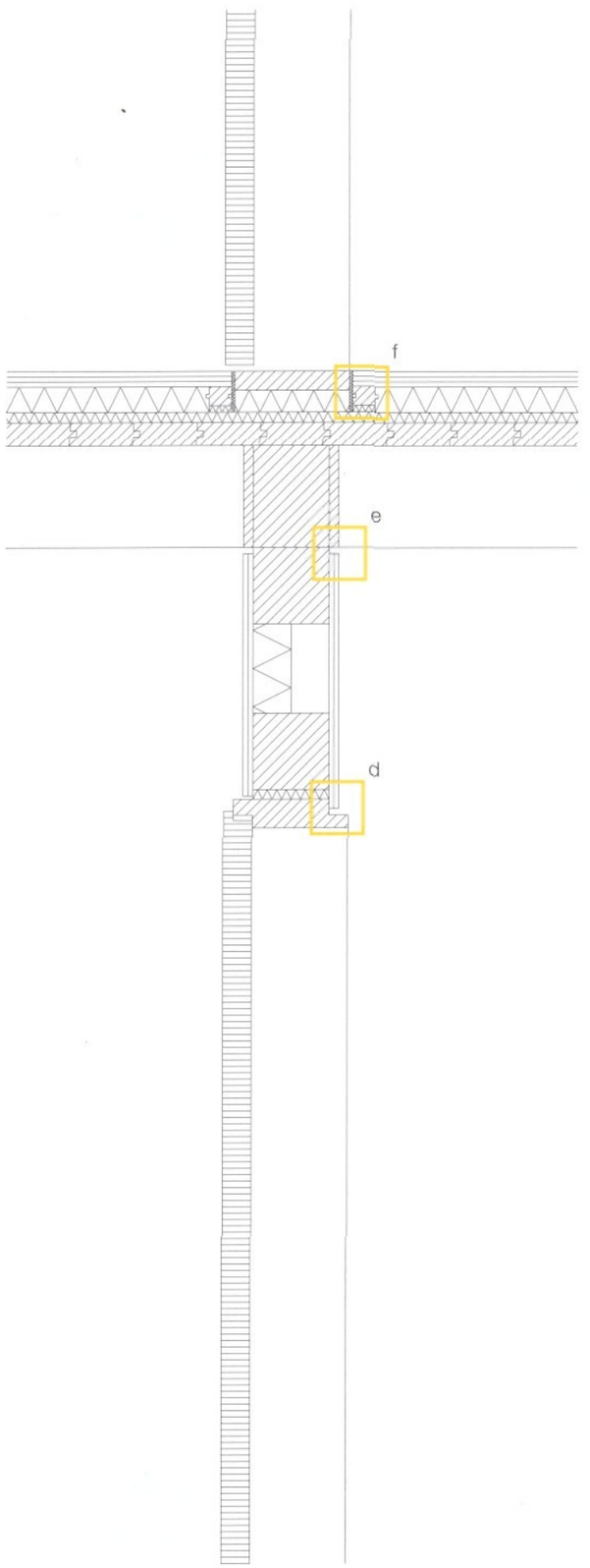
The joint between the lintel beam and the doorframe is filled in with insulating material to improve the *sound insulation* of the interior wall. The rebate in the solid door frame not only seals the joint with the interior-wall lining, but also creates a harmonious transition between the door and window flashing on the one hand, and the interior boarding on the other.

De

The fioor joists rest on the head of the interior load-bearing wall, The space between the joists is sealed with an additional rail at the same level as the joists. This area can now be covered with a board, as was the case with the *exterior wall.*

f

The solid door frame is connected to the floor by a *threshold,* a measure which not only ensures greater stability when transporting the door frame, but also makes it possible to lay the flooring without having to fit it into the door reveal.
To provide adequate *impact-sound insulation* here too, an insulating strip is fitted between the *threshold* and the flooring.
The joint between the *threshold* and the planks is filled with a cork strip to absorb any movements in the materials.

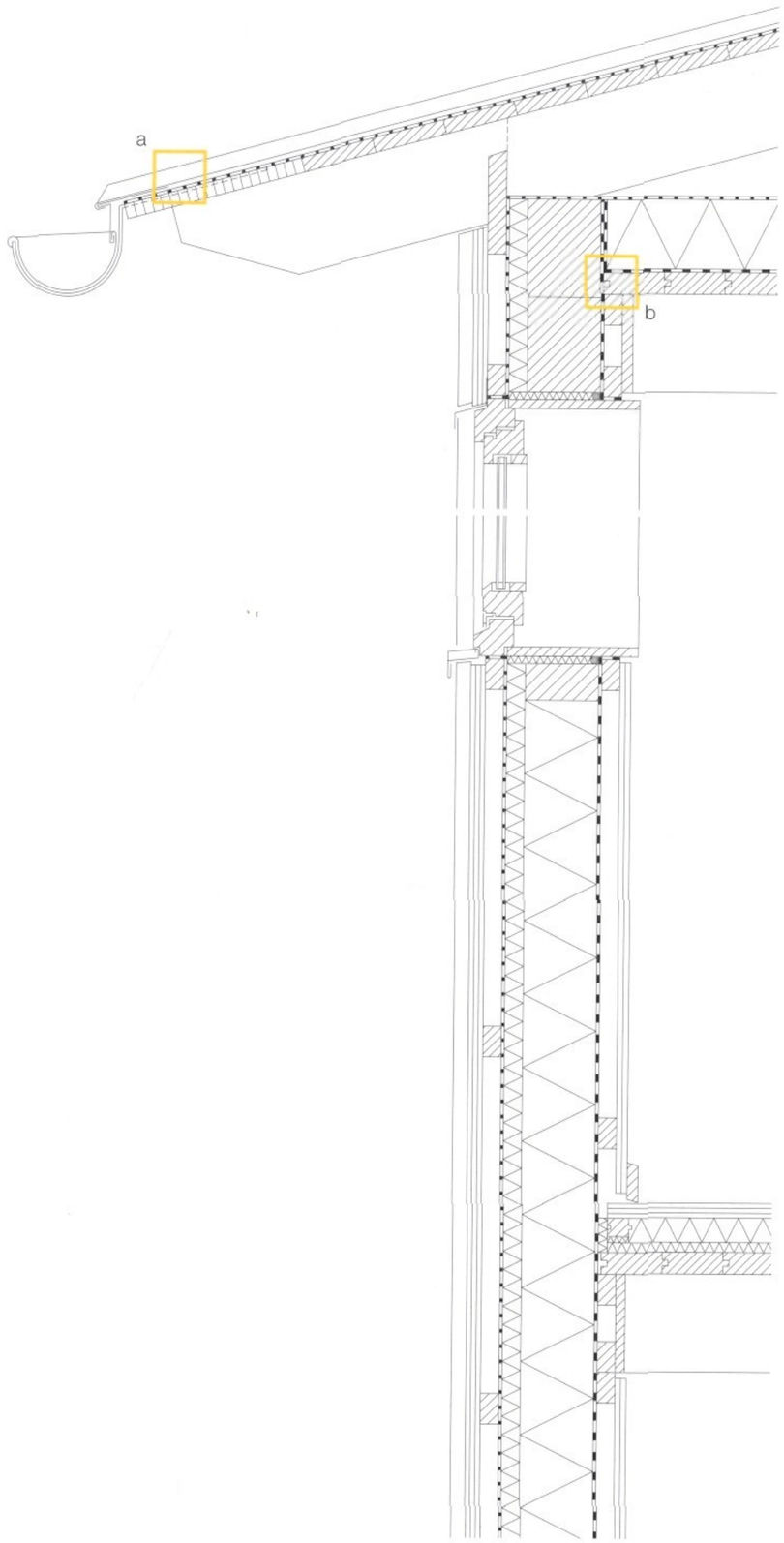


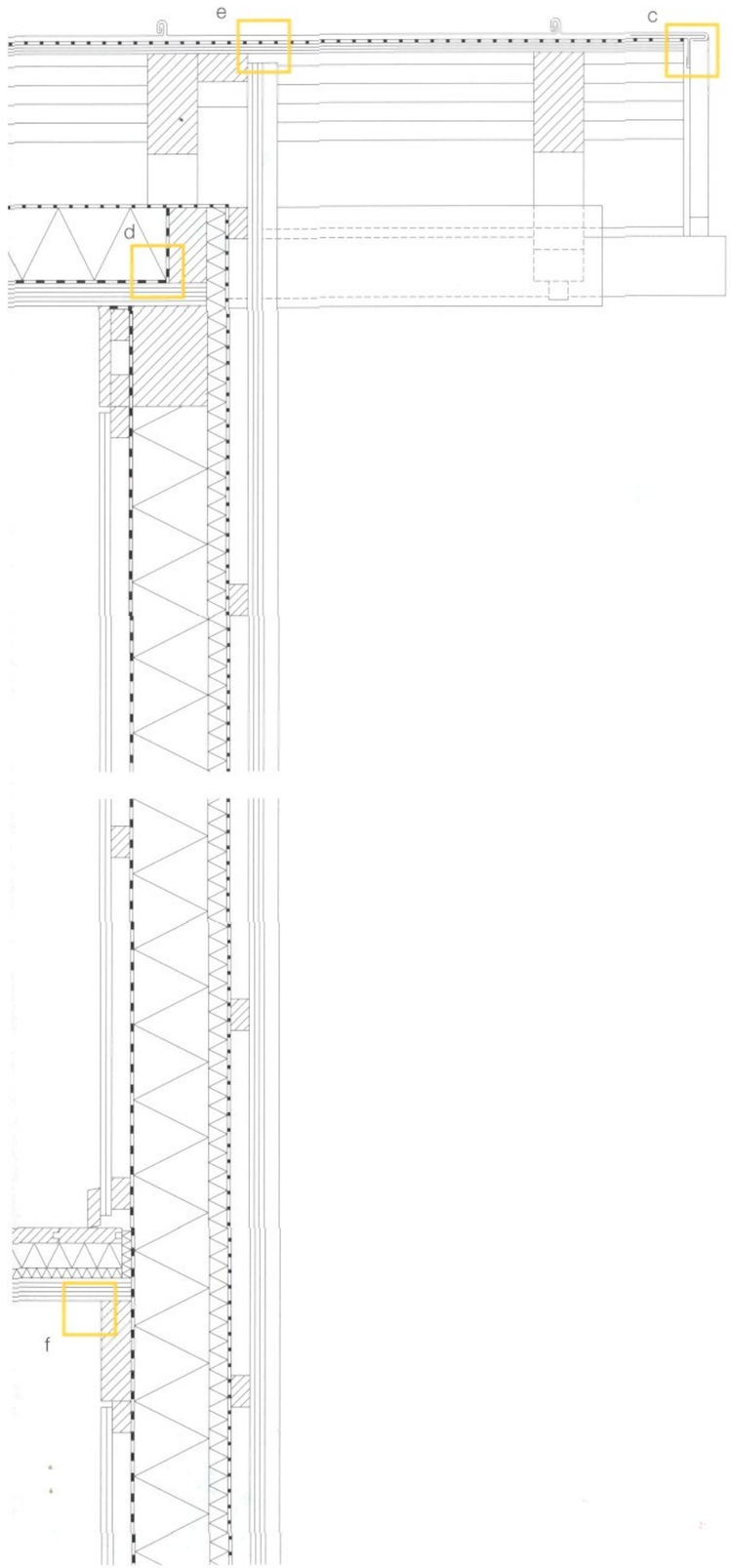
● a

A sheet-metal covering joined with locked double-welt standing seams and laid on a *separation layor* has been chosen for the roof covering. If the *separation layer* is to serve as sheathing, a more resistant material, appropriately laid, should be used. The rafter spacing of 62.5 cm corresponds to the support-grid of 125 cm. Instead of planed boarding, a panel of watertight adhesive bonded *plywood* has been used, which allows the roof-skin overhang to be extended over the ends of the rafters at the eaves. A *chemical wood preservative,* as required under DIM 68 800, is unnecessary.
As the overhang is to be fixed to the rafters, its size must be adapted to the length of the gutter bracket. The panel widths are obtained by dividing a standard panel in equal parts to avoid waste, for example by quartering a 125 cm-wide panel.

□ b

The floor beneath the roof void is designed in the same way as the upper floor, whose *joists* are connected to the posts by beams. A carpenter fits the *vapour retarding layer* and the *thermal insulation* in sections, connecting them with the ceiling boarding to the roof boarding of the profiled planks. They are then covered with a water-repellent *draughtproofing* designed to allow diffusion. The roof overhang on the gable side calls for a relatively large cross-section for the projecting eaves purlins. The *draughtproofing* is attached to the eaves puriin.





n_c

To ensure that the roof edge is kept as narrow as possible, the seam at the verge is bent over and bonded to the overhanging roof boarding to form a drip batten. The building's low height allows for a sheet bay width of 62,5 cm and thereby harmonises the locked double-welt standing seams with the rafter arrangement, which corresponds to half the structural grid.

□ d

In the gable area, the *exterior wall* structure only extends as far as the fioor beneath the roof void. The roof void is not insulated to the outside. In order to fit the insulation, the *draughtproofing* and the *vapour retarding layer* ai the transition from the wall to the ceiling, an edge beam has been fitted to the roof boarding so that the individual insulating layers can be attached to both its long sides.

□ e

The vertical exterior boarding extends as far as the lower edge of the roof boarding; it is screwed to a plank running along the edge rafter on the lower side of the roof boarding. At this edge, air from both the ventilated roof and the wall construction can escape through the ventilation cross-section of the overlapping vertical *weatherboarding.*

□ f

A vertical plank, fixed to the side of the posts, will provide sufficient support for the load-bearing roof boarding at the gable wall.

a

The exterior corner of the overlapping vertical *weatherboarding* is easily made by connecting the window boards to create a butt joint. The boards are fixed to the horizontal battens with *nails* or screws of stainless steel (they may be galvanised only in exceptional cases! to avoid corrosion stains on the boarding, Each board is fixed separately to avoid tension due to swelling and shrinkage.
The joint can be made *airtight* by overlapping or bonding the boards at the corner.

b

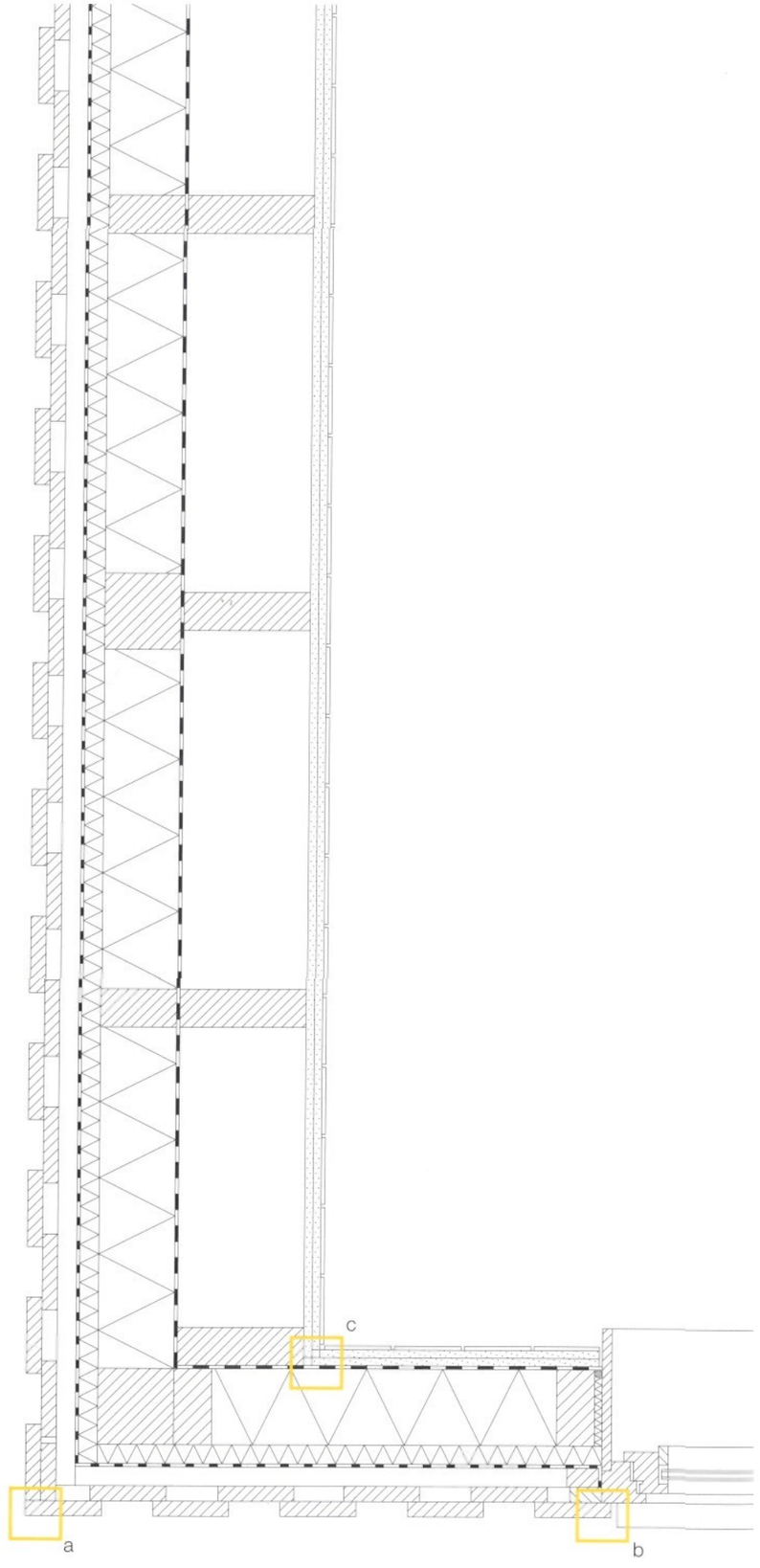
Normally, boards of equal width are used for the overlapping vertical *weatherboarding,* As the outer boards overlap those beneath them - approx. 25 mm on each side - the boards appear to be of different widths. This system allows for differences in spacing between the boards, obviating the need to use door and window flashings of special widths. It is essential that the facade be planned carefully and all measurements be precisely attuned to the positioning of the boards.

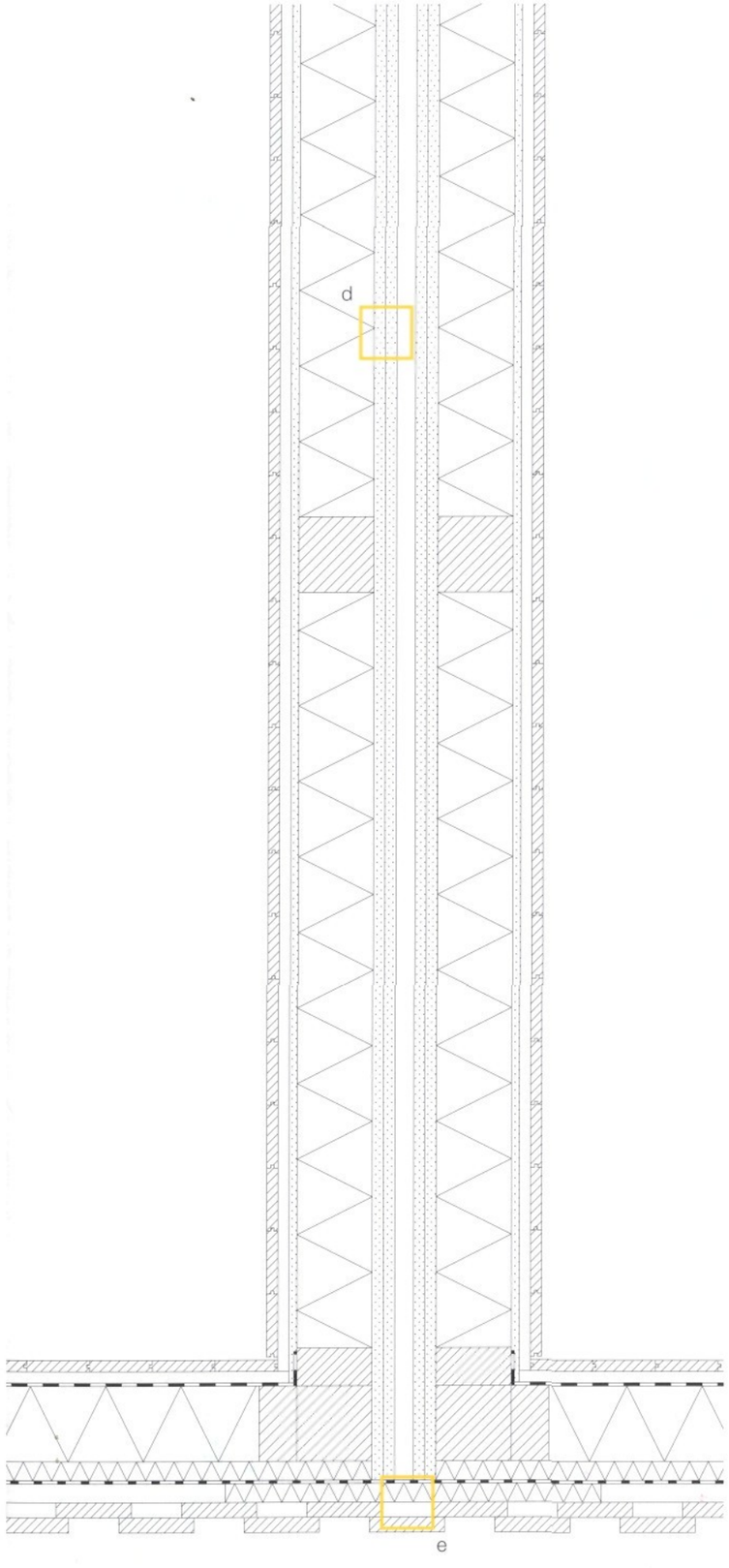
When windows are installed flush, they must be attached to the side of the outer frame in such a way that the overlapping *weatherboard* seals the joint between the outer frame and the wall. There is no need for the casement to be rebated at the side. The *draughtproofing,* insulation and the *vapour retarding layer* are connected to the wall structure in precisely the same way as the window to the lintel and the parapet beam.

c

For the services shaft, a substructure comprising 6 x 20 or 8 x 20 cm posts is necessary. Optimally, it is constructed half a grid space in the *exterior wall* to reduce the span of the *planking.* Ceramic tiles are bonded to the *gypsum fibreboard* or impregnated *plasterboard* (identification colour: green).

When connecting the sanitary fittings, the location and dimensions of the posts and rails must be taken into consideration, [f the rib spacing exceeds 40 cm, two layers of *plasterboard* will be necessary.





In the area of the shaft, the *vapour retarding layer* is fixed to the inside of the bearing structure to ensure that the service lines do not unnecessarily penetrate the *vapour retarding layer,*
The floor structure continues through the services shaft. If lines run vertically, the ceiling boarding must be drilled or cut out to the size of the conduits.

Dd

According to the building regulations and DIN 4102, a party wall must comply with fire resistance class F 30 B on the room side and F 90 B in the cavity.
These requirements are fulfilled on the interior by using a single layer of *planking* with 12.5 mm *fire-resistant plasterboard.*
For the exterior, two-layers of *planking* with *fire-resistant plasterboard* (2x18 mm) are required. In the case of terraced houses, this requirement applies to both buildings. During construction, the side of the building must be planked before the wall is erected,

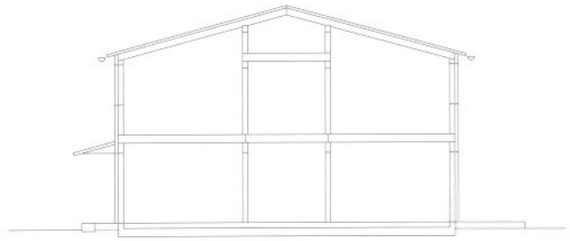
The expansion joint between the houses is not filled for reasons *of sound insulation.* A *vapour retarding layer* and *draught-proofing* are not necessary in the party wall. All things considered, this type of wall structure is a relatively costly and time-consuming affair. In timber construction, however, there is no recognised alternative to this approach.

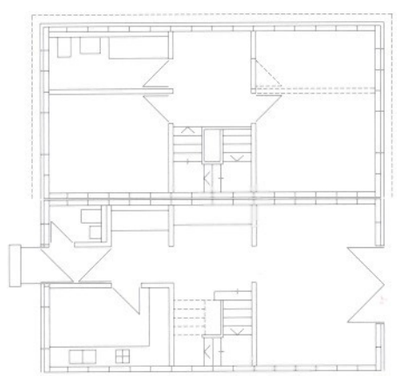
e

Under the building regulations, a terraced house is a low-rise building whose party walls are constructed like compartment walls. In the cavity, the F 90 *planking* can end at the inside of the overlapping vertical *weatherboarding.* The boarding ventilation space must, however, be sealed with a non-flammable insulating material such as *mineral fibre* extending at least the width of the party wall. The boarding can be continued uninterrupted across the expansion joint.

House B

22 Exterior wall, plinth
23 Interior wall, sole plate
24 Exterior wall, foundation
25 Interior wall, foundation
26 Exterior wall, floor/ceiling, window
27 Interior wall, floor/ceiling, door
28 Exterior wall, eaves
29 Exterior wall, verge
30 Exterior wall, corner
31 Party wall





a

Before constructing a floating foundation with a load-bearing reinforced concrete slab on frost blanket gravel, it is first necessary to carry out preliminary investigations to determine the soil type and establish its bearing capacity. A rapidly draining, concentrated soil with a good bearing capacity is absolutely essential. The top layer of soil must be replaced by a layer of clean gravel approx. 40 cm deep, which is then carefully compressed and covered with a sub-base of 5-10 cm-thick grade B5 concrete on which the reinforced floor slab is cast.

Db

On the interior, the floor slab must be thermally insulated beneath the screed. The transition to the *exterior wall* is a weak point. This problem can be overcome (and the planned insulation standard maintained) by fitting impervious *thermal Insulation* to the front side of the sole plate and covering the insulation either with a flat *fibre-cement slab* or concrete roofing tiles.

c

Prior to installing the prefabricated exterior wall elements, a *sill* is put in place, aligned, underlaid and fixed to the concrete slab with either lug angles and *dowels* or anchor bolts. The space between the *sill* and the floor slab is filled with high-expansion cement mortar. Since it is particularly exposed to hazards, the *sill* must be protected to meet *hazard class 2* requirements. Alternately, a very resistant wood species can be used, which will eliminate the need for chemical wood protection.

The *damp-proof course* on the floor slab is first bonded or welded to the seal beneath the sill. Then the plasterboard lining is attached to the elements, which are initially left unclad on the interior.

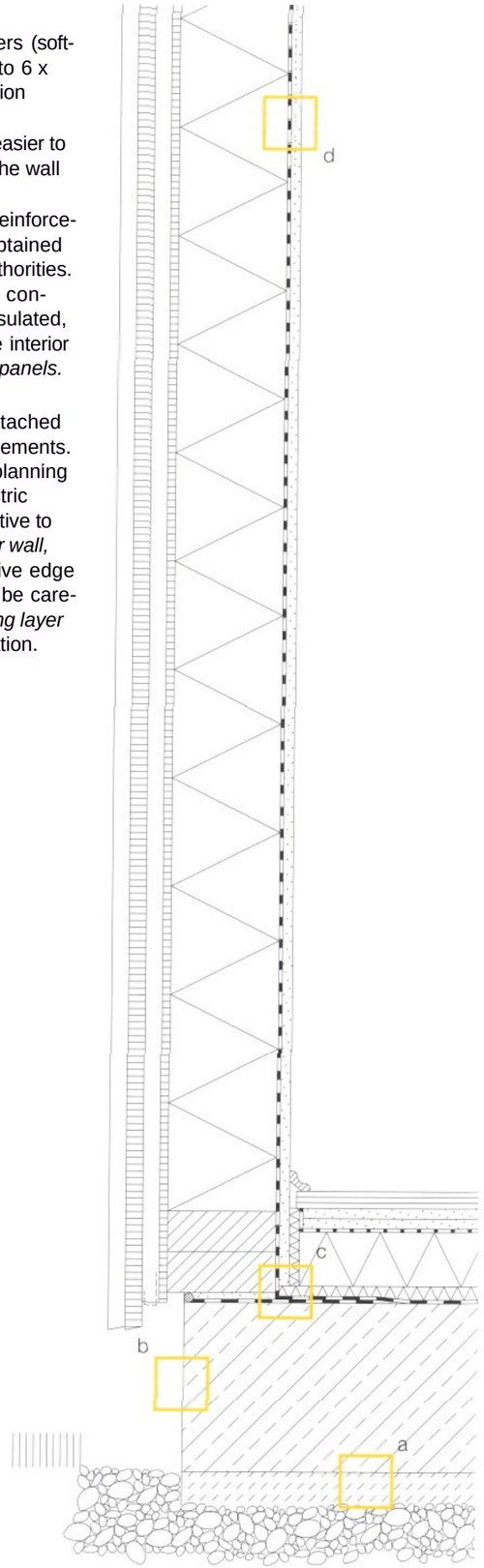
d

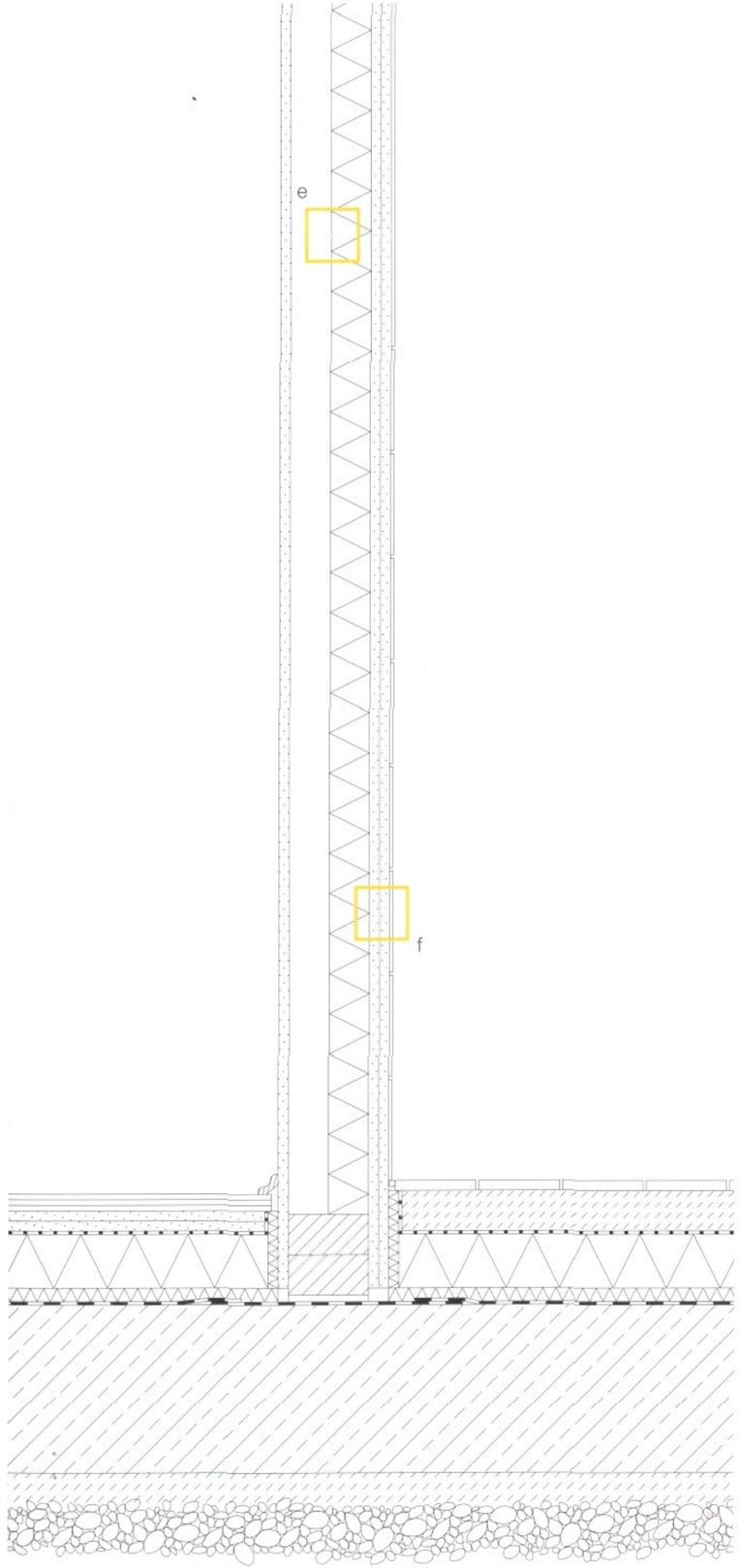
A permit must be obtained from the building supervisory authorities before the prefabricated insulated wall elements can be erected. Although these elements are subsequently panelled on both sides (clad elements), with most wooden constructions it is customary to panel them with *plywood sheeting* or *plasterboard* on the outside only at first, and to leave them unclad on the room side until they have been fitted to the structural timbers (softwood timbers measuring 6 x 12 to 6 x 16 cm, depending on the insulation standard).

The above procedure makes it easier to fix the *sill* to the floor and install the wall elements.

If the *panelling* is to be used for reinforcement, permission must first be obtained from the building supervisory authorities. The elements are screwed to the construction, which is then sound insulated, vapour retarded and lined on the interior with *plasterboard* or *wood-based panels.*

If the interior panelling is to be attached directly to the structural timber elements. great care must be taken when planning the services, particularly the electric installations. If there is no alternative to connecting sockets to the *exterior wall,* protected sockets with an adhesive edge must be used. The sockets must be carefully bonded to the *vapour retarding layer* and provided with external insulation.





e

The height of the elements corresponds to that of the room(s), which, in turn, must comply with standard board dimensions. The element lengths partly depend on the method of transport and assembly used. Elements can extend the entire width of the house.

The interior wall elements, which must comply with the standard dimensions of board materials and construction timbers, comprise structural limbers made of *softwood* and measure 6/12 cm (centre distance = 62.5 cm). Like the exterior wall elements, they should initially be panelled on one side only. Once they have been constructed and installed, they should be clad with plasterboard or wooden panels. If the cavity between the structural timber elements has not been completely filled with expanded mica, *cellulose flakes,* etc., it should be filled with *mineral* or *coconut-fibre sound insulation* at least 30-40 mm or - preferably - 60 mm thick.
Higher *sound-insulation* values can be obtained by applying double panelling or fitting additional "floating" panel cladding with flexible wall connections.

f

Appropriately bonded wooden panels or impregnated *plasterboard* (identification colour green) must be used in the humid rooms. *Gypsum fibreboard* has the advantage of not requiring additional treatment. Two layers of gypsum fibreboard will be necessary if humid rooms are to be tiled or the spacing between the structural timbers exceeds approx. 42 cm.

The shrinkage ratio of the noggings must be taken into account when attaching the *panelling.* Owing to their cross-section, this ratio is small and can be reduced still further by using pre-dried wood.

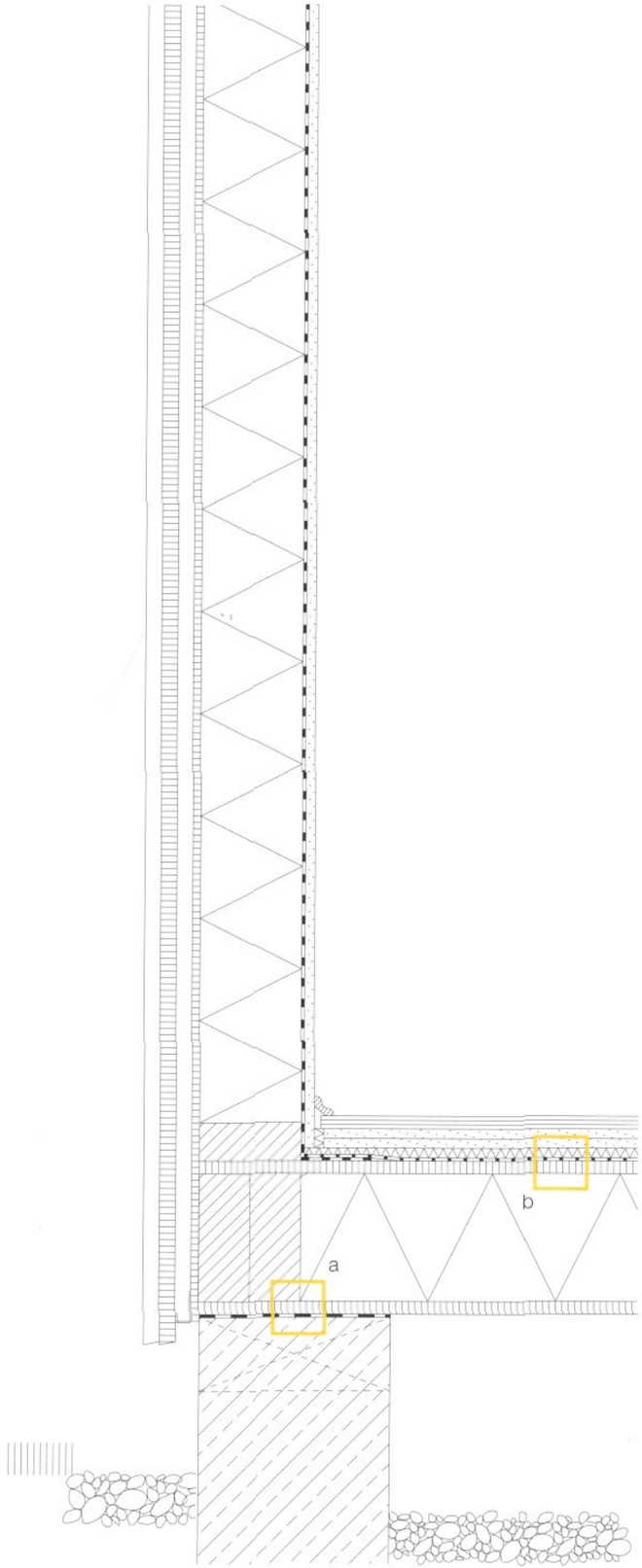
a

A different and perhaps more consistent approach to wood construction as a "dry" construction method is to use a *floor construction* comprising structural timber elements and with excellent thermal insulation, and to panel them on both sides. (These elements have dimensions of approx. 6 x 20 cm, determined statically and in accordance with insulation standards.) The rising walls are connected to the aligned and fixed floor elements. *Cemented chipboard* and *fibrated concrete slabs* make suitable underside *panels.*

The cavity between the infilling and the underside of the elements must be permanently ventilated. This can be done by installing correspondingly large grated openings on both sides of the terraced house.

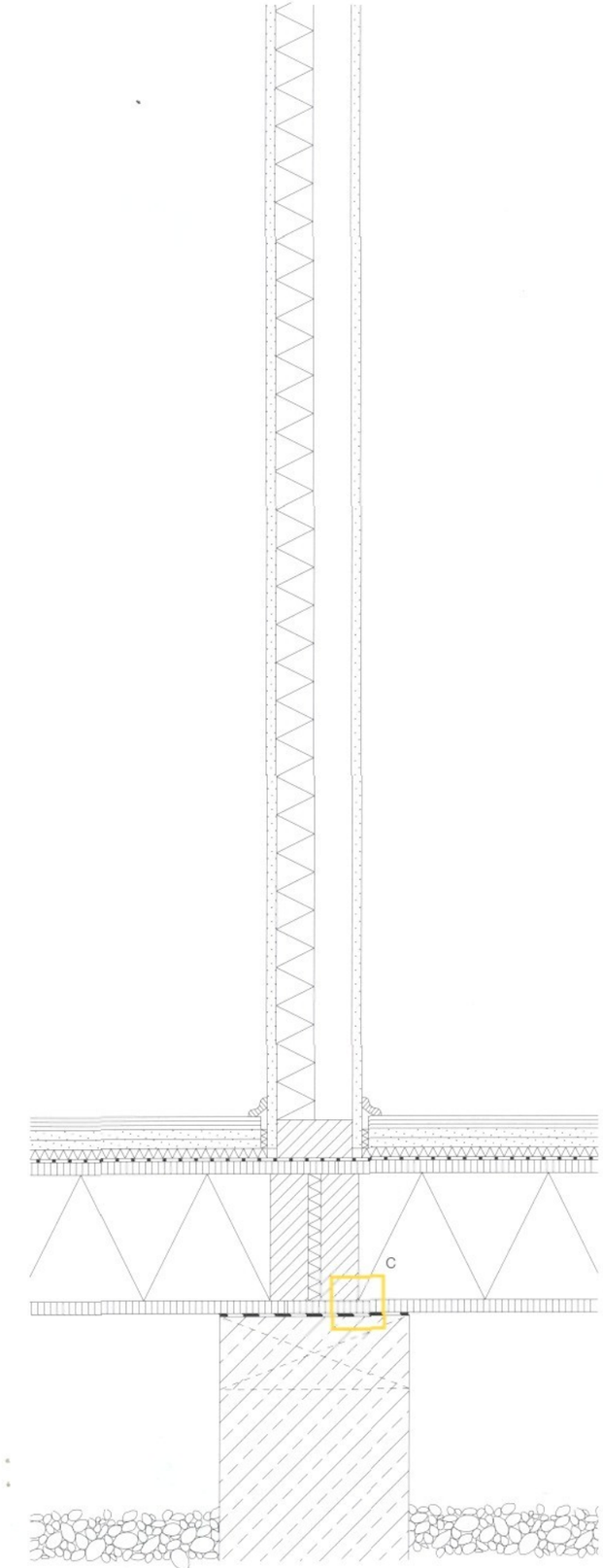
b

Floating dry screed composed of wood, plasterboard, or *gypsum fibreboard* panels should be installed as a dry construction.
The *PE-foil* under the impact-sound insulation serves as a *vapour retarding layer* and simultaneously provides draught insulation.



c

Beneath the interior walls, there is no need for frost-proof foundations or for continuous footing concreted to the soil or planked. The position of the footing is determined by that of the floor elements and the load-bearing interior walls.
The floor elements should be formed as a plate and anchored to the foundation with authorised *dowels* or connection angles and stone bolts. AW 100 *plywood* strips or high-expansion cement mortar can be used to equalise out any unevenness. A *vapour barrier* of, say, polymeric bitumen or *plastic sheet* is fitted between the floor elements and the foundations to prevent any damage through moisture. The abutting joint between the elements must be sealed with insulating strips and *sealing tape,*



a

The wall elements are held together by, and aligned with, the upper headpiece. The floor, which is composed of *glued laminated beams* or *glued laminated timbers,* is fitted and bolted in element widths of between 60 and 250 cm (beams) or 62.5 and 100 cm (timbers). Mounting and shrinkage must be taken into account when choosing the width. During the construction phase, the wood - especially the solid elements - must be protected from the weather at all times to prevent damage through moisture and swelling.

If necessary, diaphragm action can be ensured by joining the elements to make them shear-resistant.

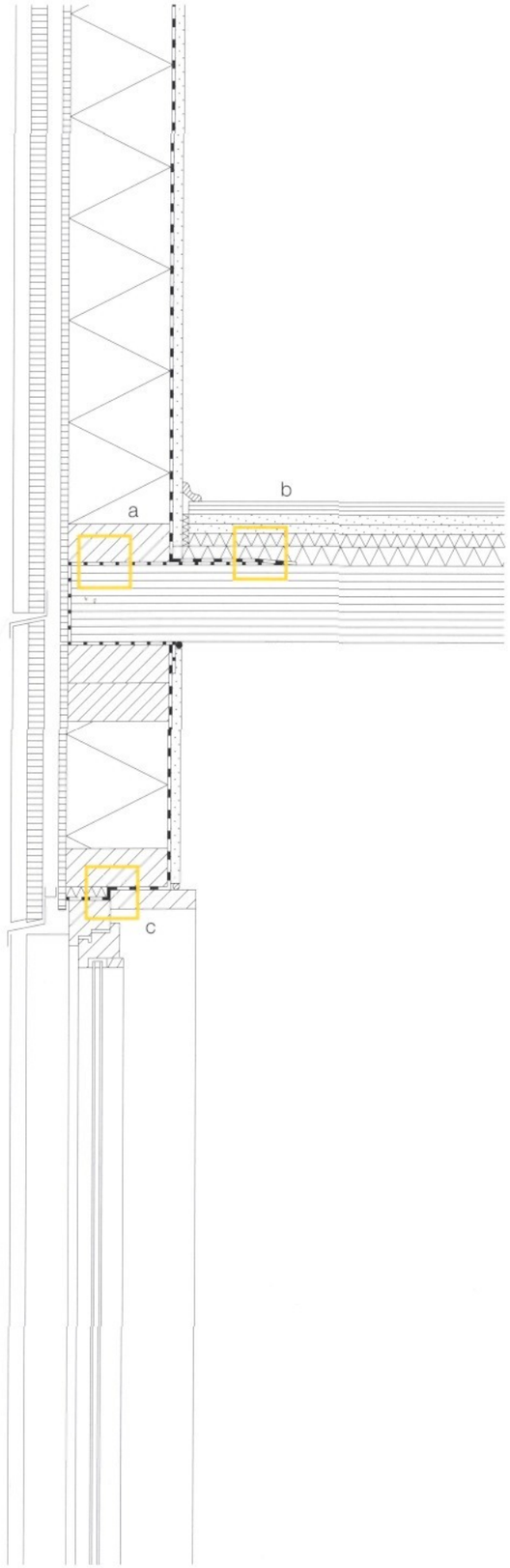
b

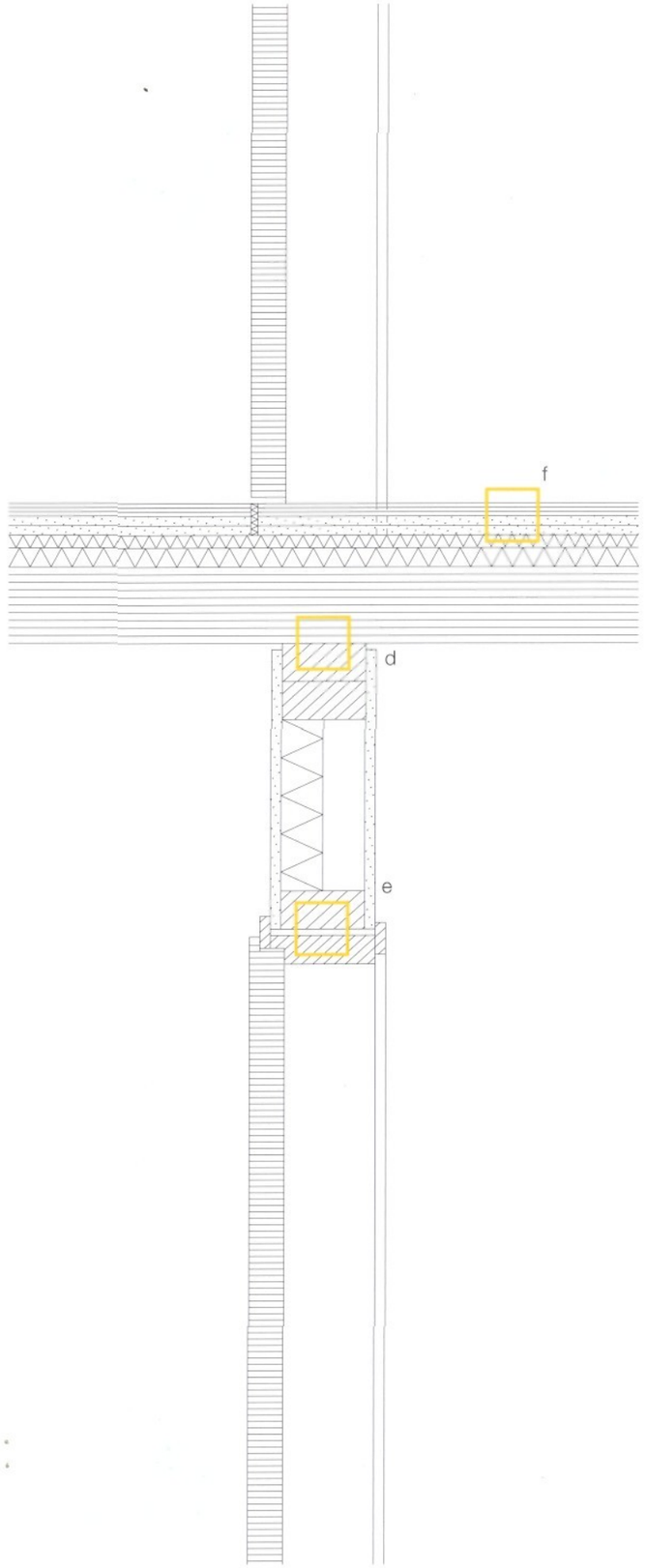
To ensure that the light, effectively insulated wooden waif fulfils its function, the *vapour retarding layer* must be connected to the wall at the floor edge in a way that allows for subsequent inspection. Correspondingly long sections of flexible *plastic sheeting* that allow for diffusion must be wrapped round the end of the floor and fixed on the upper side of the floor to the *vapour retarding layer* sheeting of the installed wall elements.

c

The selected assembly system and point in time when the exterior wall cladding is installed determine whether the surface-finished windows are assembled in the workshop or on site, and whether they are installed with or without glazing.
The windows must be fitted to the structure with a section of vapour-resistant, flexible plastic that is fixed to the window frame.

The joint between the lintel and the window frame performs a vital function during installation in absorbing tolerances and movements. It should be filled with an insulating material *(mineral fibres, mineral wool, sheep's wool, etc.)* and sealed with a pre-compressed *seating tape* or permanently elastic sealing material. The stringent requirements of the energy conservation regulations must be observed (see also p. 14a).





d

The ceiling's structural connection to the interior walls corresponds to that of the exterior walls. The problems related to fitting the *vapour retarding layer* and *draughtproofing* do not apply here.

e

The joint between the lintel and the doorframe is constructed in the same way as that of the window (see item c). The requirements of building physics concerning heat, vapour and draughts, which present considerable practical problems, do not apply here.

f

The floor structure, which is composed of parquet, *dry screed* and *impact insulation,* has been made 3 cm thicker than usual to include a services shaft which, in turn, accommodates the larger number ot lines laid along the floor/ceiling. The problem of power-supply lines crossing one another can only be surmounted by careful planning.

Even with such a relatively "complex" ceiling structure, additional measures can be taken to improve airborne-sound insulation by, for example, using "sand honeycombs".

a a

The roof floor of *glued laminated beams* or *glued laminated timbers* is fitted to the support and screwed to the *sill.* As with the floor, a section *of plastic sheet* thai allows diffusion is guided around the headpiece of the roof floor and fixed to the floor *vapour retarding layer.* The sheet ends must be either bonded together or well overlapped and fastened.

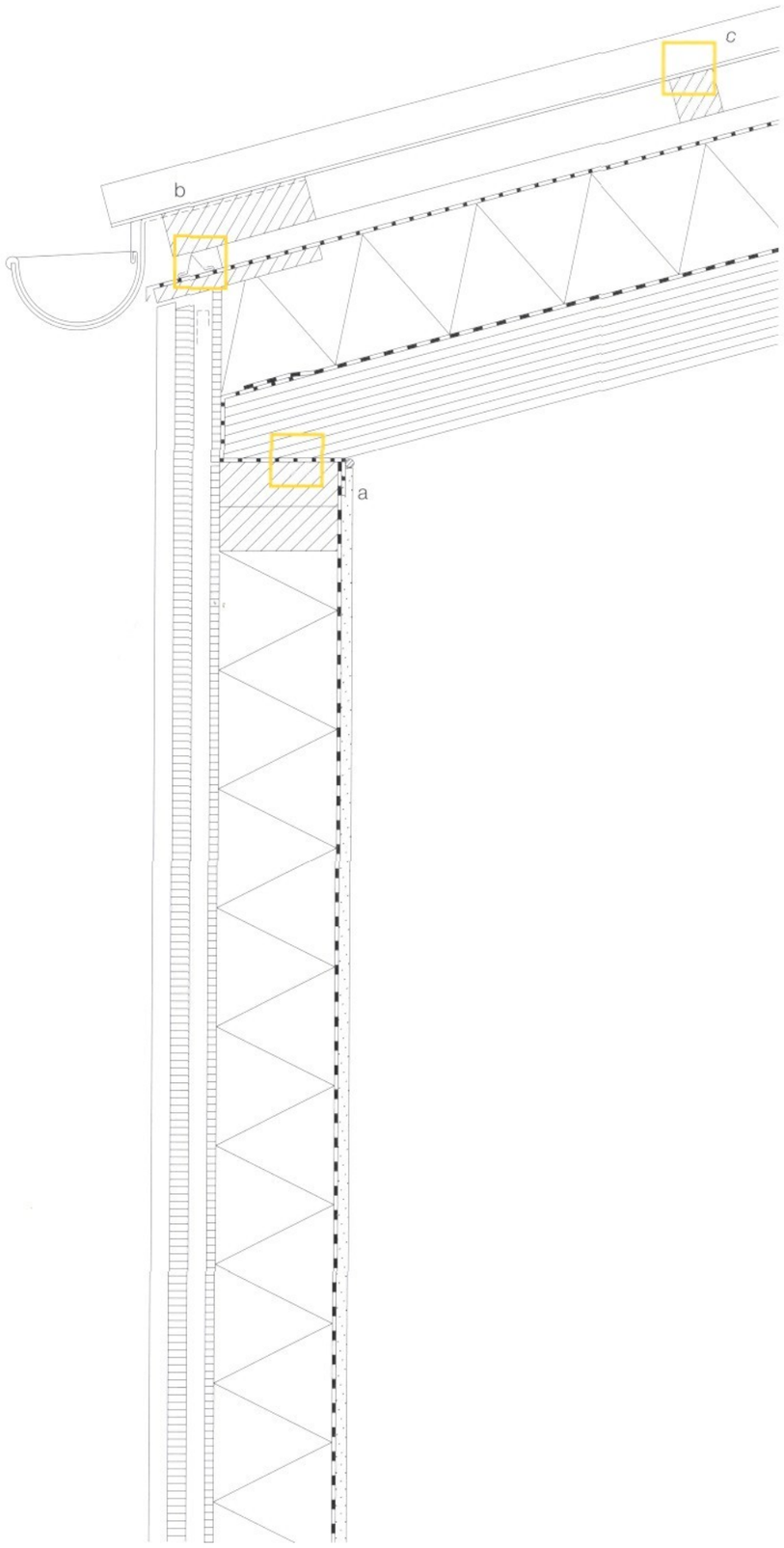
b

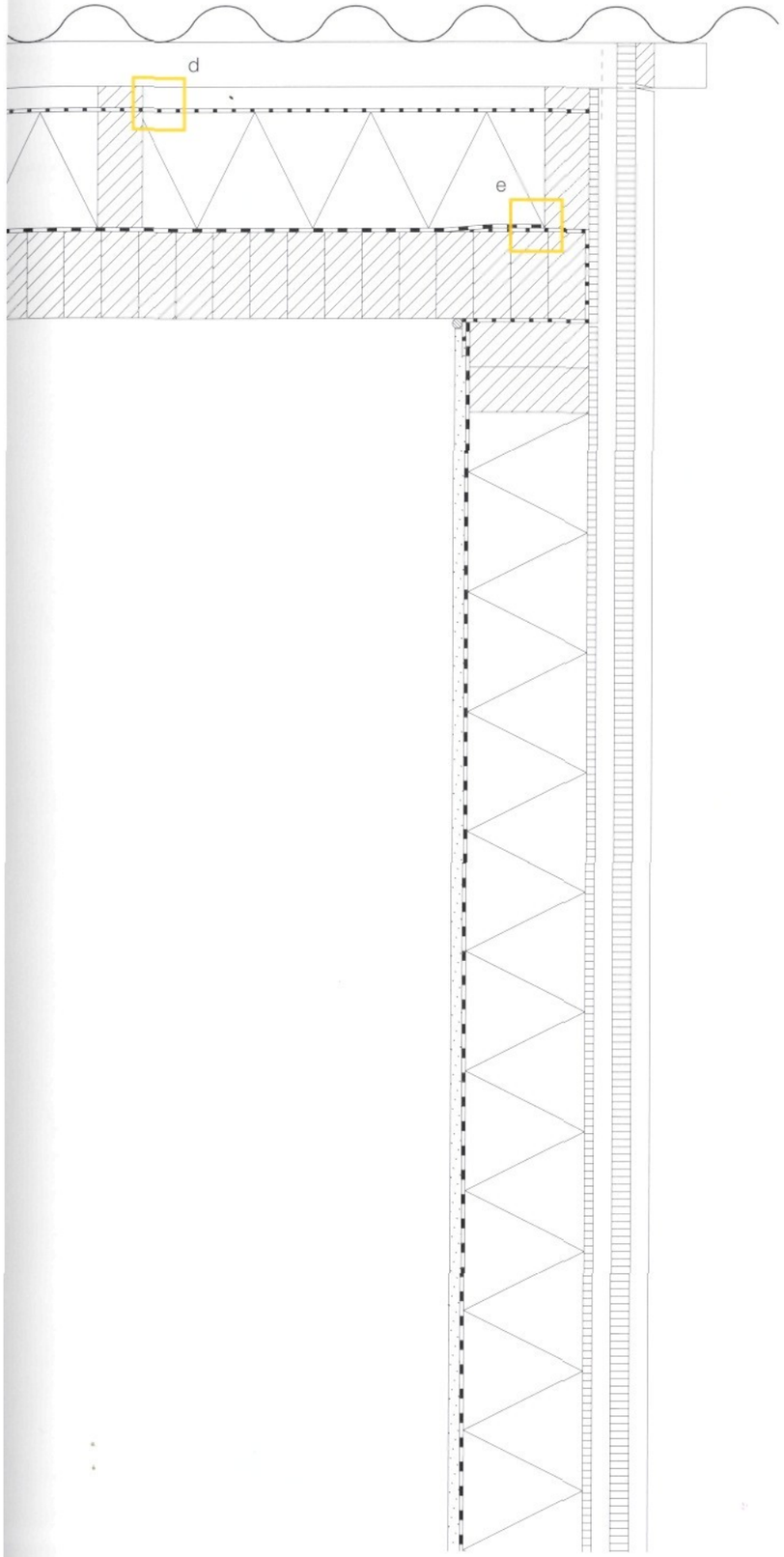
The height of the cross rafters is determined by the thickness of the *thermal insulation.*
Covering the insulation with vapour permeable, water-repellent paper, or with *plastic sheeting* displaying the same qualities, ensures that any precipitation (rain, drifting snow...) or "secondary" meltwater (changes in weather or cold night air that cools the underside of the non-sucking roofing material) can drain off, and that there is no reduction in insulation value. Ventilation and drainage are ensured by counter battens and a triangular cleat of perforated plate, which is fixed to the eaves flashing with tingles.

The eaves flashing rests on a plywood strip, for which the cross-rafters are cut out. II is advisable to bolt the flush countersunk gutter hanger onto a continuous fascia.

c

The dimensions and spacing chosen for the rafter-supporting purlins depend on the corrugated sheet roofing used.





d

The width of the insulating panels must be greater than the clear spacing of the cross rafters to accommodate the slightly compacted *thermal insulation* installed between them, which has to compensate for any wood shrinkage.
The division of the substructure into cross-rafters and counter battens ensures that the vapour-permeable protective layer is level and remains securely fixed.

The main goal here (depending on the thermal-insulation requirements for the roof) is to ensure that the continuous rafters do not create a thermal bridge. This can be avoided by installing a second insulating layer, as shown in the example here. Another solution is to place insulation beneath the foil between the horizontal counter battens, or to install continuous bituminous *fibreboard* decking, which simultaneously acts as a protective layer.

e

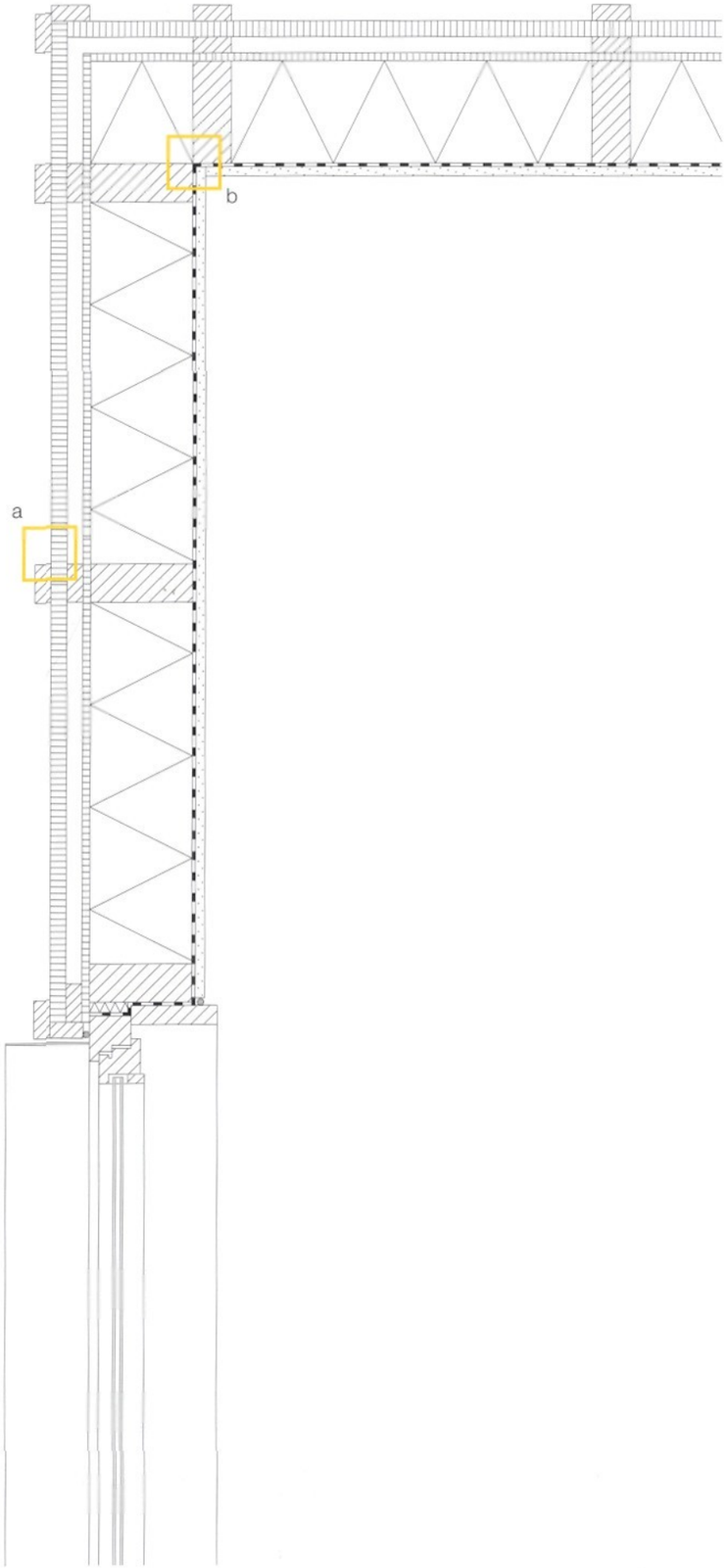
The efficiency of the various insulating measures and the utility of a house largely depends on whether the protective layers, which take the diverse loads imposed on a building (thermal, moisture, air), can be applied consistently and safely to all connections. They must also be open to inspection.

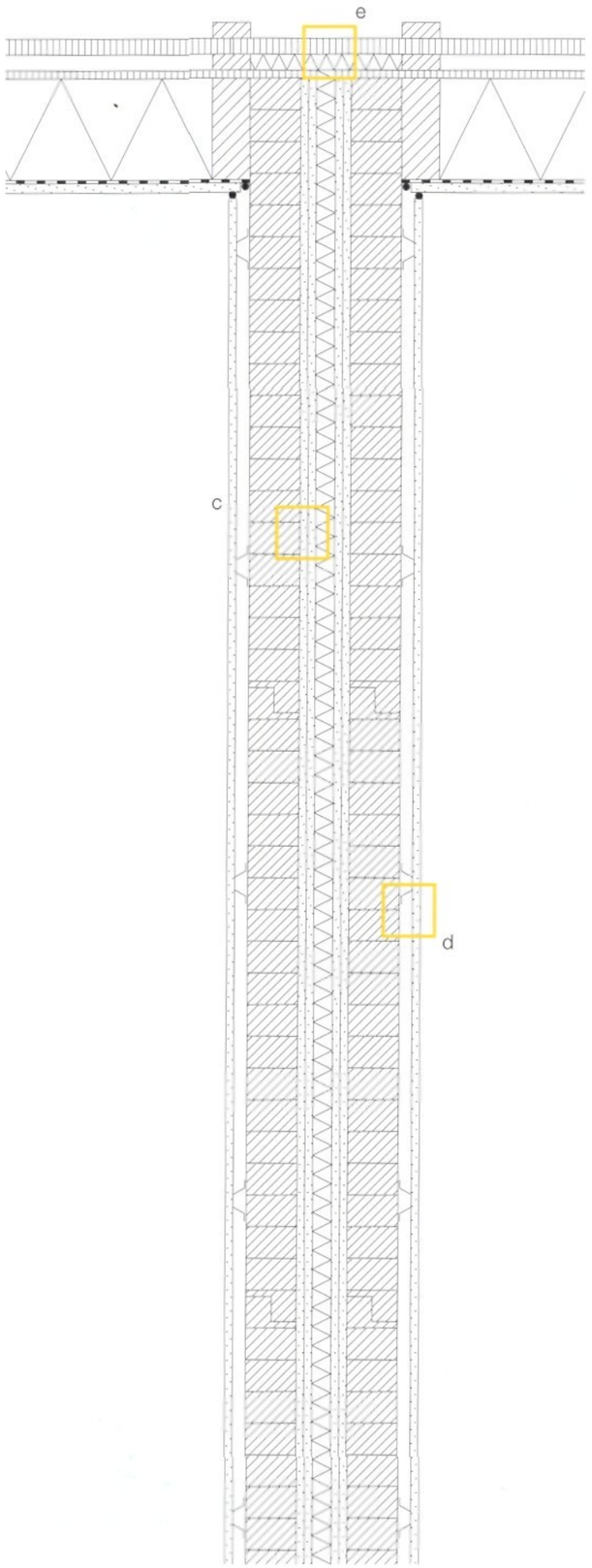
The storage capacity of the heavy roof members improves thermal protection during the summer.

● a

If the substructure unit spacing of 62.5 cm is observed, the plywood panels (which are generally 125 cm wide) can be screwed in the centre of the panels and at their edges. The width of the cover strips has to be calculated accurately to ensure that the edge spacing of the screws is sufficient, and to fully cover the screw heads. Narrower cover strips should not be used unless an alternative way is found of fixing the facing panels (e.g. by screwing them onto more closely spaced substructure elements) and the panel edges only has to be cramped by the screwed-down cover strips.

Although the absence of a visible bolted connection (with a shadow gap, sealing tape and a correspondingly wide substructure) on a smooth large plywood cladding panel does justice to the material, it nevertheless exposes the panel edges. This, in turn, makes it almost impossible to prevent water absorption and heightens the risk of damage or movement from swelling and shrinkage. The following protective measures can be taken here: reduce the weather loads, e.g. by circumspect alignment of the building, use large roof overhangs or cantilevered balcony slabs, and give all edges water-repellent treatment. As these precautions were not taken in the example presented here, a more resistant joint was chosen and secured with cover strips.





Db

The elements are jointed at the corner. Although the corner design shown here is atypical for wooden frame constructions, it does make it easier to connect the elements in an open corner joint. After it has been screwed together, the corner must be sealed on the outside with a prefabricated, thermally insulated metal angle.

The greater requirements (regarding building physics! placed on the exposed outside corner mean that considerable care must be taken when installing the *thermal insulation* and the *vapour retarding layer.* The joint must be completely packed with insulating material (filling, injecting) and the angle sealed with tape (buthyl, for instance) beneath the overlapping joint of the *vapour retarding layer* (nailed/clamped and bonded).

□ c

According to the Building Regulations and DIN 4102 T-4, party walls must have a fire-resistance class of F 30-B (interior) and F 90-B (exterior). These requirements can be met using *glued laminated beams* or *glued laminated timber* elements which are panelled accordingly on the outside (in contrast to trie procedure adopted for House A). If this method is chosen, the construction must be inspected and a permit may have to be obtained. As an alternative to leaving an air space between the party walls, an elastic *insulating material* could be used here (e.g. building class A, melting point > 1000 °C).

• d

II is necessary to establish the required acoustic reduction (required Bw = 57 dB or 67 dB for greater sound insulation). Sound insulation can be improved even more with an interior facing shell *of plasterboard panels* on spring shackles.

□ e

The expansion joint must extend to **the** outer edge of the *exterior wall.*
The width of the non-flammable backfill insulation must be established in co-operation with the responsible authority.

Products

Products

For invitations to tender and orders:
- Sawn wood species
- DIN
- Grade
- Wood species
- Sawn wood grade
- Wood moisture
- Thickness/height
- Width
- Length

Calculated per m/m^3

Solid Wood

DIN 1052-1
DIN 4074-1
DIN 68365
DIN EN 350-2
Thermal conductivity:
= 0.13 W/mK
Vapour diffusion resistance factor:
H = 40
Raw density: dependent on timber species
p - 450-800 kg/nV
Computation weight in accordance with DIN 1055-1:
4-6kN/m^3
Building material classification:
B2
Thermal capacity:
C = 350 kJ/m^3K
Wood moisture content:
as dry structural wood < 20 %
Amount of swelling and shrinkage per % change in wood moisture
0.24 % across the grain

Commonly used timber species
- spruce
- fir
- pine
- larch
- Douglas fir

Dimensions
Cross-section dimensions for square timber stock [cm]:
6/6, 6/8. 6/12,
8/8, 8/10, 8/12, 8/16
10/10. 10/12,10,20, 10/22
12/12, 12/14, 12/16, 12/20, 12/24
14/14, 14/16,
16/16, 16/18, 16/20,
18/22
20/20, 20/24
Length:
depending on the sawing facilities of the sawmill: up to 16 m.

Material
- Solid wood is debarked round timber and converted building timber (squared timber, planks, boards and laths) of softwood (coniferous wood) and hardwood (wood from deciduous trees).
- Structural timber is round wood or sawn timber. The cross-sections of load-bearing building elements are dimensioned in relation to the load-bearing capacity of the wood species in question.
- Converted building timbers are laths, planks and squared (softwood) timber.

The following types of sawn timber are distinguished according to their thickness-to-width ratio:

	'Thickness d Height h [mm]	Width b Jmm]
Lath	d<. 40	**b<80**
Board	d<:40	**b:>80**
Plank	d > 40	b > 3d
Squared timber	iblfh<. 3b	b >40

Use
Sawn softwood may be used in all areas of construction. When load-bearing timbers are used for external building elements, appropriate measures must be taken to preserve the wood (treatment with chemicals or structural reinforcement). In order to minimise fluctuations in wood moisture as well as the related negative consequences brought about by shrinkage and swelling, the moisture content of the wood used should correspond to its moisture content in service.

In-servicemoisturecontent:
Heated buildings enclosed on all sides
9 ± 3 %
Without heating
1 2 ± 3 %
Covered, open buildings
15 ± 3 %
Constructions exposed to the weather on all sides 18 ± 6 %

Grading
Structural wood, which is dimensioned in relation to its load-bearing capacity, must be graded mechanically, in relation to its load-bearing capacity, prior to use.
- Depending on the grading procedure, the moduli of elasticity, raw density, knottiness and grain deviation are recorded and the sawn timbers graded. The mechanical grades are: MS 7, MS 10, MS 13, MS 17 (see appendix)
- When wood is graded visually, the following characteristics have to be considered: the wane, knots, annual-ring width, slope of grain, cracks, stains, compression wood, insect damage, mistletoe attack and warp. The visual grades are: S 7, S 10, S 13 (see appendix). The DIN standards S 7, S 10, S 13 correspond to the old quality classes I, II, Ml.

There is no difference between visual and mechanical grades with respect to load-bearing capacity.

Sawn timber grades:

Sawn-wood grade	Grading	Permissible **wane**
S	-	-
A	S13	1/8
B	S10	1/3
C	S7	Saw-marked **sides**

Manufacturerfs)
Converted building timber is available directly from sawmills as dimensional timber (square timber stock) and can be ordered in a wide variety of cross-section dimensions and lengths.

Information
Bundesverband Deutscher Holzhandel e.V.
Bund Deutscher Zimmermeister e.V.
Lignum
Proholz

For invitations to tender and orders:
- Structural solid wood
- Identification
- Wood species
- Thickness/height
- Width
- Length
- Surface

Calculated per m/m^3

Structural Solid Wood

DIN 1052-1
DIN 1052-1/A1
DIN 4074-1
Thermal conductivity:
= 0.13 W/mK
Vapour diffusion resistance factor:
H = 40
Raw density:
p = 470-590 kg/m^{Li}
Computation weight according to DIN 1055-1:4-6 kN/m^3
Building material classification:
B2
Wood moisture content:
15 ± 3 %
Amount of swelling and shrinkage per % change in wood moisture
0.24 % across the grain

Wood species:
- spruce
- fir
- pine
- larch

Dimensions(mmj
60x120/140/160/180
60 x 200/240
80 x 120/140/160/200/240
'00x120/200
120x120/200/240
Length: with finger jointing any number of 'engths is possible

Material
Structural solid wood is a converted building pinewood which, due to its field of application, is subject to very stringent requirements. Its load-bearing capacity (S 10) and appearance are graded according to the DIN 4044-1 hardwood standard.

Additional requirements apply which go beyond DIN 4074-1 with respect to wood moisture content, dimensional stability/size consistency, sawing method, limitation of crack width, and - in the case of visible building elements - surface quality.

identification
The product must display a kite mark. In addition, it must bear the kite mark of the Überwachungsgemeinschaft Konstruktionsvollholz aus deutscher Produktion e.V. (accreditation body for German solid structural wood products).

Use
Structural solid wood is primarily used when the wood used has to fulfil strict requirements concerning its load-bearing capacity, appearance, dimensional accuracy and shape retention. In wooden house construction, structural solid wood is used primarily in the construction of fully insulated structures.

As the wood has a moisture content of 15 ± 3 %, it need not be treated with chemical preservatives.

Manufacture
Wood finishes are categorised according to use:
- structural solid timber for visible structures (planed and chamfered)
- structural solid timber for concealed structures (levelled and chamfered, with the heart plank removed)

In both cases, finger jointing is permissible as spring-actuated longitudinal jointing. This type of jointing does not weaken the cross section of the wood and need not be taken into account during stress detection.

In the case of visible structural solid timber, a heart-free cut is obligatory for cross sections of up to 100 mm. This is made by removing a 40 mm-thick heart plank, A heart-free cut is obligatory for all other cross-sectional thicknesses and for the entire range of visible structural solid woods.

Manufacturerfs)(selection)
Ante-Holz GmbH
Eugen Decker Holzindustrie
Ambros Fichtner Holzwerk
Anton Heggenstaller AG
Anton Hess GmbH+Co KG
Hulster-Holz GmbH & Co.KG
Johann Kirchhoff GmbH
Merkle Holz GmbH
Rettenmeier GmbH & Co.KG
Holz Schmidt GmbH
Schollmayer Holz GmbH
Matthaus Sturm GmbH
Holzwerke Wimmer GmbH

Information
Überwachungsgemeinschaft Konstruklionsvollholz aus deutscher Produktion e.V.
Bund Deutscher Zimmermeister e.V.
Bundesverband Deutscher Holzhandel e.V.

For invitations to tender and orders;
- Wood species
- Glued laminated timber grade
- Width, height, length
- Gluing
- Surface
- Wood preservation measures

Calculated per m^3

Glued Laminated Timber

DIN 1052-1/A1 EC 5
DIN 4074-1
Thermal conductivity:
$*_{ri}$=0.13W/mK
Vapour diffusion resistance factor:
H -40
Raw density - depending on the wood species:
p = 450-800 kg/m^3
Building material classification:
B2
Computation weight in accordance with DIN 1055-1:
4 to 5 kN/m^3
Wood moisture content:
8-12%
Amount of swelling and shrinkage per % change in wood moisture:
0.24 % across the grain

Wood species:
- spruce, fir, larch
- Douglas fir, Western hemlock,
- Southern pine, Yellow cedar

Types of glue:
Urea-formaldehyde resin (UF)
Melamine modified urea-formaldehyde resin (MUF)
Phenol resorcinol resin (PRF)
Polyurethane (PU)

Dimensions
Recommended width [cm]: 8-22
Height [cm]: up to 200
The height-to-width (h/w) ratio of 1/10 must not be exceeded
Length [m]: up to 30.
Overlengths or up to 50 m are possible (check for transportability)

Material
Glue-laminated timber is a modified solid wood in which the weakening influence of growth-related defects has been largely cancelled out.
Glued laminated timber is composed of at least three sheets of softwood timber glued under pressure, parallel lo the grain, to create stable building elements.

Glued laminated timber grades

Glued laminated timber grade	Grade of laminates
BS11	S 10, MS 10
BS14	S13
BS 16	MS 13
BS18	MS 17

Use
Synthetic resin glues with a urea-formaldehyde resin basis may be used for non-water-resistant gluing. The glued joint is light in colour and barely distinguishable from the wood.
If water-resistant gluing is required, synthetic resin glues with a phenol, resorcin, melamine or polyurethane basis must be used. Phenol and resorcin resins are identifiable by the dark-brown glued joints they make, whereas modified melamine resins are light to chocolate-brown in colour. Polyurethane joints are light and transparent.

Glued laminated timber that is exposed directly to Ihe vicissitudes of the weather requires additional chemical treatment with oleaginous wood preservatives.

Manufacture
The individual laminates used to make glued laminated timber must be at least 6mm thick and not exceed 33 mm. Straight building components may be 42 mm thick provided that they are not subject to extreme, climatically induced load changes.

The laminates are dried and planed. All natural defects such as excessively large knots and pieces of bark are removed mechanically. Abutments are staggered and glued as finger joints and clamp pressed.

Load-bearing components may only be manufactured by authorised enterprises. These components must be clearly identi fied with kite marks.

Manufacturers){selection}
Achberger Ingenieur Holzbau GmbH
Grossmann Bau GmbH
Haas Fertigbau GmbH
Härle Karl GmbH
Kaufmann Holzbauwerk
Maier Holzbau GmbH
Merk Holzbau GmbH
Zeh Ulrich GmbH&Co.KG

Information
Deutsche Gesellschaft für Holzforschung e.V. DGfH
Studiengemeinschaft Holzleimbau e.V,
Gütegemeinschaft BS-Holz e.V.
Otto-Graf-Institut

For invitations to tender and orders:
- Manufacturer
- Wood species
- Thickness/width/length
- Surface

Calculated per m/m^J

Glued Laminated Beams

Non-standardised
They may only be used if permission is [granted on the basis of the local Building [Regulations in each individual case.

thermal conductivity:
WI_{tt} = 0.13W/mK
^Vapour diffusion resistance factor:
μ = 40
Raw density:
p = 450-800 kg/m^{-1} depending on the wood species used
Computation weight in accordance with
•DIN 1055-1:
| 4-5 kN/m^3
Suilding material classification:
B2
Thermal capacity:
C = 350 kJ/m^3K
Wood moisture content:
15±3%
Amount of swelling and shrinkage per percentage change in wood moisture
0.24 % across the grain

dimensions
Beam height [cm]:
Walls 6,8-12
Floors/ceilings 12-24

Material
Glued laminated beams are solid, flat, building elements. They are composed of layers of boards or planks connected to each other with nails or hardwood drift bolts. The quality of the original material is not subject to particularly high minimal requirements. Laminations of grades S7/S10 are sufficient. Side boards can be used. Although there are no obligatory lamination thicknesses, the customary sawmill thicknesses of 24-32 mm, or up to 60 mm in special cases, are recommended. Boards and planks with thicknesses between 32 mm and 45 mm are often used for visible structures.

Use
Floors, ceilings, roofs, (both bearing and non-bearing] can be constructed with glued laminated beams. The individual beams are used vertically in the wall elements.
Additional measures can be taken if diaphragm action is desired.
Solid wooden elements have a far higher storage capacity and therefore provide better thermal insulation during the summer months than wooden framework wall constructions.
The individual elements are connected with groove-and-tongue joints, rebates or flat steel connections. Swelling and shrinkage must be taken into consideration when selecting element widths. In order to avoid swelling, the wood must be effectively weatherproofed to protect it during transport, storage and installation.

This system, which has a high load-bearing capacity, allows for extremely slender cross sections. A variety of composite construction systems involving the use of concrete are available on the market.

Manufacture
Glued laminated beams are generally prefabricated. After the laminations have been dried to a wood moisture content of 15 + 3% they are levelled, arranged close together lengthways, and glued with staggered joints in a continuous process. Laminations of the same thickness and width are used. The coupling force can be transferred to the lamination joints by using more nails, or by gluing or finger jointing. The joint can be strengthened by using profiled boards on the faces.

Floor/ceiling openings and other openings must be taken into consideration when manufacturing glued laminated beams.

The elements can be prefabricated in lengths of up to 2.40 m, depending on transportability. Lengths should not exceed 12 m.

Manufacturer(s)(selection)
Bau-Barth-Holzbauelemente
Holzbau Becke & Sohn GmbH
Hiwo Holzindustrie Waldburg zu Wolfegg GmbH & Co. KG
Rudolf Janssen GmbH & Co. KG
Kaufmann Holzbauwerke
Kaufmann Massivholz GmbH
Kobus

Information
Fachagentur Holz
Bund Deutscher Zimmermeister

For invitations to tender and orders:
• Classification
-DIN
• Grading
• Wood species
• Thickness
• Width
• Length
Calculated per m^2/m^3

Boards/Planks

DIN 4071-1
DIN 4071-1
Thermal conductivity:
$k_{,,}$= 0.13W/mK
Vapour diffusion resistance factor:
H = 40
Raw density:
p = 350-500 kg/m^1 depending on the wood species used
Computation weight in accordance with DIN 1055-1:
4-6 kN/m^1
Building material classification:
B2
Thermal capacity:
C = 350 kJ/mK
Wood moisture content:
Equivalent to equilibrium moisture content < 20 %
Amount of swelling and shrinkage
per % change in wood moisture
0.24 % across the grain

Wood species:
• spruce, fire, pine
• larch, Douglas fir
• Northern softwood species for planed assortments

Dimensions
Thickness, unplaned [mm]:
16, 18,22,24, 28,38.44,48, 50, 63, 70, 75
Thickness, planed [mm]:
13.5, 15,5, 19.5, 25.5, 35.5, 41.5, 45.5
Thickness, northern woods, planed [mm]:
9,5, 11, 12.5, 14, 16,22.5, 25.5, 28.5, 40, 45
Width [mm]:
75, 80, 100, 115, 120, 125, 140, 150, 160, 175
Length [mm]:
1,500-6,000
Gradations [mm]:
250, 300

Material
Unplaned softwood boards and planks are parallel square-edged materials. Planed softwood boards and planks are planed smooth on one side and processed to an even thickness on the back, The edges are neither planed nor profiled.

Use
Unplaned and planed boards and planks are used for shuttering, external cladding and the most diverse areas of construction. When boards and planks are used for structures that have to be dimensioned in relation to load-bearing capacity, they must meet the requirements of DIN 1052 and be graded in accordance with DIN 4074-1. If the boards do not have to perform a load-bearing or reinforcing function, there is no necessity under German building regulations to take preventive measures to preserve the wood.
It is advisable to use load-bearing lathing with a cross section of 30 x 50 mm (minimum cross section 24 x 48 mm) to affix the cladding. These cross sections are available as dry wood from trade stores: cross sections with an average moisture content of 15 ± 3 % can also be obtained by invitation to tender.
Visible joints and fastenings for external use must be made of galvanised steel or - better still - chromium-nickel stainless steel.

The spacing of the load-bearing iathing depends on board thickness:

Board thickness [mm]	Lathing spacing [mm]
18.0	400-550
19.5	500-700
22.0	550-800
24.0	600-900
25.5	700-950
28,0	800-1.050

Manufacture
Boards and planks are sawn from round timber in sawmills or milled in planing mills and then planed, if necessary. Their dimensions and thickness-to-width ration are their distinguishing features.

	Thickness (t) [mm]	Width (w) [mm]
Board	t ≤ 40	w ≥ 80
Plank	t > 40	w > 3t

If boards are to be used externally, they must be treated with a preventive structural wood preservative. Careful planning and execution are essential.

If boards are exposed to weather, they should not be made of pine as it invariably has sap rot and blue stain. Their sap is particularly susceptible to wood-decaying and wood-staining fungi, which not only damage the wood but also cause paint failure.

To avoid changes in form in internal areas, the wood moisture content must be stated when placing orders. It is advisable to ventilate the wood cladding.

Manufacturer(s)
Boards and planks, both planed and unplaned, can be obtained from a variety of sawmills and planing mills.

Information
Lignum

For invitations to tender and orders:
• Designation
-DIN
• Grade
• Wood species
• Thickness
• Width
• Length
Calculated perm?

Profile Boards

DIN 4072 (matched boards)
DIN 68122 (matched tibreboards)
[)IN68123 (weatherboards)
[)IN 68126-1 +3 (profile boards with broad •cot and chamfer)

L)imensions
M(latched boards:
'fhickness (European) [mm]:
15.5, 19.5,22,5,35.5
Wkith [mm]: 95, 115. 135, 155
Thickness (northern) [mm]:
19.5, 22.5, 25.5
Width [mm]: 96, 111,121

Matched fibreboards:
Phickness (European) [mm]:
15.5, 19.5
Width [mm]: 95, 115
FTiickness (northern) [mm]:
12,5
[Width [mm]: 96, 111

[Weatherboards:
Thickness (European) [mm]:
19.5
jWidth[mm]: 115, 135, 155
[Thickness (northern) [mm]:
19.5
Mdth [mm]: 111, 121, 146

'rofile boards with broad root and chamfer
'"hickness (European) [mm]:
12.5, 15.5, 19.5
Vidth [mm]: 96, 115
micknessi (northern) [mm]:
112.5,14,19.5
pidth [mm]: 12.5, 14, 19.5

-engtli (European) [mm]:
1,500-4,500, gradations 250 (increments)
^.500-6,000, gradations 500
•^gth (northern) [mm]:
fe .800-6,000, gradations 300

Material
Matched boards are boards with grooves and planed tongues.

Softwood matched boards are boards with planed tongues and grooves, chamfered to an angle of less than 45" on the upper side.

Softwood weatherboards are boards with planed tongues and grooves, and a concave-rounded edge on the tongue side.

Softwood profile boards with broad root and chamfer are boards with tongues, planed grooves and chamfered edges on the visible face and a wide tongue on the face side.

Use
Matched and profile boards are used to panel both interiors and exteriors.
Any building boards that have to be dimensioned in relation to their load-bearing capacity must meet the requirements oi DIN 1052 and be graded in accordance with DIN 4074-1.

Manufacture
Planed and profile woods are sawn from round timber in sawmills and then milled and planed in planing mills.

In addition to the forms and dimensions covered by DIN, other profiles and dimensions can be obtained from the manufacturer - depending on the tools and equipment at the manufacturer's disposal. Planing mills make profile boards on request and sell them through trade stores.

Manufacturers/(selection)
The assortment of profile boards available from trade stores varies considerably due to the great range of types and shapes.

Information
Bundesverband Deutscher Holzhandel e.V.

For invitations to tender and orders:
- Manufacturer
- DIN
- Panel type
- Wood species
- Emission class
- Thickness
- Width
- Length
- Surface

Calculated by m^2

Blockboard and laminated board

DIN 68705-2
Thermal conductivity:
λ_R = 0.15W/mK
Vapour diffusion resistance factor:
H = 50/400
Raw density:
p = 400-800 kg/m^3
Computation weight in accordance with DIN 1055-1:
4.5-6.5 kN/m^3
Building material classification:
B2
Material class:
20, 100
Emission class:
E1
Wood moisture content;
5< 15%
Amount of swelling and shrinkage per % change in wood moisture content:
0.020 %

Wood species:
- spruce
- fir
- pine

Material
Formerly known as core plywood, blockboard consists of a core layer of solid wood board-shaped strips that are glued together. The width of the strips varies from approx. 24 mm to a maximum of 30 mm. A face veneer (three-ply board) or a cross-band veneer and a face veneer (five-ply board) is fixed to each side, with the grain running perpendicular to that of the adjacent layer.

Laminated boards are composed of a middle core of perpendicular rotary-cut veneers (strips) that are glued together. The veneers are 5-8 mm thick. A face veneer, or a cross-band veneer and a face veneer, are fixed to each side. The grain of each sheet runs perpendicular to that of the adjacent one.
All glues with an assured adhesive strength are permissible.

In the case of blockboard. the glued wooden core is composed of softwoods (primarily spruce) to ensure a more stable form, whereas softer or harder hardwoods are generally chosen for cross-band veneers and face veneers.
The same wood species can be used for both wooden core and veneer plywood, alongside the customary indigenous softwoods and hardwoods. A number of tropical woods are also used for the cores and for cross-band and face veneers, rounding off the customary indigenous softwoods and hardwoods available.

Use
Blockboards and laminated boards are primarily used in the manufacture of furniture, as well as in laboratory and stair construction. However, they are rarely used in timber engineering.

Manufacture
In general, 24 mm-thick softwood boards that have been carefully dried to a wood moisture content of approx. 6-8 per cent are considered suitable for the manufacture of block cores. These boards are cut into laths with multi-blade circular saws so that the lath width corresponds to the thickness of the inner core. The laths are then glued together with casein, polyvinylacetate or urea-formaldehyde resins to form boards and pressed.

DIN 68705-4 refers to structural blockboard and core-stripe blockboard as plywoods with defined, monitored elasto-mechanical properties. They are used in building construction (e.g. for reinforcement).

In the manufacture of the core, rotary cut veneers 5-8 mm thick are glued in layers parallel to the grain to create blocks. These are then sawn at right angles to the level of the single plies to make boards. In both manufacturing processes, the cross-band and face veneers are glued to the inner plies with the same glues and pressed.

Dimensions
Thickness [mm]:
13, 16, 19,22,25,28,30,38
Length [mm]:
1,220, 1,530, 1,830.2,050,2.500.4,100
Width [mm]:
2.440. 2,500, 3,500, 5,100, 5,200. 5,400

Manufactures) (selection)
Pfleiderer

Invitations to tender and orders:
- Manufacturer
- Certification number
- Panel type
- Wood species
- Wood preservation measures
- Thickness
- Width
- Length
- Surface

Calculated per m^2

Three- and Five-Ply Panels

German building authority certification:
Z-9.1-242
2-9.1-258
Z-9.1-376
Z-9.1-404
Z-9.1-477
Thermal conductivity:
λ_R = 0.14 W/mK
Vapour diffusion resistance factor:
11=50/400
Raw density:
p = 400-500 kg/m^3
Building material classification:
B2
Material class:
20,100, 100G
Emission class:
E1
Wood moisture content:
12 ± 2 %
Amlount of swelling and shrinkage per % change in wood moisture content:
0.020 %

Wood species:
- spruce
- larch
- Douglas fir

Material
The panels consist of three or five layers of softwood, each glued at right angles to the adjacent ply. Melamine modified urea-formaldehyde and phenolic resin are used as glues.
Since the thicknesses of the single plies vary according to type and manufacturer. the elasto-mechanical properties of panels of equal thickness can also differ considerably.

Applications)
Depending on glue type and the wood preservative (if any), the panels can be employed wherever panels of wood classes 20, 100 and 100 G are allowed under both the German Building Regulations and DIN 68800-2.
Once permission has been granted, the multi-ply panels can be used as effective and as reinforcing planking in manufacturing wall, ceiling and roof panels for wooden houses that are erected as panel construction systems in accordance with DIN 1052-3.

Depending on the type of permit granted, these panels can sometimes be used in place of laminated construction board as per DIN 1052-1.

If the edges are carefully covered or sealed for protection, they can also be used for large ventilated facades.

Dimensions
Thickness (three-ply) [mm]:
12-75
Thickness (five-ply) [mm]:
33-80
Length [mm];
2,500-6,000
Width [mm]:
1,000-4,750

Manufacturer(s)(selection)
Dold Süddeutsche Sperrholzwerke
Gmach Holzbauwerke
Haas Fertigbau GmbH
Kaufmann Holzbauwerk
Probstel Holzwerke

Invitations to tender and orders:
- Laminated construction board
- DIN 68705
- Certification number
- Panel type
- Emission class
- Thickness, width, length
- Surface finish

Calculated by m^3

Laminated Construction Board

DIN 68705-3
German building authority certification:
Z-9.1-43
Z-9.1-6
Z-9.1-7
Thermal conductivity:
$X_{„}$ = 0.15W/mK
Vapour diffusion resistance factor:
u = 50/400
Raw density:
p = 450-800 kg/rrf
Building material classification:
B2
Wood moisture content:
5-15 %
Amount of swelling and shrinkage
per % change in wood moisture content:
Thickness: 0.25-0.35 %
Length/width: 0.01-0.02 %

Wood species (selection):
- spruce
- pine
- Clear pine
- Douglas fir
- Hemlock
- Soutlwn pine
- mahogany
- Cherry mahogany

Panel types;
Laminated construction board 20
Laminaled construction board 100
Laminated construction board 100 G

Dimensions
Thickness [mm]:
8,9, 10, 12, 15, 18.20.21,24.25,40
Formats [mm]:
2,500/3,000x1,250/1,500
2,400/3.050 x 1,200/1,525

Material
Laminated construction board is made by arranging and gluing alternate veneers perpendicular to one another. Urea resin is used to glue the veneers of laminated construction board 20, whereas water-resistant, alkaline hardening / phenolic resin, phenol-formaldehyde resin, and resoreino! resin are used for laminated construction board 100 and 100 G. All other glues must be certified by the building authorities.

Application(s)
Laminated construction board is mostly used as effective, reinforcing panelling for walls, ceilings and roofs, For the required panel type, which depends on the panel's position in the building component, please refer to DIN 68800-2.

Panel type	Panel moisture in service
Laminated construction board 20	k 15 %
Laminated construction board 100	<. 18 %
Laminated construction board 100Gk	21 %

Manufacture
Laminated construction board is made from the same wood species as normal plywood. However, light species of tropical wood such as limba and obeche may not be used.

Beech laminated construction board, as per DIN 68705-5, consists of three to nine veneers, each 1.5-3.2 mm thick (from wood classes 100 and 100 G). It is used, in particular, for building elements subjected to great static loads.

Beech laminated construction board (100 G) panels are either made of sap-clear wood corresponding to at least resistance class 2 as specified in DIN 68364 (e.g. oak, mahogany, cherry mahogany) or from another wood species bonded with a glue liquor to which a wood preservative has been added.
II a chemical wood preservative is required because the species used has a low resistance class, a wood preservative designed to eliminate destructive fungi (basidiomycetes) must be added to the glue liquor when the panels are being manufactured.

The panels must bear the following permanent identification:
- Kite mark
- DIN certification number
- External quality control stamp
- Panel type
- Emission class
- Thickness

Manufacturer(s)(selection)
Blomberger Holzindustrie
Bruynzeel Multipanel GmbH
Dold Süddeutsche Sperrholzwerke
Finnforest Oy
Glunz AG
Hess & Co. AGT
ROHOL Rosenauer
R.O.L. Rougier Ocean Landex
Schaumann Wood Oy
Teuteburger Sperrholzwerk
Westag & Getalit AG

Information
American Plywood Ass. (APA)
Cofi Canadian Plywood Association
Council of Forest Industries
of British Columbia
Finnish Plywood International
Güteschutzgemeinschaft Sperrholz e.V.
Lignum
Proholz
Verband der Deutschen
Holzwerkstoffindustrie e.V.

Invitations to tender and orders:
- Manufacturer
- Certification number
- Type of parallel laminated veneer
- Thickness, width, length
- Wood preservation measures

Calculated by $m^{:i}$

Parallel Laminated Veneer

German building authority certification:
Z-9.M00
Z-9.1-291
Z-9.1-245
Thermal conductivity:
= 0.15 W/mK
Vapour diffusion resistance factor:
(1 = 50/400
feaw density:
• p = 400-800 kg/$m^{:i}$
Building material classification:
B2
Emission class:
E 1

Wood species:
* spruce
* pine (kerto)
* Douglas fir
* Southern pine (microlam)

dimensions:
Kerto-S veneers are used for load-bearing, rod-shaped structural members.
thickness [mm]:
21-69
lax. dimensions [mm]:
1.820x23,000
Kerto-Q veneers are used for panels and plates.
h ≤ 1,800
hickness [mm]:
21-75
ax. sizes [mm]:
(1.820x23,000

Material
Parallel laminated veneer is a multi-ply wood-based material. In contrast to plywood, its veneers are generally arranged parallel to the gram and glued watertight with phenol-formaldehyde resin. If broad widths are required, plies are also arranged crosswise to increase stability. When wood class 100 G veneers are glued together, the single sheets are impregnated with a wood preservative to for protection against destructive fungi.

Application(s)
Parallel laminated veneer may be used in all areas of work in which glued laminated timber is permitted.
Owing to the high loads it is permitted to bear, parallel laminated veneer can also be used for reinforcing the following structural elements:
purlins and other girders subject to bending, girders at the point of support, load-bearing plates, connecting plates, etc.

The presence of cup shakes in the veneers makes it relatively easy to impregnate parallel laminated veneer with aqueous wood preservatives across its entire cross-sectional area. As a result, it can be used in areas exposed to the weather (e.g. external use for roof panels).

Manufacture
In the manufacture of parallel laminated veneer, softwood logs are de-barked, soaked in water and stripped to make 3 mm-thick veneers, which are then cut into dimensioned sheets and dried. Large defective areas are removed, as are veneers that are too light, moist or mis-shapen. The veneers, which are provided with staggered joints, are then glued with phenol-formaldehyde resin parallel to the grain, placed on top of one another and pressed to form a panel.
The large panels thus created can be sawn to the desired panel or beam size.

Manufacturers)(selection)
Merk Holzbau GmbH
Finnforest OY
Trus Joist Mac Millan

Invitations to tender and orders:
- Certification number
- Wood species
- Thickness
- Width
- Length

Calculated by m:i

Parallel Strand Lumber

German building authority certification:
Z-9.1-241
Thermal conductivity:
A_H = 0.15W/mK
Vapour diffusion resistance factor:
M = 50/400
Raw density:
p = 670 kg/m^3 for Douglas fir
p = 720 kg/nr for southern yellow pine
Building material classification:
B2
Material class:
100, 100G

Wood species:
- Douglas fir
- Southern pine

Material
Parallel Strand Lumber (PSL) consists of strands approximately 16-mm wide and 3.2 mm thick. These are aligned parallel to the longitudinal axis of the beam and glued with waterproof phenol-formaldehyde resin. The graded strands are glued to create 483 mm-thick panels and then sawn into beams.

Currently, PSL is only manufactured in the USA.

Paraffin is applied to give the lumber a water-repellent finish.

Owing to the natural resistance of the two wood species used (resistance class 3 in accordance with DIN 68364|, no wood preservatives are added.

Application(s)
Parallel Strand Lumber can be used for all work in which glued laminated timber is permitted unless otherwise certified.

Parallel Strand Lumber has maferial properties very similar to those of glued lamiNaled timber; its advantages lie in its considerable flexural, compression and shearing strengths.

The adhesive bond is weather resistant, but weather exposure causes the wood to turn grey.

Manufacture
After being soaked and steamed, the logs are peeled to create veneers 2.5-3.2 mm thick. The strands are then dried to obtain a9-10 percent moisture content and cut into 45-260 cm-long strips. After the defects have been extracted, the strands are glued with phenol-formaldehyde resin and pressed in continuously operating press. Afterward, they are cured in a microwave process.

The veneer strands are arranged parallel to one another with their ends staggered. During the pressing process, the material is compressed to increase its raw density to a value slightly higher (approx. 15 per cent) than that of the original wood. As there are gaps between the strands, cavities are visible, especially at the ends. The resulting 20 m-long section is then cut to fhe desired lengths.

Dimensions:
Width [mm]:
44-280
Height [mmj:
44-483
Length [m]:
up to 20

Manufacturers)(selection)
Merk Holzbau GmbH
Trus Joist Mac Millan

Invitations to tender and orders:
- Manufacturer
- Certification number
- Panel type
- Wood species
- Gluing
- Emission class
- Thickness
- Width
- Length

Calculated by m^l

Laminated Strand Lumber

German building authority certification:
Z 9.1-323
Thermal conductivity:
^ = 0.14 W/mK
Vapour diffusion resistance factor:
u = 50/400
Raw density:
p = 600-700 kg/m^3
Building material classification:
B2
Material class:
100
Emission class:
E1
Wood moisture content:
15%

Wood species:
poplar

Glues:
Polyurethane adhesive

Applicationfs)
Laminated Strand Lumber may be used for all areas of work in which glued laminated timber is permitted in accordance with DIN 1052-1 and in which laminated construction board is permitted in accordance with DIN 68705-3.
The wood is preserved in the same way as glued laminated timber.

Manufacture
Laminated Strand Lumber consists of approx. 1.0 x 25 x 300 mm-long poplar chips which are glued together with formaldehyde-free polyurethane resin (PMDI).

After being bonded in a mixer, the chips are aligned in their original grain flow. The mass is pressed under heat and then separated and ground.

Long-chip wood is manufactured in two grades: tntratlam S and Intrallam P.

Dimensions:
Thickness [mm]:
32-89
Format [mm]:
max. 2,438 x 10,700

Manufacturers)(selection)
Trus Joist MacMillan

Oriented Strand Board (OSB)

DIN EN 300
German building authority certification:
2-9.1-275
Z-9.1-326
Thermal conductivity:
λ_R = 0.13 W/mK
Vapour diffusion resistance factor:
H = 50/100
Raw density (depending on wood species):
p = 600-660 kg/m^3
Computation weight in accordance with 1055-1:
5-7.5 kN/m^5
Building material classification:
B2
Material class:
100
Emission class:
E1
Wood moisture content:
5 - 6 %
Amount of swelling and shrinkage per % wood moisture content:
0.035 %

Wood species:
- pine
- Clear pine
- Douglas fir
- Oregon pine
- alder
- poplar

Material
OSB (oriented strand board) is composed of aligned strands. Owing to the alternating, cross-alignment of the strands, oriented strand boards - like plywood - have mechanical properties.
Excellent mechanical properties have been obtained (two to three times those of normal chipboard types) by machine-cutting the wood parallel to the grain.

A variety of glues is used for bonding: phenol resin, polycarbamide (isocyanate), MUPF (Kauramin) surface glue, and PMDI core resins. All these resins are waterproof.

Application(s)
Typical areas of application:
OSB flat-pressed boards may be used for all work where class 100 wood-based materials are permitted under the local Building Regulations.
It may be used for panelling, with weather proofing, the exterior of load-bearing/ reinforcing walls.

Manufacture
Large coarse rectangular chips (ca. 35 x 75 mm, thickness 0.6 mm) are used to manufacture OSB boards. The flat chips are obtained by peeling and crushing veneers or by using a chipper. They are then sieved, graded, dried, glued, spread out and aligned. The strands are arranged crosswise in three or five layers, depending on the required board thickness. In the case of three-ply boards, the core (comprising 50 per cent of the whole) is generally laid crosswise, whilst the grain of the surface sheets (accounting for 25 per cent each) generally runs parallel to the machined length. Once the strands have been aligned, the sheets are pressed under heat. After they have cooled, they are formatted and ground.

DimGnsions
Thickness [mm]:
6, 8, 9, 10, 11, 12, 13, 15, 18, 22, 25,30
Formats [mm]:
2,500/5,000x1,250
5,000 x 2,500
2,440x1,220
2,620 x 1,250/5.000

Manufacturers)(selection)
CSC Forest Products (Sterling) Ltd.
Glunz AG
Kronospan Ltd.&Cie.

Information
Verband der Deutschen Holzwerkstoffindustrie (VHI)

invitations to tender and orders:
- Manufacturer
- Certification number
- Panel type
- Emission class
- Thickness, Width, Length
- Surface

Calculated by m^2

Fibreboard

DIN 68754-1
Thermal conductivity:
\, = 0.065-0.17 W/mK
Vapour diffusion resistance factor:
H = 5-70
Raw density:
p = 350-1100 kg/m^3
Computation weight in accordance with DIN 1055-1:
9-11 kN/rn^3
Building material classification:
B2
Material class:
20 (100 with certification)
Emission class:
E1
Wood moisture content:
5 ± 3 %
Amount of swelling and shrinkage per % change in wood moisture content:
< 20 % in thickness

Wood species:
- spruce
- pine
- fir
- beech
- poplar
- birch

Glues:
- Urea-formaldehyde resins
- Phenol-formaldehyde resin

Material
Fibreboards are panel-shaped materials made of fibrous - primarily wood - particles.
The particles are combined under heat, with or without glue or additives. Pressure may be applied.
Fibreboards can be manufactured as single- or multi-ply boards in a wet process without bonding agents or in a dry process using bonding agents.
Depending on their raw density they are subclassified as:
- Porous fibreboards, not bituminated
- Bituminated porous fibreboards
- Hardboard and medium-density wood fibreboards for the construction industry
- for interiors and furniture

Other types of wood fibreboard are also available, e.g. medium-density fibreboards.

Soft fibreboard: see insulating materials.

Application®
According to DIN 1052-3, the use of fibreboards as effective and reinforcing boards in the manufacture of wall, ceiling and roof panels is restricted to wooden houses built as panel construction systems.
They may also be used in rooms with a low moisture content, i.e. in areas where wood class 20 is used and in areas in which wood class 100 is permitted by the local Building Authority.

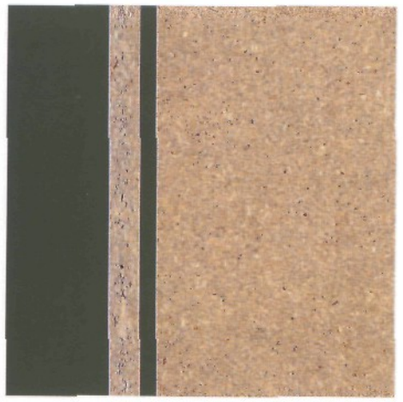
IDimensions:
Thickness [mm]:
5-16
[Width [mm]:
up to 2,100
Length [mm]:
up to 5,500

Manufacturer(s)(selection)
Euro MDF Board
Gutex
Hornitex
Kunz GmbH & Co
Odenwald Faserplattenwerk
Pavatex
Wilhelmi Werke GmbH & Co KG

Invitations to tender and orders:
- Manufacturer
- DIN
- Certification number
- Panel type
- Gluing
- Emission class
- Thickness
- Width
- Length

Calculated by rrf

Manufacture
In the manufacture of wood fibreboards, the wood chips are placed in a reaction tank known as a defibrator, steam-treated and then defibrated mechanically with grinding plates. This approach primarily exploits the matting properties of the fibres and their natural adhesive strength. The latter can be increased by adding bonding agents and water-repellents as well as by thermal and other treatments. The various manufacturing processes differ mainly in the technique employed to produce the fibrous material and the fibrous mat. These processes are referred to as wet or dry processes, depending on whether the fibrous material is transported or formed in a wet or dry process.



Invitations to tender and orders:
- Manufacturer
- DIN 68763
- Panel type
- Gluing
- Emission class
- Thickness
- Width
- Length

Calculated by *in²*

Flat-Pressed Boards (FP)

DIN 68763
Thermal conductivity:
A_H = 0.13 W/mK
Vapour diffusion resistance factor:
LI = 50/100
Raw density:
p = 550-700 kg/m³
Computation weight in accordance with DIN 1055-1;
5-7.5 kN/rrr³
Building material classification:
B2
Material class:
20, 100, 100 G
Emission class:
E1
Wood moisture content:
5< 12 %
Amount of swelling and shrinkage per % change in wood moisture content:
0.035 %

Wood species:
- Softwood
- Hardwood

Glues:
- Urea-formaldehyde resins
- Melamine modified urea-formaldehyde
- Phenol resin
- PMDI

Material

Flat-pressed boards are panel-shaped wood-based materials that are made by bonding and pressing particles of wood or wood-like fibrous materials.

Depending on the gluing procedure and wood preservatives, the panel types can be classified as follows:

- V20

This resin is only suitable for rooms where humidity is generally low, as it is not resistant to atmospheric corrosion.
Glues: aminoplasts, alkaline-hardened phenolic resins, polymeric diphenyl methylene diisocyanate (PMDI).

• V100

For use in humid rooms.
Glues: alkaline-hardened phenolic resins, phenol-resorcinol resins, PMDI.

• V100G

Also durable in highly humid environments; protected against destructive fungi by a wood preservative.
Glues: alkaline-hardened phenol resorcinol resins, PMDI.

Application®

Flat-pressed boards manufactured for lhe construction industry are primarily used as effective, reinforcing panelling for walls, floors, ceilings and roofs. Panel selection depends on the intended use in these building elements. Information may be found in DIN 68800-2 (see appendix).

Manufacture

Flat-pressed boards are manufactured by bonding and pressing relatively small wood chips, which are ideally aligned parallel to the board surface. These boards are generally manufactured as homogenous multi-ply panels.

Dimensions
Thickness [mm]:
4,8,10, 13, 16, 19, 22,25, 28, 38
Formats [mm]:
1,250 x 2,500, 1,250 x 5,000,
4,100x1,850,2,710x2,080,
2,750/5,300x2,050
Lengths of up to 14,000mm are available

Manufacturer(s)(selection)
Glunz AG
Hornitex
Kunz GmbH
Pfleiderer Industrie
Schlingmann GmbH & Co.

Information
Verband der Deutsche Holzwerkstoffindustrie e.V.

Invitations to tender and orders:
- Manufacturer
- DIN
- Panel type
- Wood species
- Gluing
- Emission class
- Thickness
- Width
- Length

Calculated by m²

Extruded Particle Boards

DIN 68764-1/2
Thermal conductivity:
\, = 0.17W/mK
Vapour diffusion resistance factor:
^i = 20
Raw density;
p = 450-700 kg/m³
Computation weight in accordance with 1055-1:
5-7.5 kN/m³
Building material classification;
B2
Emission class:
E1
Wood moisture content:
5< 12%

Wood species:
- spruce
- fir
- pine

Glues:
- Urea-formaldehyde resin
- Melamine modified urea-formaldehyde
- Phenol resin
- PMDI

Material

Extruded particle boards have a high shearing strength but a low flexural strength and insufficient integrity. Consequently, when used in the construction industry, they must be panelled with chipboards, hardboards, veneers or plastic boards.

Application^)

Extruded particle boards are used in making doors. They are authorized for use as panelling in wooden panel-construction houses,

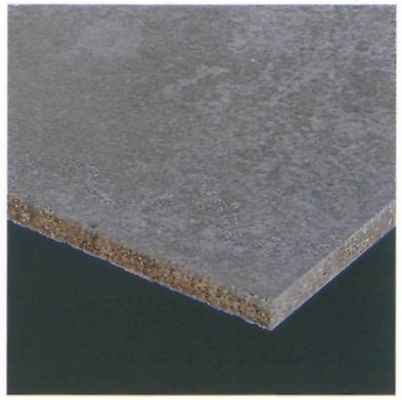
Manufacture

In the manufacture of extruded particle boards, particles are mixed with a bonding agent and pushed rhythmically along a heated channel by a ram. The cross-section of the channel forming the board corresponds to that of the resulting product. The particles are positioned perpendicularly to the board's surface, which produces a relatively high shearing strength at right angles to the surface. Extruded particle boards are made in a continuous manufacturing process because the heating process and the rate of feed are adjusted to the curing time- As the particles pass through the channel shaft, they are bonded together to form an endless stream of board that is only cut into sections after pressing is completed.

Solid extruded boards are produced in single layers only. Owing to the arrangement of the particles, these boards have a lower flexural strength than flat-pressed boards. Extruded particle boards are only suitable as cores in composite boards, Tubeboards, whose cores contain tubular cavities, are produced by arranging tubes parallel to the shaft.

Ltimensions
Thickness [mm]:
. Solid extruded board: 10-34
j Tubeboards [mm]: 23-80
[Width [mm]:
I 900-2,100
length [mm]:
up to 5,000

Manufacturers)(selection)
SauerlanderSpanplatten GmbH & Co. KG



Invitations to tender and orders:
- Manufacturer
- DIN
- Certification number
- Panel type
- Emission class
- Thickness
- Width
- Length
- Surface

Calculated by rrf

Fibre-Reinforced Cement Boards

DIN EN 633
DIN EN 634
Thermal conductivity:
$X_{„}$ = 0.35 W/mK
Vapour diffusion resistance factor:
H = 20/50
Raw density:
p= 1,250-1,300 kg/m^3
Building material classification:
B1, A2
Material class:
20, 100,100 G
Emission class:
E1
Wood moisture content:
9 ± 3 %
Amount of swelling and shrinkage
per % change wood moisture content:
0.03%

Wood species:
- spruce
- fir

Bonding agent:
- Cement

Material
In contrast to organically bonded wood-based materials, fibre-reinforced cement boards are anorganically bonded with cement (which accounts for approximately one third of their weight percentage). They can be used in the same fields as wood classes 20, 100. 100G in accordance with DIN 68800-2. The bonding agent renders the boards moisture-resistant. The boards can be coated and plastered for more effective and enduring weather protection. They are certified for use as load-bearing and reinforcing panels for wooden panel-construction houses under DIN 1052-3.

The panels are hardly flammable and have been classified as B1 under DIN 4102. To ensure that they meet the requirements of building material classification A 2 (not flammable), perlite (amounting to approx. 24 % of total mass) is added.

Apphcation(s)
Fibre-reinforced cement boards are used as exterior wall cladding or as wall-reinforcement panelling. Effective, enduring weather protection is essential for extenor walls. Their good fire-proofing properties make these panels suitable as fire barriers. They also have good sound-insulating properties owing to their high raw density, and can be used as a floor covering.

Manufacture
Coniferous wood (spruce or fir) that has been stored for three to four months and not treated against fungi is chipped and separated into fine and coarse chips and then stored in chip bins. A mixture of wood chips, cement, recycled trimmings, supplementary agents and water is prepared in a semi-dry process in a mechan ical mixer. The material is evenly separated into an outer layer and a core layer in a mechanical sifter and spread evenly across plates. Surplus material is fed straight back into the mixer. There is no waste water. The mix is pressed and allowed to set in a climatic chamber. Afterwards, the boards are cured for approximately four weeks in a conditioning storage unit. Prior to shipment, the panels are conditioned so thai they have the right moisture balance; they are then trimmed and cut, and their edges profiled. Finally, they are impregnated and coated.

Dimensions
Thickness [mm]:
8-40
Format [mm]:
1.250x2,600, 1,250x3.100

Manufacturer(s)(selection)
Eternit AG
Fulgurit
Glunz AG

Invitations to tender and orders:
- Manufacturer
- Certification number
- Thickness
- Width
- Length
- Surface area

Calculated per m^2

Fibre Cement Boards

German building authority certification:
Z-31.1-34
Z-31.1-36
Thermal conductivity:
λ_h = 0.58 W/mK
Vapour diffusion resistance factor:
H-11
Raw density:
p= 1,150-2,000 kg/m^3
Building material classification:
A2

Material
Fibre cement is a composite material of fibre and cement. It consists of 40 % Portland cement, 11 % aggregate (limestone powder), 2 % reinforcement fibre, and 5 % cellulose fibres and water.

Application
Fibre cement boards are suitable as weatherproofing for roofs and walls, and may also be used as ventilated exterior wall cladding as per DIN 18516-1.

Production
Fibre cement boards are made of an intimate mixture of cement and water plus artificial and cellulose fibres. They are manufactured with a surface coating or with various colour additives. The inorganic materials are weatherproof, frost- and rot-resistant, and incombustible. In addition, they are largely resistant to aggressive chemical atmospheres. In the mixture, the fibres perform a similar function to that of steel in reinforced concrete.

Dimensions
Length [mm]:
1,250,2,000, 2,500
Width [mm]:
1,250, 1,500
Thickness [mm]:
8,10, 12.5, 15, 18

Manufacturer(s)(selection)
Eternit AG
Fulgurit Baustoffe GmbH
Wanit

Information
Fachregeln des Deutschen Dachdeckerhandwerks (Professional Regulations of the Germany Roofing Trade Deutsches Dachdeckerhandwerk)

Invitations to tender and orders:
• Board type
- Thickness
• Length
- Width
• Edge shape
Calculated per rrf

Plasterboard

DIN 18180
German building authority certification:
2-9.1-199
Z-9.1-204
Z-9.1-221
Z-9.1-246
Z-9.1-318
Z-9.1-319
Thermal conductivity:
X_R = 0.21 W/mK
Coefficient of thermal expansion:
0.013-0,020 mm/mK
Vapour diffusion resistance factor:
H = 8
Raw density:
p = 900-1000 kg/m[1]
Building material classification:
A2
Heat storage capacity:
C = 960 J/kgK

Material
Plasterboard consists of a plaster core encased in adhesive cardboard. Natural and FGB plaster obtained from flue gas desulfurisation provide the raw materials for production.
Depending on the application, various types of plasterboard may be used, with different cardboard casings and plaster additives:
- Gypsum plasterboard
Yellowish-white cardboard, blue lettering
• Fire protection plasterboard
Yellowish white cardboard, red lettering
• Impregnated plasterboard
Greenish cardboard, blue lettering
• Impregnated fire protection plasterboard
Greenish cardboard, red lettering
• Gypsum baseboard
Grey cardboard, blue lettering
• Gypsum dry screed board
with/without sound-impact insulation

Applications)
Plasterboard can serve as wall or ceiling panelling, as a lining for suspended ceilings, as lining for prefabricated walls, and as dry screed.
It may be used wherever class 20 wooden boards are allowed as per DIN 68800-2. In addition, impregnated plasterboard may be installed on the outside of exterior wall elements if the conditions for effective, lasting weather protection, as specified in the note of authorization, are met.
Plasterboard may be used as reinforcing panelling for ceilings in wooden buildings (fixed to the bottom side) and for pitched roofs.
Plasterboard may also be employed as a load-bearing reinforcement for wall panelling in wooden houses erected as panel construction systems.

Production
Plasterboard is produced on large conveyor belts in a continuous manufacturing process. The calcined, ground plaster is mixed with water and additives, sprayed onto a base, and formed into boards together with the cardboard lining. The boards are then lettered, cut, turned, dried and bundled.
In combination with the plaster core, the cardboard reinforces the tensile zone and lends the boards the requisite firmness and flexural strength.

Dimensions:
Thickness [mm]:
9.5, 12.5, 15, 18,20, 25
Width [mm]:
600, 625, 1,250
Length [mm]:
2,000-4,000 in increments of 250

Manufacturer(s)(selection)
Danogips GmbH
Fels-Werke GmbH
Gebr. Knauf Westdeutsche Gipswerke
Gyproc GmbH
Lafarge Gips GmbH
Lindner AG
Fiigips GmbH

Information
Industriegruppe Gipsplatten

For requests for tenders and orders
• Gypsum, fibreboard
• Certification number
• Thickness, length and width
Calculated per m[J]

Gypsum Fibreboard

German building authority certification:
Z-9.1-187
Z-PA-III 4.864
Thermal conductivity:
\ = 0.36 W/mK
Vapour diffusion resistance factor:
H=11
Raw density:
p = 880-1,250 kg/m[3]
Building material classification:
A2

Material
Gypsum fibreboard is a homogenous board made of a mixture of calcined natural plaster and cellulose tibres. The cellulose fibres, which are primarily obtained from recycled paper, strengthen the board.

Application^)
Gypsum fibreboard can serve as wall or ceiling panelling, as a lining for suspended ceilings and prefabricated walls, and as dry screed (when used in multiple layers). In the form of composite board with foam plastic, it can be used to provide additional thermal insulation.
Gypsum fibreboard may be used as a load-bearing reinforcement for wall panels in both wooden houses with a panel design and in limber skeleton buildings.
It may be employed as reinforcing and load-bearing wall panelling wherever class 20 wood material is permitted (in accordance with the German building authority certification).
It may also be used to plank the outside of exterior wall elements if effective, lasting weatherproofing is ensured.

Gypsum fibreboard is resistant to fire and humidity.

Production
Cellulose fibre is obtained from paper in a recycling process and then mixed with ground plaster. Water is added to the mixture, with no additional bonding agent. The mix is pressed into boards under high pressure, dried, impregnated with a water-repellent agent and formatted.

Dimensions:
Thickness [mm]:
10,12.5, 15, 18
Sizes [mm];
1,000 x 1,500
1,245x2.000
1,245x2,500
1,245x2,540
1,245x2,750
1,245x3,000

Manufacturers)(selection)
Fels-Werke
Lindner AG
Rigips GmbH

For invitations to tender and orders:
- Manufacturer
- DIN
- Application type
- Thickness
- Width
- Length

Calculated per m^2

Wood Fibre

DIN 68755
DIN EN 316
Thermal conductivity:
λ_B = 0.045-0.060 W/mK
Vapour diffusion resistance factor:
μ = 5-10
Raw density:
ρ = 130-450 kg/m^3
Building material classification:
B2
Thermal capacity:
C = 360 kJ/m-K
Application types:
T, TV, IC

Material
Porous soft fibreboard is manufactured from spruce, fir and pine pulp in a wet production process. Fibre humidity exceeds 20 per cent during the manufacturing process.
The raw density of soft fibreboard lies below 450 kg/m^3, making it lower than that of medium hard and hard fibreboard.

Application®
Soft fibreboards are used as insulation for floors, walls, ceilings and roofs; they are also employed as impact sound insulation under floor screed, dry screed and wood flooring, and as sound absorbing panels.

Depending on the application, the boards are connected by butt joints, rebate joints or tongue-and-groove joints. The panels are loosely laid and then mechanically fastened or glued. Special joint adhesive sealing may be required to ensure air tightness.

Like untreated wood, wooden fibreboards must be protected against UV-radiation and humidity. With a wood moisture content of less than 20 per cent, these boards are highly resistant to wood pests and other sources of damage (bacteria, fungi, and insects).
Wood fibreboards are available as insulating plaster-base elements for exterior walls. They are also suitable as elements for composite or sandwich construction in combination with hardboard or gypsum board.

Manufacture
In the wet manufacturing process, waste (rom locally harvested coniferous trees is chipped and shredded. The chips are pulped with vapour in a reaction chamber and subsequently milled into fibres. Additives and, if required, wood preservatives are blended into the fibre slurry. The slurry is spread on a Foudrinier to create a flat fibrous mat, which is then dehydrated by extrusion or by applying negative pressure. In the final stage, the mats are shaped into boards and dried.
Thicker panels (25-30 mm and upwards) are manufactured by laminating several individual boards.

Dimensions
Thickness [mm]:
6-80
Width [mm]:
400-1,220
Length [mm]:
1,200-2.500

Manufacturer®(selection)
Emfa Baustoff GmbH
GlunzAG
Gutex
Holzfaserplattenwerk Schonheide GmbH
Pavatex
Steinmann

For invitations to tender and orders:
- Manufacturer
- DIN
- Application type
- Thickness
- Width
- Length

Calculated per m^2

Bituminated Fibreboard [Asphalt-Treated Board; US]

[DIN 68752
Thermal conductivity:
λ = 0.056-0.060 W/mK
Vapour diffusion resistance factor:
μ = 5-10
Raw density:
ρ = 200-350 kg/m^3
Building material classification:
B2
Thermal capacity:
C - 630 kJ/m'K
Application types:
T,TV

Material
Bituminated fibreboards are porous wood fibreboards, manufactured with a bitumen additive.
A distinction is made between bituminated (ibreboards
- with 10-15 per cent bitumen additive (moisture-proof) and a water absorption rate of less than 25 per cent (BPH)
- with more than 15 per cent bitumen additive (increased moisture resistance) and an average water absorption of less than 20 per cent (BPH2).

Application®
The primary areas of application *ar&* exterior walls, roof extensions and subfloors. Bitumen-impregnated wood fibreboards can be used under roof covering as water- and airtight layers. The bitumen content renders them resistant to moisture, rot, fungi and insects.

Manufacture
Bituminated wood fibreboards are manufactured in the same manner as porous wood fibreboards; the only difference being that a bitumen emulsion is added to the fibre slurry.

Dimensions
Thickness [mm]:
16-25
Width [mm]:
[400-1,220
Length [mm]:
[2,440,2,500

Manufacturer®(selection)
Emfa Baustoff GmbH
Gutex
Isofloc Wärmedämmtechnik GmbH
Pavatex

For invitations lo tender and orders:
- Manufacturer
- DIN
- Application type
- Thickness
- Width
- Length

Calculated per m^2

Cork

DIN 18161-1
Thermal conductivity:
X_H = 0.040-0.055 W/mK
Vapour diffusion resistance factor;
H = 5-10
Raw density:
p - 80-200 kg/m^3
Building material classification:
B2
Thermal capacity:
C = 223 kJ/m^{i}K
Application types:
T. TR, TS

Material
Cork, the outer bark of the cork oak tree, is available - as natural or expanded granulated material (expanded cork, caking cork) - in the form of insulating panels and fill.
The cork oaks, predominantly indigenous to the western Mediterranean region, can be debarked every 8 to 10 years. They have a lifespanof 100 to 150 years.

Applications)
Cork is mould and rot resistant even when thoroughly moist. However, exposure to moisture over an extended period may result in fungal decay.
Cork insulating boards are laid down loosely, then nailed, plugged or glued. Granulates are poured or injected. Insulating cork is especially suitable for use in areas subjected to pressure loads and as impact sound insulation. Cork can also be employed in composite insulating systems.

Manufacture
Cork is processed into insulating materials in a variety of ways depending on the intended use.

Natural granulated cork is manufactured by crushing raw cork; it is used without additives as insulating fill.

Expanded granulated cork is manufactured by adding superheated vapour to the natural granulated cork under pressure in a hermetically sealed container. The natural cork resin (suberin) shifts to the outside of the granules and bonds them to each other. The required vapour temperature depends on the resin content. The blocks are then cut into slabs or granulated.

Impregnated cork is manufactured by adding a bonding agent such as synthetic resin or bitumen to the heated granulate.

Dimensions
Thickness [mm]:
20-100
Format [mm];
500 x 1,000, 600 x 1,200

Manufacturers)(selection)
Cortex
Emfa Baustoff GmbH
Gradl & Stürmann
Heck Dämmsysteme GmbH
Henjes Naturschrot
Rdthel GmbH & Co KG
Zipse Korkvertrieb

For invitations to tender and orders:
- Manufacturer
- DIN
- Application type
- Grade
- Thickness
- Width
- Length

Calculated per m^2

Expandable Polystyrene (EPS)

DIM 18164-1
Thermal conductivity:
λ_1, = 0.035-0.040 W/mK
Vapour diffusion resistance factor:
μ = 20-100
Raw density:
p= 15-30 kg/m^3
Building material classification:
B1
Thermal capacity:
C = 43 kJ/rrfK
Application types:
T, TV, TR, TS, IC

Material
Plastic foams are oil-refining products that are manufactured by foaming the raw material and simultaneously adding propellants or blowing agents. Plastic foams are porous in structure and are mainly available as HR-foams.

Expandable polystyrene, also called styropor, is a predominantly closed-cell, hard plastic foam. The "styropor" granulate is processed into boards, mouldings and sheets. The material is rot, mould and pest resistant. It is not resistant, however, to constant moisture or humidity.

Appiication(s)
It is typically used in non-ventilated flat roofs (which must be protected against hot bitumen), and composite insulation systems for exterior walls.
Rigid plastic foamboard is not very suitable for use in timber frameworks, however, because it does not compensate for wood shrinkage.
EPS boards are frequently employed in sandwich constructions in combination with a variety of materials, for example, with fibrated cement panels as fagade elements, or with timbering and plasterboard as wall and roof elements.
In floor construction, EPS boards are used as impact sound and thermal insulation. Loose polystyrene particles can also be used as fill.

Manufacture
The product is manufactured in three stages:
- Frothing
  The compact beads are heated with hot vapour and inflated under pressure with pentane blowing agent to make foam pellets.
- Intermediate storage
  The beads are cooled and dried.
- Foaming
  The trothed beads are further inflated with vapour into solid forms and bonded to each other. Block mouldings are produced to manufacture the polystyrene boards, which are saw-cut or hot-wire cut.

tOimensions
•Thickness [mm]:
I 10-200
Format [mm]:
500 x 1,000

Manufacturers)(selection)
BASF
Joma
Schwenk

Information
Industrieverband Hartschaum e.V.

For invitations to tender and orders:
• Manufacturer
•DIN
• Application type
• Thickness
• Width
• Length
Calculated per m^2

Extruded Polystyrene (XPS)

DIN 18164-1
Thermal conductivity:
λ_R = 0.030-0.040 W/mK
Vapour diffusion resistance factor:
ji = 80-200
Raw density:
p = 25-45 kg/m^3
Building material classification:
B 1.B2
Thermal capacity:
C = 58 kJ/m^3K
Application types;
T, TR, TS

Material
Extruded polystyrene (XPS) is a closed-cell, hard plastic foam. It differs from expandable polystyrene (EPS) in the manner of manufacture. Extruded polystyrene foam is characterised by its low moisture absorption and resistance to rot, ageing and decay; it is not, however, resistant to UV-radiation.

Applications)
Extruded polystyrene foam is employed for all insulation purposes. It is not. however, used in manufacturing impact sound insulating boards. Its principal applications are the insulation of pitched roofs and perimeters.
Rigid plastic foamboard is not very suitable for use in timber frameworks, however, because it cannot compensate for wood shrinkage.

Manufacture
In the production of extruded polystyrene foam, polystyrene - which is heated and melted in an extruder - is foamed by admixing a blowing agent. The resulting foam is continuously pressed through air jets into boards, whose characteristic feature is their smooth, sealed foamed skin. They are suitable for use as perimeter insulation for building components that are in direct contact with the soil and as insulation for pitched roofs. For other uses, blocks are foamed and cut into panels.

Dimensions
Thickness [mm]:
20-200
Width [mm]:
600
Length [mm]:
1,250,2,500

Manufacturers)(selection)
BASF
DOW Deutschland
Gefinex

Information
Industrieverband Hartschaum e.V

For invitations to tender and orders:
• Manufacturer
-DIN
• Application type
• Thickness
• Width
• Length
Calculated per m^2

Polyurethane (PUR)

DIN 18164-1
Thermal conductivity:
^ = 0.020-0,030 W/mK
Vapour diffusion resistance factor:
H = 30-100
Raw density:
p = 22-100 kg/m^3
Building material classification:
B1.B2
Thermal capacity:
C - 43 kJ/m^3K
Application types:
T, TR, TS, TRS

Material
Polyurethane is composed of various crude oil products with different cross-linking densities and raw densities.
Polyurethane HR-foam is characterised by its low moisture absorption and its resistance to rot, ageing and decay. It is, however, not resistant to UV-radiation.
In contrast to polystyrene, PUR HR-foam can withstand temperature stresses of up to 250 °C.

Polyurethane is manufactured as both HR-foam and in-situ foam.
• Polyurethane HR-foam is a strongly cross-linked, thermosetting synthetic material, which is usually foamed into a closed-cell structure (closed-cell ratio of approximately 90 per cent]. Open-cell grades are also manufactured for special applications. Boards are available in both laminate and non-laminate form.
• PUR in-situ foam is manufactured on site. It is used to insulate roofs and to fill and seal building joints of doors and windows, etc.

Application^)
PUR foam is used:
• as flat roof insulation (PUR HR-foam is resistant to hot bitumen),
• as insulation for high pitched roofs, between and underneath rafters,
• as insulation for external walls on ventilated facades (cavity walls),
• as a component in sandwich and composite construction.

Rigid plastic foamboard is not very suitable for use in timber frameworks, however, because it does not compensate for wood shrinkage.

Manufacture
PUR HR-foam boards are manufactured in two different processes:

In the double-belt process, the foamed blend (with pentane blowing agent] is applied to a bottom surface layer and then bonded to a top surface layer. Mineral fibrous mats, glass fibrous mats, paper, metal- or compound (sandwich) foil, roof sheeting and moisture-proof roof sheeting are used as surface layers.

In the block foam process, the reaction mixture is poured into an ingot mould. The resulting blocks are cut into boards once the foam has hardened and settled.

Dimensions
Thickness [mm]:
10-300
Width [mm]:
500-1,200
Length [mm]:
1,0003-3,000

Manufacturers)(selection}
Bauder
Correcthane
Puren Schaumstoff GmbH

Information
Industrieverband Hartschajm e.V.

For invitations to tender and orders:
- Manufacturer
- DIN
- Application type
- Thickness
- Width
- Length

Calculated per m^2

Mineral Wool

DIN 18165-1+2
Thermal conductivity:
λ = 0.035-0.050 W/mK
Vapour diffusion resistance factor:
μ = 1-2
Raw density:
ρ = 12-250 kg/m^3
Building material classification:
A 1, A2
Thermal capacity:
C = 115 kJ/nr'K
Application types:
T TV, TR, TS, TRS, TF, I, IC

Material

Mineral wool is a synthetic fibre manufactured from a glass, stone and slag smelt. It is supplied as insulation in the form of sheets, mats, felting or panels of differing density. A distinction is made, depending on the raw material used, between glass wool (yellow colouring] and rock wool (olive green colouring).
Mineral fibre insulation, including mineral wool, must be protected against moisture. It is resistant to micro-organisms and pests and does not rot. Composite materials of felting and panels with paper-, aluminium- and synthetic laminate are available as required.

Application^)

Mineral wool insulating materials have a wide range of applications as sound, impact sound and thermal insulation, with a special material for each particular use. Sheets are used on ceilings and walls as insulating and sound absorbing layers. Composite materials composed of mineral wool and paper/aluminium foil are designed with special edges so that they can be fastened between squared timbers (e.g. rafters).

Panels or boards have a variety of uses in walls, for example, on the exterior side of masonry beneath a weather protection layer, in composite insulating systems, and (provided permission has been obtained) as core insulation.
They are used as impact sound insulation in floors. Due to their relatively high degree of compressibility, the thinnest possible mineral wool impact sound insulation panels should be used.
Since mineral wool is non-combustible, it is suitable in areas with special fire-protection requirements.

Manufacture

Glass wool is composed of quartz sand, sodium carbonate (or: soda ash), limestone, dolomite, feldspar, borax, with a recycled glass content of up to 70 per cent.

Basalt or diabase, limestone, dolomite and flux additament are used to manufacture rock wool,

The raw materials are melted at a temperature of 1,200-1,400°C, before being blown or spun through fine nozzles, defibrated and subsequently felted into wool-like materials. Synthetic resins are also added as bonding agents. Water-repellent oils are employed to bind the fibre dust. Waterproofing and bonding agents are also used.

Dimensions
Thickness [mm]:
20-200
Width [mm]:
600, 625, 1,200
Length [mm]:
1,200, 1,250,6,000

Manufacturer(s)(selection!
Deutsche Heraklith
Deutsche Owens-Corning Glasswool
Deutsche Rockwool
Pfleiderer
Saint-Gobin Isover G+H AG
Thiiringer Dammstoffwerke

For invitations to tender and orders:
- Manufacturer
- Certification No.
- Application type
- Delivery format
- Thickness
- Width
- Length

Calculated per m^J

Sheep's Wool

Building authority certification:
Z-23.11-1022
Z-23.11-332
Z-23.1.3.-253
Thermal conductivity:
λ_R = 0.040 W/mK
Vapour diffusion resistance factor;
μ = 1–2
Raw density:
ρ = 20-80 kg/m^3
Building material classification:
B2
Application types:
T TV

')etiveryformats/dimensions
Wool and braided wool packaged in sacks vials/rolled felting:
Thickness [mm]: 20-220
Width [mm]: 450-1,000
[Length [mm]: 1,000-8,000

Material

Sheep's wool is one of the oldest materials used by humans to protect themselves against cold. Sheep's wool fibrous mats are composed entirely of shorn sheep's wool. Up to 50 per cent of all recycled wool is used for sheep's wool felt. With the addition of borax, sheep's wool is largely resistant to insects and mould fungi.

Application^)

Sheep's wool is used in the form of insulating mats, braided insulation and packing wool to provide thermal and sound insulation in roofs, walls and ceilings; it is also employed in the form of felting as impact sound insulation.

According to various manufacturers, sheep's wool has an excellent moisture absorption capacity (up to 30 per cent), combined - in contrast with other fibrous insulating materials - with extremely good insulating properties.

Manufacture

The wool is thoroughly washed with soap and soda. The cleansing agent is then completely removed through repeated rinsing in cold water. Next, the wool is mechanically bonded and impregnated. During the final rinse, some manufacturers add borax as well as a urea-derivative, such as sulcoforen, as a legally authorized preservative against keratin-digesting insects (e.g.. moths, carpet beetles). Some manufacturers also use polyester or cotton wool as binding fibres to improve the dimensional stability of insulating rolls with a thickness greater than 120 mm.

Manufacturer®(selection)
Doppelmayer
Falke Game KG
Klöber
Purwoll GmbH
ROWA F. Rothmund GmbH
Thermowoll Dämmstoff GmbH

Cotton wool

Building authority classification:
Z-23.11-251
Z-23.11-308
Z-23.11-1056
Thermal conductivity:
λ_R = 0.040-0.045 W/mK
Vapour diffusion resistance factor:
μ = 1-2
Raw density:
ρ = 20-60 kg/rri'
Building material classification:
81, B2
Application types:
T,TV

)e/Velyformats/dimensions
Siting (thickness [mm]: 2-20):
Width [mm]: 625, 1,200, 1,800
Mats (thickness [mm]: 50-180):
Width [mm]: 500-1,200

Material

Cotton wool insulation is composed of the hull fibres (up to 97 per cent) of the cotton bush. The long fibres of the hulls contain more than 90 per cent cellulose. The insulating material contains borax additive (as much as 3 percent),

Applications)

This material is used as thermal and sound insulation in roof, wall and ceiling cavities. Insulating feltings are employed as impact sound insulation.
Cotton wool insulation is mould resistant. Damage caused by moths, carpet beetles, insects and rodents can be prevented.

Manufacture

Cotton harvested in tropical to subtropical cultivation areas is processed into fibrous mats, which are then layered to achieve the desired thickness.
Cotton wool is available in the form of mats, felting, padding and injection wool, and as braided insulation.

Manufacturers)(selection)
Isocotton GmbH
K + K ISO Baumwolle

For invitations to tender and orders:
- Manufacturer
- Certification No.
- Application type
- Thickness
- Width
- Length

Calculated per m^2

Flax

Building authority certification:
Z-23.11-239
Z-23.11-276
Z-23.11-1010
Thermal conductivity:
V 0.040 W/mK
Vapour diffusion resistance factor:
H=1-2
Raw density:
p= 25 kg/m^3
Building material classification:
B2
Application types:
T, TV

Dimensions
Thickness [mm]:
40,60,80, 100
Width [mm]:
500-1,200
Length [mm]:
10,000

Material
Flax is a textile fibre (belonging to the group of bast fibres) harvested from the roughly 1-metre-long flax plant. As insulation, flax is resistant to mould and can absorb and release up to 20 per cent of its own weight in moisture.

Application(s)
Insulating mats of flax are used for roof, wall and floor insulation.
Insulating feltings are used as impact sound insulation. Cavity flocks (insulating mats cut into small pieces) and shives (wooden parts of the stalks) are used to fill cavities, (or example, sound-boarded ceilings.
Flax, in the form of pipe casing, is also used to insulate ducts and pipes.

Manufacture
After the harvest, the stalk of the flax plant is separated into seed capsules and leaves and then roasted to free the fibre bundles of bonding agents. These steps are followed by washing, drying, breaking, tumbling (separating the fibres from the wood of the stalks) and chopping. The cellulose content of the resulting short fibres constitutes the thermal insulating material. Polyester is usually added as a stabilising and binding fibre to achieve good recovery. Some manufacturers also include borax, soluble sodium or ammonium phosphate to protect the fibres against fire.

Manufacturer(s)(selection)
Deutsche Heraklith GmbH
Flachshaus GmbH
Pavatex GmbH
Stattbauhof GmbH
Best Naturdammstoffe

Hemp

Building authority certification:
2-23.11-1341,
ETA 02/0015 (European certification]
Thermal conductivity:
$X_{„}$= 0.045 W/mK
Vapour diffusion resistance factor:
M-0.5-1
Raw density:
p= 20-40 kg/m^3
Building material classification:
B2
Application types:
T, TV

Dimensions
Thickness [mm]:
20-240
Format [mm]:
575/600/625/635 x 1,200
1,000x2,000

Material
Hemp fibres are tear-resistant and also highly stress-resistant, which makes them suitable as impact sound insulation. Since hemp fibres do not contain protein, they are naturally protected against pests and mould, thus obviating the need for additives. Hemp fibres can absorb up to 18 per cent of their own weight in moisture and release the moisture when the air is dry. They therefore have a balancing effect on the interior climate.
Hemp insulating materials are recyclable.

Applications)
Hemp mats are used as thermal insulation in walls, ceilings and floors, as sub- or common-rafter insulation and as impact sound insulation (d = 15/20/ 30 mm) below floor screeds.

Manufacture
The cultivation of non-intoxicating types of hemp has been permitted in Germany since 1996. Hemp fibre is gathered from the fast-growing hemp plant, which can be harvested biannually.
Safe and harmless agents, such as soda or ammonium phosphate, are added to provide flame protection.
Hemp insulation is available in pure form and with an admixture of sheep's wool. The mixed grade must be protected against pests. Textile fibres, (e.g. polyester), are added for support.

Manufacturer(s)(selection)
Emfa Baustoff GmbH
Hock Vertriebs-GmbH & Co KG
Saint-Gobin Isover G+H AG
Treuhanf AG

For invitations to tender and orders:
- Manufacturer
- DIN
- Application type
- Delivery format
- Thickness
- Width
- Length

Calculated per m^2

Coconut Fibre

DIN 18165
Thermal conductivity:
\ \ , = 0.045-0.050 W/mK
Vapour diffusion resistance factor:
μ = 1–2
Raw density:
p = 50-140 kg/m^3
Building material classification:
B2
[Thermal capacity:
C = 22-57 kJ/nrK
Application types:
T, TV, I, IC

Dimensions:
Boards:
Thickness [mm]:
13, 18, 20,23, 25, 28,40
Width [mm]:
625
Length [mm]:
1.250
Rolled felting:
Thickness [mm]:
20. 25. 35
Width [mm]:
400.500, 670, 1,000
Length [mm]:
10,000

Material
Coconut fibre is gathered from the outer, fibrous layer of the coconut. It is available in the form of rolled felting, insulating mats or boards, braided insulating material and packing wool.

Applications)
Coconut insulating mats are available as:
- screed insulating boards, multiple needle-felted and pressed layers, for wet and dry screed as well as for poured asphalt;
- coconut wall panels for airborne sound insulating facing shells and partitions;
- needle-felted coconut rolled felting for cavity insulation in walls and floors; thermal insulation for roofs and walls; sound insulation; fill material for door and window joints.

Coconut insulating materials are available in the form of boards and rolled felts.

Manufacture
The fibrous layer, which is up to 10 cm thick, is manually removed from the coconut and then stored for 6 to 10 months in seawater, during which process all perishable components decay (retting). The usable fibres are dried, aerated, refined and pressed and formed as needed.

Manufacturers)(selection)
EZO Isolierstoffe GmbH
Emfa Baustoff GmbH
Rothel GmbH & Co KG
Zipse Korkvertneb

For invitations to tender and orders:
- Manufacturers
- Certification No.
- Application type
- Thickness

Calculated per m^3

Cellulose

Building authority certification;
Z-23.11-280
Use is subject to compliance with DIN 18165-1 for fibre insulating materials.
Thermal conductivity:
K = 0,040-0,045 W/mK
Vapour diffusion resisfance factor:
H = 1-2
Raw density:
p = 30-80 kg/m^3
Building material classification:
B1, B2
Thermal capacity:
C = 100 kJ/m-K
Application types:
T,TV

Material
Old newsprint provides the base material for all cellulose flocks. Borate is added for protection against rot and flammability. Cellulose flocks are loose in structure and injected into cavities or onto horizontal, curved or inclined surfaces.
Injection pressure compresses the flocks to a density of approximately 45-60 kg/m" in roof pitches and 60-70 kg/m^3 in walls.

Application(s)
Cellulose is typically used to provide thermal insulation in roof, wall and ceiling cavities.
The mode of application varies: pouring or blowing for open ceilings; injection for roofs and ceilings; spraying for walls.
According to **DIN** 18165-1, the insulating flocks cannot be assigned any specific type of application. They can only be employed in closed cavities. They must not be subjected to pressure loads and must be protected against damp.
Compliance with the wood preservation regulation for hazard classification 0 under DIN 68800 is a prerequisite for use of this material.

Manufacture
Cellulose is recycled newsprint, pulped from finely flocked stock, which is impregnated with borates (borax and boracic acid) to protect it against fire, rot and pest attack.
The paper is pre-shredded, the borate is added in pulverised dosages, and both components are blended in a milling process and mechanically bonded. The cellulose mix is freed from dust, slightly compacted and packaged in paper sacks.

Deliveryformat
Paper sacks of 12.5 kg and 13.6 kg

Manufacturers)(selection)
Besin Mehren GmbH
Dobry GmbH
Climacell GmbH
Climatizer
C.F.F, Cellulose
CWA Cellulose
Homann Dämmstoffwerk GmbH & Co.KG
Intercel GmbH
Isofloc Wärmedämmtechnik GmbH
Stattbauhof GmbH

For invitations to tender and orders:
Perlite:
- Manufacturer
- Delivery format
- Certification No.

Swelling clay:
- Manufacturer
- DIN

Calculated permVm^3

Perlite

Non-standardised
Building authority certified
[Thermal conductivity:
λ_R = 0.55-0.66 W/mK
Vapour diffusion resistance factor:
μ = 3–4.5
[Raw density:
p = 60-300 kg/m^3
fBuilding material classification:
A 1, for bitumen casing
B 2, for natural resin casing

Material
The base material is crude perlite rock, an aluminium-siliceous rock resulting from volcanic activities with temperatures in excess of 1000 °C. It is mined in open-pit mines in countries with natural deposits such as Greece and the United States. Expanded perlite contains a wide variety of additives, chiefly bitumen, natural and synthetic resins and mineral bonding agents.

Applications)
Expanded perlite is used as insulation in floors and roof slopes, as a levelling layer under floor construction, as sloping insulation on flat roofs and as core insulation in double-layered masonry. Perlite is also used for chimney linings and as a lightweight aggregate for gypsum plasters and mortar.
Owing to their extraordinary load capacity, perlite boards are even employed beneath screeds and floors that are subjected to high load stresses.

Manufacture
The crude rock is crushed, ground and then flash-heated to over 1200 ^{J}C. During this process, the rock softens, and as the combined water in it evaporates, the raw perlite expands to 15 to 20 times its original volume (rock foam). The outcome is a white granulate with granules measuring 0-6 mm in diameter.
The surface of the granules, which are composed of microscopic cells, is open-pored, providing good interlocking qualities for loose, dry in-fill. The surface is also highly temperature-resistant.
Various agents are added to relieve the inherent sensitivity to moisture or to increase the compressive strength.
Fibres and bonding agents are combined to produce compression-proof panels.
(TR, TS)

Manufacturer(s)(selection)
Morgan Thermal Ceramics GmbH
Perlite Dämmstoff GmbH

'Deliveryformats/dimensions
Paper bags
Panels:
Thickness: 20-200 mm
Format: 600x1,200 mm

Swelling Clay

Non-standardised
Thermal conductivity:
\ = 0.13-0.20 W/mK
Vapour diffusion resistance factor:
μ = 2–8
Raw density;
p = 325-800 kg/m^3
Building material classification:
A1
Thermal capacity;
C = 252 kJ/nrK

Materiai
Swelling clay is a mineral granulate composed of clay. Swelling clay is dimensionally stable, water repellent, rot resistant and also resistant to micro-organisms and pests. As a mineral material, it is non-combustible.

Application®
Swelling clay is used as cavity fill for sound and thermal insulation (e.g., in ceiling cavities) or loosely as a lightweight aggregate for bricks, plaster, lightweight concrete, etc.

Manufacture
The clay is prepared, finely ground, granulated and fired in revolving kilns in a countercurrent process at roughly 1,200 "C The organic matter enclosed in the clay is burnt off. Supported by heavy oil, the clay granules expand while the surface melts to some degree and forms a sintered outer skin.

Deliveryformat
Loosely packaged in bags of 50, 62.5

Manufacturer® (selection)
Fibrolith WilmsGmbH
Leca Deutschland
Lias Franken

Vapour Retarding Layer/Vapour Barrier

DIN 4108-4

For invitations to tender and orders:
- Manufacturer
- s_D-value
- Thickness
- Width
- Length

Calculated per m^2

Vapour retarding layers or vapour barriers are essential layers in multi-shell or multilayer wall structures, whose importance with regard to building physics and construction engineering is increasing as ever greater requirements are placed on thermal insulation and energy savings.

Material

Vapour retarding layers are composed of coated or uncoated special papers and foils. They ensure that the outward diffusion of water vapour forming in a building can be metred and controlled through its thermal insulation. Permeated or condensed water vapour has to be dissipated either directly or by ventilation. A seasonal balance at least must be maintained to ensure that the thermal insulation remains serviceable,

Vapour barriers are vapour-tight sheets of plastic, metal foil or layered paper and/or synthetic materials, which prevent the outward diffusion of water vapour from the inside. Their vapour diffusion resistance is determined by the vapour diffusion resistance of the individual layers from the inside out. As a basic principle, each building element layer should permit more diffusion than the layer below it.

The effectiveness of a vapour barrier is fundamentally dependent on the technical and permanent connections that are made. Perforations and permeation can significantly reduce the functioning of vapour barriers.

Properties

The s_u-value, the water vapour diffusion-equivalent air-layer thickness, specifies by how much lower the flow of water vapour is through a building element layer in comparison to an air layer of equal thickness. The value is specified in metres and is the product of the thickness of the building material (s) and its water vapour diffusion resistance coefficient u.

$s_D = u \times s (m)$

Metal foils with a thickness greater than 0.05 mm are classified as absolutely vapour-tight under DIN 4108-4. A material layer with a diffusion resistance of s_o= 1500 m is considered vapour-tight for construction purposes. These materials can be used as vapour barriers.

A material with a diffusion resistance $2 < s_0 < 1500$ m can be used as a vapour retarding layer.

Materials with an s_D-value < 0.3 m are considered diffusion-open.

Diffusion-open	$s_D <$ 0.3 m
Vapour retarding layer	s_D 2-1,500 m
Vapour barrier	$s_D >$ 1,500 m

Recommendations for sealing joints, overlaps, junctions and penetrations of vapour retarding layers and vapour barriers are contained in DIN 4108-7.

Building papers and sheeting, in addition to their function as a vapour retarding layer or a vapour barrier, can also perform the following functions in the structure of a wall or roof construction:
- Air-tight layer
- Windproof layer
- Waterproof underlay
- Moisture barrier
- Separating layer

Pay attention to the vapour diffusion resistance!

Use

Air-tightness is a basic principle for a wood construction designed to function in line with the requirements of building physics and construction engineering. The high insulation values, which are relatively easy to achieve, of the exterior surfaces will only be effective if they are not cancelled out by leakages involving condensation problems and draughts.

What is required is a continuous, airtight level with a minimal number of junctions and penetrations as well as joints and junctions which are not only technically simple and safe to install, but also take into consideration inevitable deformations. Their correct installation can be checked using a blower door test.

This requirement applies to vapour-permeable or ventilated exterior wall constructions and especially to those where the airtight level is also the vapour barrier. The sealing materials must be co-ordinated and selected in accordance with wood construction requirements. As a rule, the air seal is attached inside and may be identical to the vapour retarding layer or vapour barrier,

The *wind seal,* however, is fastened on the outside of the thermal insulation. It protects the thermal insulation from excessive cooling and prevents exterior air from infiltrating, for instance, through the joints between the wooden construction and the thermal insulation. To satisfy the requirement of increasing vapour permeability from the inside to the outside, a diffusion-open wind seal should be chosen.

For the dimensions and materials
see table p. 68 and 69

Manufacturers)(selection)
Alkor Draka Handel GmbH
Ampack Bautechnik
A.W. Andernach KG
Bauder
Binne & Sohn GmbH&Co.KG
Braas Dachsysteme GmbH
Deutsche Heraklith GmbH
Deutsche Rockwool Mineralwoll GmbH
DIB Potthast GmbH
Ewald Dörken GmbH
EmfaBaustoffGmbH
Forbo-Stamoid
KIbberGmbH&CoKG
Koster Bauchemie GmbH
Moll Bauökologische Produkte GmbH
Rothel GmbH S Co KG
Samt-Gobin Isover G+H AG
Vedag AG
Wanit Universal GmbH
WIKA Isolier- und Dammtechnik GmbH

Damp-Proofing

DIN 18195-1 to 10

For invitations to tender and orders:
- Manufacturer
- DIN
- Thickness
- Width
- Length

Calculated by m^2

Building seals that meet the requirements of DIN 18195 are designed to prevent damage caused by pressing or non-pressing water as well as by ground moisture on the outside along the bordering building elements.

Damp-proofing is also required to avert damage to wooden elements that could emanate from adjacent building elements such as concrete or masonry (building damp) or be caused by damp from the subsoil or weather.

For these seals, which are not included in DIN 18195, other types of bituminous sheeting can be used than listed bare bitumen sheeting, asphalt roofing felt, asphalt roofing seal sheeting, bitumen seal sheeting, asphalt sheeting with different interply sheets: e.g. thick PE foil or other flexible plastic sheeting.

Separating layers become necessary when different building materials are connected in such a way that their effectiveness is impaired or completely lost.

Typical examples of this are separating layers on anticapillary courses underneath reinforced concrete floor slabs, separating layers between impact-sound insulation and wet lines, or between sheet covering and timber formwork, etc.

The following materials can be considered for use as separating layers between different building elements:
- Polyethylene foil
- Polyester felts
- Foam mats
- Oil paper
- Sodium bicarbonate kraft paper

Dimensions
Bitumen sheeting
Thickness (mm): 4-5
Width [cm]: 100
Length [m]: 5
Plastic sheeting
Thickness [mm]: 1-3
Width [cm]: 100,120, 130, 170,200
Length [m]: 10,20,25

Descriptions
Bitumen sheeting

Brief description	Designation
R500"	Asphalt roofing felt with roofing felt intermediate ply
G 200 DD	Asphalt roofing seal sheeting
V 13	Glass fibre asphalt roofing felt
J300D	Bitumen seal sheeting with jute cloth
Al 0.2 D	Bitumen seal sheeting with steel tape interply sheet
V60S4	Asphalt sheeting with glass fibre interply sheet
PV200 PYDD	Polymer bitumen Roofing felt with polyester fleece interply sheet
G200PYS5	Polymer bitumen sheeting i with glass fibre interply sheet

Plastic Sheeting

Brief description	Designation
EPDM	Ethylene Propylene Diene Monomer
CSM	Chlorsulfonated Polyethylene
MR	Butyl rubber (isobutylene-isoprene elastomer)
NBR	Nitrile rubber (nitrile butadiene rubber)

Manufacturers)(selection)
A.W. Andernach KG
Paul Bauder GmbH Co.
Georg Börner GmbH & Co.
Braas GmbH
DLWAG
Phoenix AG
Saar-Gummiwerk GmbH
Vedag AG

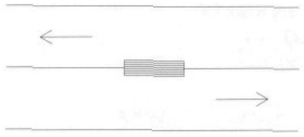
Information
Industrieverband Bitumen-Dach- und Dichtungsbahnen e.V.
Wirtschaftsverband der deutschen Kautschukindustrie e.V.

S_D = u x d [m]	u	Thickness [mm]	Width [cm]	Length [m]	Material	Product	Company
0.008	15	0.50	100	100	wool fibre board, impregnant and cellulose fibre	Perkalor normal	WIKA
0.008	15	0.50	100	50	wool fibre board, impregnant and cellulose fibre, reinforced	Perkalor Diplex	WIKA~
<0.02	–	-	150,280	100	high-pressure PE	Tyvek Soft	Klöber
<0.02	–	–	150	100	high-pressure PE	Tyvek Dry	Klöber
<0.02	–	–	150	50	high-pressure PE/PP	Tyvek Plus	Klöber
0.09	423	0.22	125	50	impregnated kraft paper	Sisalit 50	Ampack
0.12	–	–	250	25	special acrylate coating on polyester fleece	Stamisol DW	Forbo-Stamoid
0.2-5	–	0.005	200	30,60	Polyamid	Difunorm Vario	Saint-Gobin IsoverG+H AG
0.30	–	0.30	150	50	special PE fleece with mjcrofibre structure	Herafol	Deutsche Heraklith
0.50	2,000	0.25	75,105, 135	100	recycling cellulose, with glass fabric	pro clima	Moll KS+
0.80	–	–	200	50	diffusion-open PP spunbonded fabric	Tyvap	Klöber
0.80	–	0.20	165	100	sodium bicarbonate kraft paper	Volint	Klöber
2.00	8,700	0.23	150	50	kraft papers with flame-retarding paraffin intermed-iate ply and glass fibre mesh	Sisalex 500	Ampack
2.00	–	–	150	50	spun fleece with vapour retarding coating	Delta-Fol WS	Dörken
2.30	–	0.23	75,135	100	building paper reinforced with recycling cellulose paper	EMFA-PWD	Emfa
2.30	–	0.35	105	50	special paper made of building paper reinforced with cellulose	EMFA-PWS	Emfa
2.30	10,000	0.23	75, 105, 135	100	recycling cellulose	pro clima DB	Moll
2.30	10,000	0.23	14,21,75, 105, 135	100	recycling cellulose, with glass fabric	pro clima DB+	Moll
2.30	5,000	0.45	105	50	recycling cellulose, with glass fabric	pro clima DA+	Moll
2.90	–	0.20	100	100	double ply sodium bicarbonate kraft paper with giass fibre reinforcement	Difulint	Klöber
<3.00	–	0.18	150	25	laminated film made of PP and LDPE coating	Wandufol	Wanit
>3.00	–	0.25	150	25	double ply kraft paper and glass-grid vapour retarder	Wandufol	Wanit
4.39	17,560	0.25	100,125, 150, 215	50	laminate of two kraft papers and a glass fibre mesh	Sisalit 303	Ampack

S_D = M x d [m]	u	Thickness [mm]	Width [cm]	Length [ml	Material	Product	Company
21	53,304	0.40	100	100	Paper one-sided coated	IMepa	WIKA
23	68,800	0.33	150, 180	100,50	PP fibre fleece with PP filling layer	Ampatex DB 90	Ampack
25	–	0.30	140, 280	100, 50	PP fleece with PP coating, transparent	DB 25	Bauder
26	77,000	0.33	100	100	plastic coated kraft paper	UmodaniO	WIKA
50	–	0.2	200	30,60	PE foil	Difunorm	Saint-Gobin IsoverG+H AG
58	187,000	0.31	150, 180	100,50	PP fibre fleece with PP filling layer	Ampatex DB 95	Ampack
75	300,000	0.25	400	25	PE foil	vapour barrier PE	Braas
100	–	0.20	200	50	Polyethylene	Rockfol PE	Deutsche Rockwool
100	–	–	150	50	Aluminium layer between polyester foil and mesh-reinforced PE foil	Delta-Fol Reflex	Dörken
100-130	–	0.1	392	50	laminate of two PE foils	PE vapour barrier (highly tearproof)	Koster
111	58,500	0.20	400,600	25,50	polyethylene	DIB vapour retarding sheeting	DIB Potthast
112	45,000	0.25	600	25	extruded high pressure polyethylene	Alkorplus 81010	Alkor
120	300,000	0.40	400	25	PE foil	vapour barrier fk	Braas
"13O"	–	–	150	50	mesh-reinforced PE foil	Delta-Fol DS130	Dörken
155	62,000	0.25	400, 600	25,50	polyethylene	DIB vapour retarding sheeting	DIB Potthast
285	69,000	0.40	400, 600	25,50	polyethylene	DIB vapour retarding sheeting	DIB Potthast
310	125,000	0.30	100	100	kraft paper with plastic coating and aluminium foil	Umodan DS	WIKA
379	1,895,000	0.20	100,125, 150	50	two impregnated kraft papers with glass fibre mesh and one-sided aluminium coating	Insulex311	Ampack
>500	–	0.14	150	25	double-ply alu foil with intermediate glass mesh	Wandufol Technonorm	Wanit
620	1,240,000	0.50	100	100	kraft paper with plastic coating and aluminium foil	Umodan Super	WIKA
4,000	–	0.12	150	100	aluminium laminated foil with double-sided special plastic lamination	DIB aluminium laminated foil	DIB Potthast
4,500	11,250,000	0.40	122,200	50	two watertight kraft papers with an intermediate ply of bitumen and sisal fibres, one-sided aluminium coating	Insulex718	Ampack
vapour-tight	∞	2.50	110	50	PE with aluminium foil and polyester fibre	Umodan 3-Plus	WIKA

Dowels

Dowels are predominantly used as joints and fasteners subject to shearing stress.

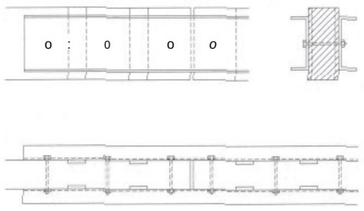


Rectangular wooden dowels,
made of dry hardwood
(groups A-C).

Use
Wooden rectangular dowels are inserted in the direction of the grain into recesses in the elements to be connected. They are secured with locking bolts.

Ordering
Hardwood dowels
Number l x b x d in mm
Wood species
Timber quality

Manufacturer
Trade

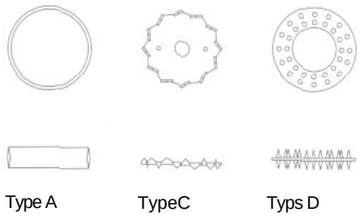


Rectangular anchor made of steel.
Flat steel anchors

Use
Flat steel anchors are inserted into recesses across the grain, held with splices and secured with locking bolts.

Ordering
Flat steel anchors
Number l x b x d in mm
Steel quality
Surface

Manufacturer
Trade



Specially designed anchors
DIN 1052-2

Use
Permissible load and installation requirements; minimum timber dimensions; minimum spacing and initial wood lengths; size and depth of cut; hexagonal stud bolts matching the anchors as per DIN 1052-2

Type A Anchor Split ring connector (shear plate previously Appel System)
0 65-190 mm

Type B Anchor Split ring connector (round wooden dowel made of oak; previously Kiibler System)
0 66 and 0 100 mm

Type C Anchor Force fitted dowel (previously Bulldog System)
0 48-165 mm

Type D Anchor Force fitted dowel (previously Geka System)
0 55-115 mm

Anchor type E Split ring connector, force fitted dowel (previously Siemens-Bauunion System)
0 55 and 0 80 mm

Transverse connector for cross-grain joints with a fitting or wind rod with cross thread in the corresponding bore.

Ordering
Quantity
Type of anchor
one-sided/two-sided
plates

E.g. 2x2 anchors 0 65-A
plate 0 58/6

Manufacturers) (selection)
Bierbach GmbH S Co. KG
Bulldog-Simpson GmbH

Anchors
DIN 1052

Material
Anchors are pin-shaped fasteners made of round steel with headless chamfered ends; they are driven into pre-drilled holes. The bore must not be greater than the diameter. Minimum diameter 6 mm, in use 8-10-12-16 mm.
Lengths 60-160 mm.

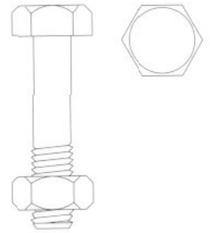
Use
Fitted by hand; the number and size of anchors required is to be calculated in relation to the load and type of load and to the thickness of the material and the installation location.
The anchor spacing is determined in relation to the diameter and to the position of the anchors vis-à-vis the load-bearing edge and the direction of the grain. Steel sheet timber joints using anchors require a minimum thickness of 3 mm for the internal sheets.
At least 2 anchors are required per joint.

Material
SteelS 235, S 275, S 355
in accordance with EN 10025
Surface galvanised/stainless steel

Ordering
DIN
Diameter
Length
Steel quality
Surface

E.g. S Anchor DIN 1052 0 16x160
S 235, galvanised

Manufacturers)(selection)
Bossard AG Schrauben
Bulldog-Simpson GmbH



Bolts
Bolts DIN 601, DIN 931, DIN 933, DIN 6914

Material
Bolts are pin-shaped fasteners made of round steel with heads, threads and nuts; they are driven into drilled holes with a maximum diameter 1 mm greater than their own, with washers on each side, Diameter M8-M24 (for load-bearing connections greater than 12 mm),
Length 16-200 mm.

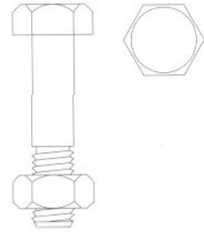
Bolts should be fitted so that they can be re-tightened to compensate for wood shrinkage.

Use
The numbers and dimensions of the bolts are calculated in relation to the different hole soffit strengths, e.g. of solid wood, glued laminated timber, wood-based material or sheet steel-to-timber joints.
The direction of the grain must be taken into account when determining distances to the load bearing and non-load bearing edges.

Ordering
Bolts
Steel quality 3.6, 4.6/4.8, 5,6/5.8, 6.8 in accordance with EN 20 898
Surface hot-dip galvanised

E.g. BM16(0 16) DIN 1052

Manufacturers)(selection)
Bossard AG Schrauben



Shear pins
DIN 7968

Material
Shear pins are bolts, which - like anchors - are driven into tight pre-drilled holes.
DiameterM12-M24,
Length 35-100 mm.

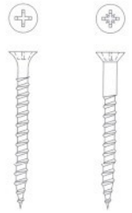
Use
Shear pins are used for securing anchor connections.

Ordering
Steel shear pins
Surface hot-dip galvanised
Diameter, DIN

E.g.PBMi6(0 16)
DIN 1052

Manufacturers) (selection)
Bossard AG Schrauben

Screws



Wood screws

DIN 95 Raised countersunk head wood screw, slotted
d_s = 3-6 mm
l = 12-80 mm

DIN 96 Round head wood screw, slotted
d_s = 3-6 mm
l = 10-80 mm

DIN 97 Countersunk head wood screw, slotted
d_s = 3-8 mm
l = 10-100 mm

DIN 571 Hexagon head wood screw
d_5 = 4-20 mm
l = 20-350 mm

Use
The screw spacing as ior pre-drilled nails.
Pilot hole:
smooth shank with d_s,
threaded portion with 0.7 d_s.
Load-bearing assemblies:
Nominal diameter d, = min. 4 mm
Observe minimum thicknesses of building elements to be connected.

Material
Steel
- natural bright
- galvanised
- nickel-plated
- brass-plated

Ordering
Quantity
Abbreviation Sr
Nominal diameter x length in mm
DIM
Surface

E.g. 10 x Sr 0 8 x 50 - DIN 97 galvanised.

Manufacturer® (selection)
Altenloh, Brinck + Co
Bierbach GmbH & Co. KG
Bossard AG Schrauben
MAGE Geriring GmbH
Adolf Würth GmbH 8 Co. KG

Dry wall screws

DIN 18182 Dry wall screws for fastening plasterboard, phosphated
d_s = 3.5 mm
l - 25-70 mm

non-standardised
chipboard screws countersunk (Spax) with
- cross recessed head,
- posidrive cross recessed head,
- Torx hexagon socket

d_s = 2.5-10 mm
l = 10-400 mm

Use
Self-tapping, usually inserted without pilot holes.

Material
Steel
- galvanised
- phosphated (partially)
- stainless

Ordering
Quantity
Abbreviation Sr/Type
Nominal diameter *x* length in mm
DIN (for dry wall screws for fastening plasterboard)
Surface

E.g. 10 xSr 0 3.5x40-DIN 18182 phosphated

Manufacturer(s)(selection)
Altenloh, Brinck + Co
Bierbach GmbH & Co. KG
Bossard AG Schrauben
Adolf Würth GmbH & Co. KG

Staples

Staples

U-shaped bent wires,
Diameter d_n 1.2-2.0 mm.
Back min. 15 mm.
Length of shank approx. 30-90 mm.

Use
Fitted by hand or with a nail gun, in accordance with Ihe German building authority certification.

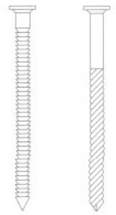
Material
Steel - electrogalvanised
- rustproofing paint

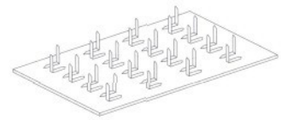
Ordering
Staples
Wire diameter d, x length of shank l_n
d_n, l_n in mm
Staple spacing e in mm

E.g. Kl 1.53x44 e = 7.5

Manufacturer(s)(selection)
Raimund Beck KG
Joh. Friedr. Behrens AG
Bostitch GmbH
Duo-Fast GmbH
Haubold-Kihlberg •
Karl M. Reich
Paslode GmbH

Nails





Nails

IDIN 1151 wire nails
"DIN 1143 machine nails

Smooth shank, mostly round nails.
Diameter d_n from 1.8 to 8.8 mm.
Length l_n from 35 to 260 mm.
Countersunk, deep countersunk, compression, flat-head, clout, round-head or lentil. Head diameter in accordance with EC 5 min. 2 d_n.

Use
The numbers and dimensions of the nails (used are to be calculated to take into account the material, its thickness and the installation location (single-, double- or multi-jointed). The impact depth and the spacing of the nails from the edge and from each other is dependent on the thickness of the material, the wood species and grade as well as on the materials that are to be jointed (e.g. solid wood with wood-based material, steel, concrete....). By using pilot holes (< 0.9 d_n), the splitting effect of the nails can be diminished, the spacing reduced and the load-bearing capacity increased. Nails should not be used in cross-grained timber, not even for lower level building elements.

Material
Steel
- natural bright
- electrogalvanised
- hot-dip galvanised
- possibly tempered
- stainless

aluminium (partially); copper (partially)

Ordering
Type of nail, DIN,
Diameter d_n x Length l
d_n in 1/10 mm, l_n in mm
Material
Surface

E.g. nails 38x100 DIN 1159, steel hot-dip galvanised

Manufacturers)(selection)
Bierbach GmbH & Co. KG
Bossard AG Schrauben

Special nails

Special nails, with the German building authority certification, in load-bearing capacity categories I - III. V.a. for nailed joints using sheet steel brackets.

Groove, ridge/anchor nails
wilh horizontally profiled shank (barbed profile).
Diameter d_n from 2.5-6 mm.
Length In from 35-100 mm.

Self-piercing screws/rafter nails
with screw threads.
Diameter d_n of 4.2 and 5.1 mm,
Lengths l_r from 100-320 mm.

Use
Use in accordance with the German building authority certification

Material
Steel
- electrogalvanised
- phosphated
- stainless

Ordering
Type of nail
Material
Surface

E.g. ridge nail 4/50, electrogalvanised product.....
load-bearing capacity category III

Manufacturers)(selection)
Bierbach GmbH & Co. KG
BMF Holzverbinder GmbH
Bulldog-Simpson GmbH
GH-Baubeschlage Hartmann GmbH

Nail plates

These are 1-2 mm thick steel sheets with nail or claw-shapes punched and bent out on one or both sides.
The German building authority certification has been issued for the different systems e.g. BAT-Muttm, BMF, Gang-Nail, Hydro-Nail, TTSTwinaplatte.

Use
The size of the nail plates must be calculated. The nail plates are pressed into the equally thick (single) timbers using hydraulic jacks.

Material
Hot-dip galvanised steel

Ordering
Nail plates
Size b x h in mm, Type

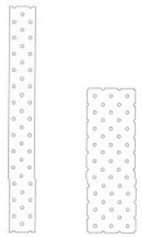
E.g. NaPl 66x166 GN200

Manufacturer(s)(selection)
Eleco Bauprodukte GmbH (Gang-Nail)
Mi-Tek Industries GmbH (Hydro-Nail)
J. Wolf GmbH & Co Systembau KG (Wolf Nagelplatlen)

Information
Informations- und Giitegemeinschaft der Nagelplattenverwender e.V.

Sheet Steel Brackets

Sheet steel brackets are made out of 2-4 mm thick sheet steel, punched and cold-formed.



A German building authority certification has been issued for the various shapes and their mountings, The terms used to describe the same fastenings vary from supplier to supplier.

The selected sheet steel brackets do not represent the complete product range, and relate to the forces appearing in the examples chosen.

The use of modern beam constructions has rendered traditional carpentry joints affordable once again. For this reason they are being increasingly used in modern wood construction.

Use
Sheet steel brackets are fastened with authorized special nails that are chosen according to the installation location, (wood-to-wood, wood-to-concrete/steel)

Material
Hot-dip galvanised steel,
Stainless steel (partly)

Perforated steel strips

Use
As connectors for smaller constructions.

Dimensions
20 x 1.0/1.5 mm
25x2.0 mm

Ordering
Dimensions, Type
Nail type, d_n x l_n

Canvas bands

Use
For bracing roof constructions. Tighten to ensure the load-bearing capacity e.g. using a ratchet clamp.

Dimensions
40 x 2.0/3.0 mm
60x2.0 mm
80 x 2.0 mm

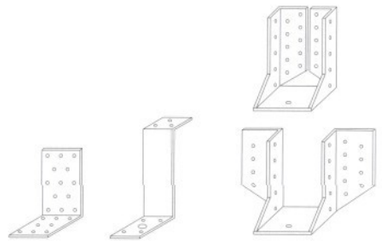
Ordering
Dimensions, Type
Nail type, d_n x l_n

Flat connector

Made of perforated panels in different, partially standardised dimensions.

Use
For connecting flat building elements.

Ordering
Dimensions, Type
Nail type, d_n x l_n



Angle connectors

As a perforated plate angle or from punched sheet

Use
For connecting and fastening.

Ordering
Dimensions, Type
Nail type, d_n x l_n

Z-Profile

Use
For the frontal tastening of the cross-beams to the main beam.

Ordering
Dimensions b x h (mm)
Manufacturer, Type
Nail type, d_nxl_{ri}

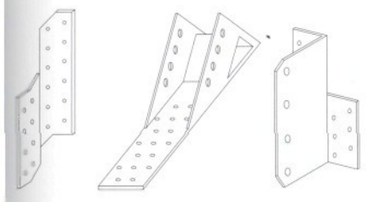
Beam hangers

One or two-piece, sides bending inward or outward.

Use
To fasten beams to beams/ walls.

Dimensions
For wood widths from 36-200 mm with fixed heights.
Customised dimensions may sometimes be ordered.

Ordering
Dimensions
Manufacturer, Type
Nail type, d_nx **l,**



Rafter-to-purlin connectors/purlin anchors

Use
For connecting crossing beams.

Ordering
"nufacturer, Type
lil type, d_nx ***i**n*

Rafter foot joints/rafter holders

Use
For connecting rafters to inferior purlins or ceilings.

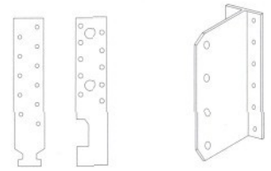
Ordering
Manufacturer, Type, Length
Nail type, d, x l_i

Main and cross beam-connectors/ integral connectors

Use
For connecting main and cross beams.
Fastened to the main beam/pillar with special nails; slotted into the crossbeam and fixed with anchors.

Dimensions
Heights from 80-240 mm

Ordering
j Manufacturer, Type
Anchor/nail type, d_n x **l_n**



Track anchors/profile anchors/wood connection anchors

Use
To fasten wooden elements into anchor tracks or with steel profiles.

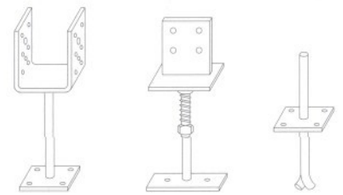
Ordering
Manufacturer, Type, Length
Nail type, d_nxl_n

Beam supports/suspended supports (T-shaped)

Use
For fastening crossbeams to the main beam or from beams to pillars.
Fastened to the main beam/pillar with special nails; slotted into the crossbeam and fixed with anchors.

Material
Hot-dip galvanised steel

Ordering
Type, Quantity, Dimensions
Nails/anchors



Pillar bases

Use
Pillar bases (pillar bracket, post holder) serve to connect the pillar with the foundation or the ceiling. The connection is made by fixing base plates and dowels onto the concrete or by using ribbed rock dowels and grouting in the recesses in the concrete.
A distinction is made between the following types:

- Pillar base made of U-shaped bent flat steel with a welded-on wing rod or circular tube.
  Fastened with wood screws or anchors, fixed or height adjustable.
- Pillar base made of T-profile with welded-on wing rod or circular tube.
  Fastened with wood screws or anchors, fixed or height adjustable.
- Pillar base made of round steel or threaded rod with plate (glulam pillar support).
  Drilled and secured with a steel spike and if necessary glued, fixed or height adjustable
- Pillar base made of two flat steel profiles.
  Fastened with wood screws

Ordering
Company-specific type designation

Manufacturerfs)(seiection)
Hot-dip galvanised steel
Bierbach GmbH & Co. KG
(BILOFormteile)
BMF Holzverbinder GmbH
Bulldog-Simpson GmbH
GH-Baubeschläge Hartmann GmbH

Wood Preservation

DIN 68800 1 to 5
DIN 68364
DIN EN 350-2
DIN EN 460

Wood and wood-based materials are at risk from vegetable pesls (fungi) and animal pests (insects). When infestation occurs, the outward appearance, the efficiency and the load-bearing capacity of wooden structures can be reduced to such an extent that they are completely destroyed.

Fungi require organic material (cellulose) for their development. They thrive particularly well in moist, warm areas without an air-flow. There are different types of mould, e.g. "real dry rot". As a rule the rot caused by fungi requires a wood moisture content of at least 20 %.

Insects, primarily beetles, e.g. wood ticks, use the sap area of the wood (predominantly softwood), as a source of food and to house their larvae. The fully developed ticks leave the wood through characteristic entrances. Not only living trees can be attacked, but also dry built-in timber, A wood moisture content of at least 10% is a precondition for infestation.

Wood preservation is subdivided into remedial wood preservation, which is necessary when infestation has already taken place, and preventative wood preservation, which stops infestation by destroying the preconditions under which the pests thnv9.

Preventativewoodpreservation
Preventative wood preservation can be achieved in several ways:
- wood selection
• wood preservation by design
• chemical wood preservation

Wood Selection:
It is important to select well-dried and seasoned timber (wood moisture content u < 20 %) and, where possible, to use a timber species with great durability or high resistance (see appendix).

Structural wood preservation:
This must be taken into consideration during the design phase e.g. when choosing the location of the building, designing the facade or planning protective roof projections. When working out the details, however, what must be avoided, above all, is contact to the ground, the formation of condensation, and continual moisture penetration of the wood by rain and splashing water. Damp timbers must be able to dry out. Thus a fundamental aspect of structural wood preservation involves aerating and ventilating the construction and the building element layers in order to allow any moisture to escape.

Chemical wood preservation:
Fungus and insect infestation should be prevented by using chemical wood preservatives.

DIN 68800-3 differentiates between chemical wood preservatives for:
• load-bearing and reinforcing wooden building elements
• non-bearing timbers which are dimensionally unstable
• dimensionally stable non-bearing timbers for windows and exterior doors

Preventative wood preservation is compulsory for load-bearing building elements. However chemical wood preservatives are only required for certain hazard classes, which are listed in DIN 68800-3 (see appendix).

The standard merely makes recommendations for non-bearing building elements which are dimensionally unstable. If written agreement has been reached between the architect and the builder, the wood need not be chemically preserved. Large-area application of wood preservatives should generally be avoided on the interior.

Chemical wood preservatives need not be used on windows and exterior doors if heartwood complying with certain durability grades is used (see appendix).

Durability grades in accordance with DIN 1052:

Grade	Description
1	very durable
2	durable
3	reasonably durable
4	not very durable
5	non-durable

Hazard classes:
Under DIN 68800-3. timber building elements and wood-based materials are allocated a hazard class ranging from GK 0 to GK 4 - not at risk to highly at risk - according to their area of application. Hazard class 0 does not require chemical wood preservation.

The application of chemical agents is not mandatory for classes GK 1 to GK 4 either, e.g. if timbers are used which are considered sufficiently "naturally durable" for the hazard class in question.

A special certificate can also be obtained to assign a structure to a lower hazard class. To obtain this certificate, special structural measures must be taken to destroy destructive fungi and prevent insects from accessing covered timbers.

A wood moisture content of below 20 per cent is required to avoid fungal decay. Insect attacks can be prevented by taking structural protection measures, e.g. by using suitable cladding or by keeping the wood moisture content below 10 per cent. If the wood remains open and can be inspected for insect attacks, chemical wood preservatives can also be avoided, e.g. in undeveloped roof trusses, if accessibility is ensured.

Nearly all load-bearing and reinforcing building elements can be classified as GK 0, with the exception of sills (GK *2).* Chemical wood preservatives can also be dispensed with here if sap-free pine, larch or Douglas fir is used.

Chemical wood preservatives:
Wood preservation by design should be given priority in every case when building wood constructions. If it is pursued consistently chemical wood preservatives can be avoided completely. Even under DIN, preventative chemical wood preservation is only a supplementary measure, and should be taken only when wood selection and design measures prove inadequate.

DIN 68800-3 specifies how the wood preservatives are to be applied:
• according to the inspection grades:
  - insect repelling Iv
  - inimical to mould P
  - weatherproof W
  - inimical to mildew E,
  each preservative can be applied individually or in combination depending on the hazard class.
• according to the wood species (round timber, sawn timber, laminated wood ...)
• according to the method of application (painting, spraying, dipping, borehole impregnation, vacuum and boiler pressure impregnation ...), including possible pre-treatments of wood species that are difficult to impregnate and the appropriate amounts to be applied for the hazard classes stipulated, whilst observing occupational health and safety measures.

Pay attention to the manufacturers' instructions.
Wood preservatives can be divided into:
• water soluble wood preservatives,
• solvent based wood preservatives,
• oleaginous wood preservatives.

Water soluble wood preservatives:
These preservatives contain inorganic or organic salts as agents which act as biocides.
A problem with inorganic water-soluble wood preservative salts is leaching caused by moisture, e.g. rain. Salts for hazard classes 1 and 2 are always leachable and need to be covered on site to protect them against moisture. Non-leachable salts for hazard classes 3 and 4 contain chromates (chrome-VI-compounds) and require a fixing period of several weeks in the wood. They need to be stored and protected from rain during this time.

Organic water-soluble salts are approved for hazard classes 3 and 4 and fix in wood without the addition of chromates.

Solvent based wood preservatives:
These comprise organic solvents and organic compounds which act as biocides. There is a controversial public debate about some of the fungicides and insecticides used (e.g. pyrethroid). Specific problems arise when pentachlorophenol (PCP) and lindane-containing agents are used indoors. For this reason PCP has been banned in Germany since 1990.

Oleaginous wood preservatives:
These are creosote compounds and creosoles.

Processing:
For reasons of occupational health and safety during processing, and to protect subsequent occupants from exposure to the agents and solvents contained in the wood, it is principally recommended that closed equipment be used to introduce the preservatives into the wood (boiler pressure impregnation, possibly also trough impregnation, spray tunnel procedure).

The processing of wood preservatives on the construction site should be limited to the treatment of sawn edges, etc. Furthermore, the wood preservative should be applied by brush and not sprayed.

Identification:
Only products whose effectiveness and harmlessness have been demonstrated in tests may be used as chemical wood preservatives. They are subject to the approval mark regulation of the German *Lander* and are issued with the Institute of Structural Engineering in Berlin approval mark when their usability has been proven,
The area of constructed wood that has been treated must be provided with long-term visible identification by the contractor in accordance with DIN 68800-3.

Waste disposal:
Remains of wood preservatives as well as empty containers and contaminated packages are hazardous waste. Timber treated with wood preservatives must be incinerated as hazardous waste. Landfilling is prohibited.

Manufacturer(s)(selection)
AURO-Pflanzenchemie GmbH
BeeckGmbH 8 Co KG
Desowag GmbH
Kulba-Bauchemie GmbH
Leinos-Naturfarben GmbH
Livos Pflanzenchemie GmbH
RCH Fluorchemie GmbH
Remmers Chmie GmbH & Co
Wehl GmbH
Dr. Wolmann GmbH

Information
The Deutsche Institut für Bautechnik (DIBt) Berlin (German Institute for Structural Engineering) issues a list of approved wood preservation products annually.
Gutegemeinschaft Holzschutzmirtel e.V.

Joint sealing tapes

DIN 18542

For invitations to tender and orders:
- Manufacturer
- Thickness
- Width
- Length
- Colour

Calculated per metre

Material

Open-pored and closed-cell materials are used for joint sealing tapes.
Common types of sealing tapes are:
- foam sealing tape
- silicon sealing tape
- butyl rubber tape

Open-pored sealing tapes are made of polyuretriane soft foam, for example, which is impregnated with pre-set flame-retardant synthetic resin, partially impregnated with bitumen, and can be pre-compressed at the factory for the application in question.

Closed-cell materials made of plastic are usually used for damp-proofing.

Open-pored materials have good sound insulation properties, but are only effective as damp- and wind-proof seals when compressed.

Joint sealing tapes are available as single or double-sided adhesive tapes.

Use

Joint sealing tapes are used to functionally connect building elements and building element layers to each other. According to the level of compression, they are either driving rain or wind-proof, and can therefore create both rain and wind barriers along joints.

To prevent the formation of condensation at a joint's edges, the joint must have a vapour-tight structure on the inside.

Processing:

Sealing tapes are normally supplied pre-compressed (to approx. 20 per cent of the original thickness), whereby the retraction to the width of the joint is so gradual that it allows sufficient time during application to position the tape into the joint.

The seal effect of the joint sealing tape depends on its residual compression when in position:

< 20 %	Delivery condition
up to 25 %	requirements in accordance with DIN 18542
up to 35 %	seals against strong rain, good sound insulation
up to 50 %	water repellent, draught-proof, dust-tight
100 %	original thickness

The adhesive strength at the edges of the joints is primarily determined by the restoring force of the expanding tape. The self-adhesive tape surface serves as an application aid,

Dimensions:

Length of reel [m]: 2-10, according to thickness
Thickness (uncompressed) [mm]: 10-150
Width [mm]: 10-1,000

Manufacturers)(selection)

Hanno-Werk GmbH & Co.KG
Henkel Bautechmk GmbH
Henkel Teroson GmbH
Nlbruck Bautechnik GmbH
KAWOKarlWolpers
Slka Chemie GmbH

Built Examples

[Temporary Bank in Nuremberg

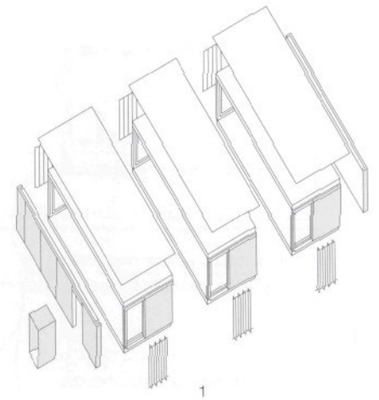
I ami architekturwerkstatt
[**Matthias** Loebermann, Nuremberg

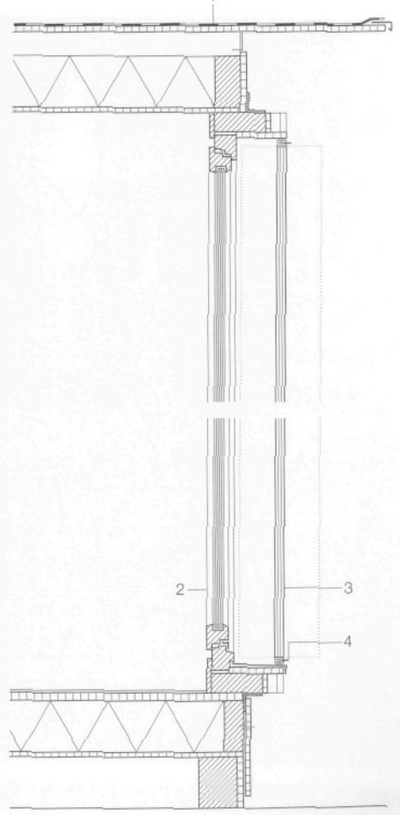
Tlie "Blue Box" meets the requirements of fthe brief by providing a flexible, low-cost, [1] temporary structure with a pleasant internal ambience. The modular system consists of a basic unit 3 m wide and 9 m long, Three modules are combined here to create a single structure 9 x 9 m on plan with a room height of 2.50 m. (The elements are laid on a supporting base, consisting of three beams. The wall, roof and floor panels are in timber-frame construction with insulation. To reduce the span of the minimally sloping roof, a row of columns was inserted along the middle of the space. A room-height window can be installed in every module, with pivoting louvres to provide sunshading. The system can also be used for exhibition or information pavilions.

03 DETAIL 4/2001

1 roof construction, waterproof membrane
19 mm three-ply laminated sheeting
40 mm ventilated cavity; 40-80 mm wood finings
160 mm thermal insulation;
80/160 mm timber rafters
15 mm oriented strand board
2 softwood casement with insulating double glazing
3 30 mm five-ply larch laminated sunshade louvres
4 flat steel movable fixing for louvres

Isometric (not to scale)
Vertical section scale 1:20





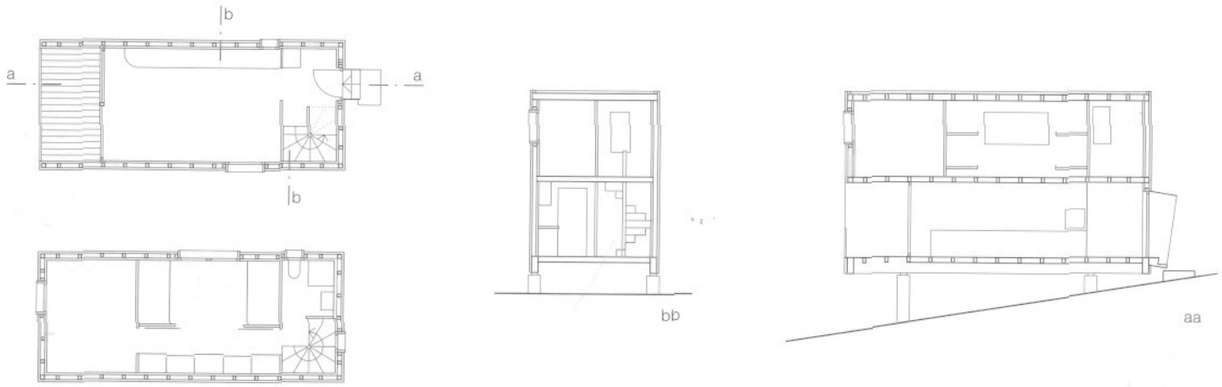
Weekend House in Vallemaggia

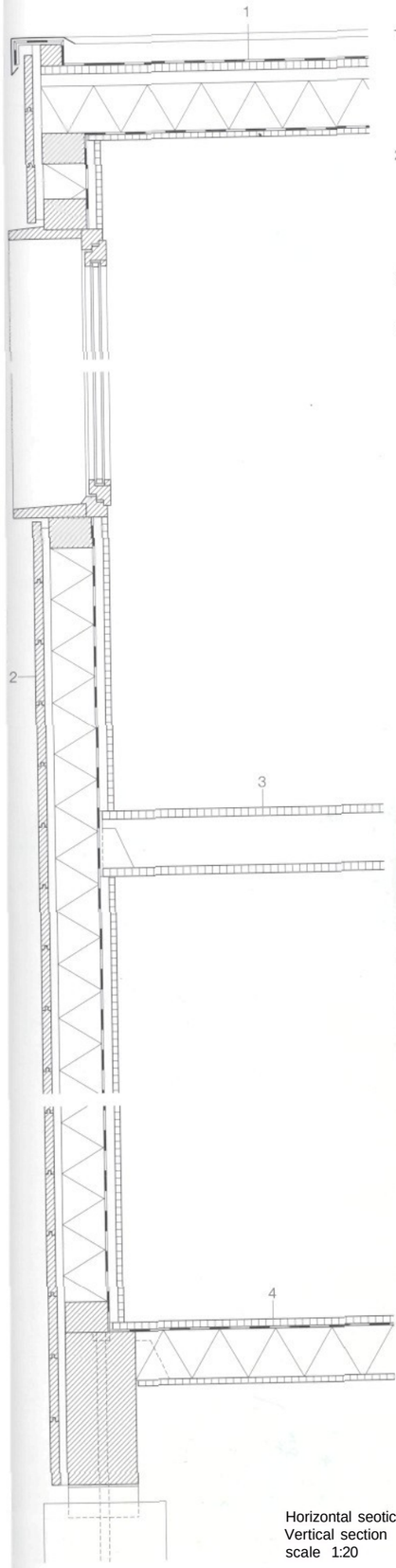
Roberto Briccola, Giubiasco

Reflecting the tradition of the Walser Valley granaries, this small weekend house was designed to impinge as little as possible on the natural surroundings. The siting of the simple cubic volume allows for later additions. Raised on four corner piles, it seems to hover above the Alpine meadow.

The ground floor houses the entrance, living and dining areas, with an integrated kitchen strip. The living realm extends out into a sheltered loggia, On the upper floor are two simple sleeping cells and a shower. Apart from the concrete piles and the raking, welded-steel porch, the house is entirely in timber. The structural elements are in fir. Externally, the house is clad on all faces with larch boarding. Internally, it is lined with three-layer laminated sheeting. *IQ* DETAIL 3/2001

Floor plans • Sections scale 1:200



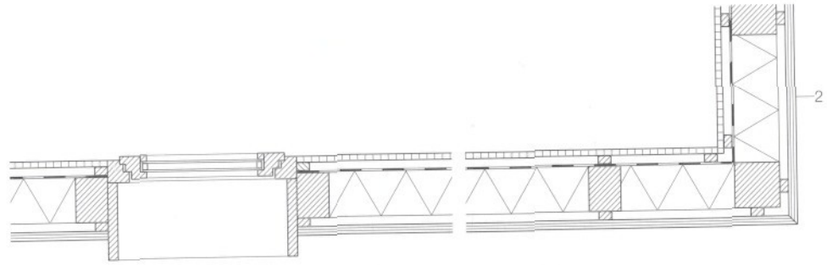


1 roof construction:
plastic sheet sealing layer
27 mm three-layer fir laminated boarding
160 mm miners l-wool thermal insulation
100/200 mm fir rafters
vapour barrier
19 mm three-layer tir laminated boarding

2 wall construction:
27 mm larch tongued-and-grooved boarding
27 mm battens
140 mm mineral-wool thermal insulation
vapour barrier
27 mm battens
19 mm three-layer fir laminated boarding

3 27 mm three-layer fir laminated boarding
100/160 mm (ir rafters
19 mm three-layer hr laminated boarding

4 27 mm three-layer fir laminated boarding
vapour barrier
160 mm mineral-wool thermal insulation
19 mm orientsd-stranfl board



Horizontal seotici
Vertical section
scale 1:20

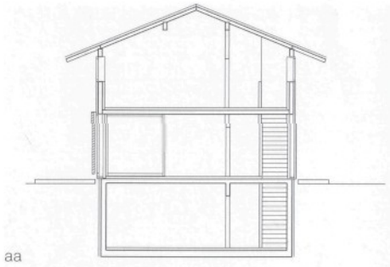
House near Bad Tölz

Fink + Jocher, Munich
Dietrich Fink
Thomas Jocher

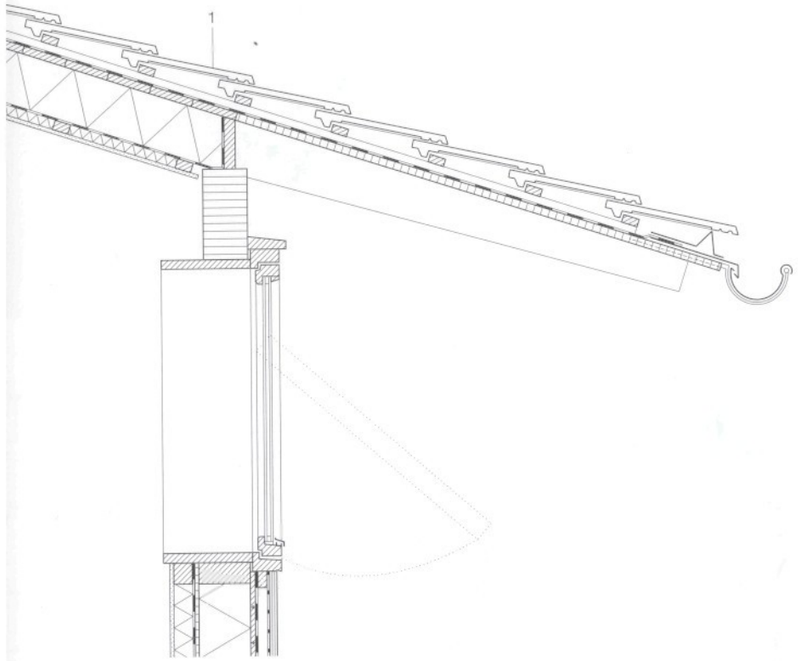
Erected within a period of nine months with prefabricated timber elements, this two-storey, low-energy house reflects the vernacular of the local farm buildings through the use of a few simple details. The transparent areas in the north facade were kept to a minimum in order to reduce energy losses. To avoid extremes of temperature, sliding shutters with louvres set at different angles were installed for the large areas of glazing in the south, west and east faces.

The timber stud walls were based on the American balloon-frame system, using full-height elements with continuous vertical members. The walls are in a two-skin form of construction and are braced by the internal plywood lining. The inner leaf, in which the mechanical services are housed, bears the loads from the floor, which stops short of the vapour barrier. This ensured a simple assembly of the house and a safe, airtight construction. The wall is insulated with a total thickness of 22 cm cellulose fibre. The problem of noise transmission via the continuous vertical studs was reduced by building the inner leaf of the wall with horizontal members.

The floor is in a simple, hand-nailed vertically stacked plank construction. The advantage of this system is that it allows the use of cheaper offcut products. The floor also has great rigidity, with a structural depth comparable to that of a reinforced concrete slab. No chemical preservatives were used for the wall, floor or roof timbers. *ty* DETAIL 1/1998



Floor pla-is • Section scale 1:250

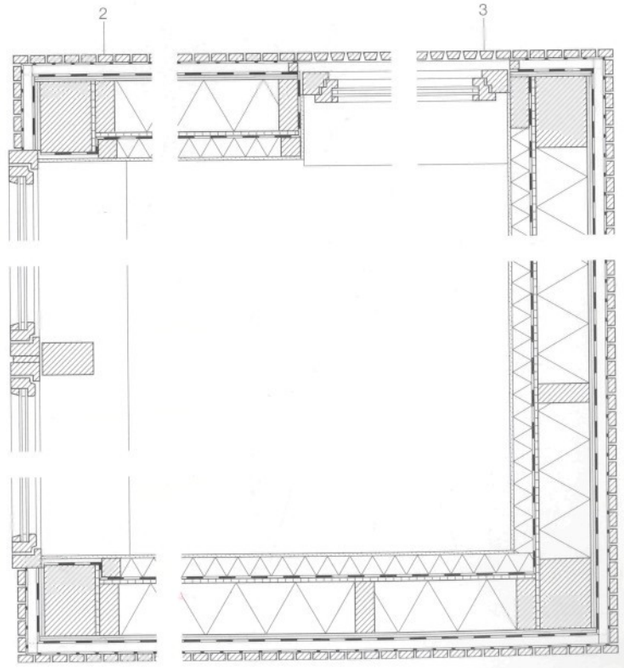


Horizontal section First floor • vertical section
scale 1:20

1 roof construction: concrete roof tiles
30/50 mm battens, 24/46 mm counter-battens
moisture-diffusing roof sheeting
24 mm sawn tongued-and-grooved boarding
160 mm cellulose-fibre thermal insulation
between 60/160 mm ratters
aluminium foil vapour barrier
40 mm thermal insulation
between 40/60 mm battens
12.5 mm plasterboard

2 wall construction:
30/50 mm untreated larch strips
insect screen, 30/50 mm battens
moisture-diffusing wind proof building paper
24 mm softwood tongued-and-grooved boarding
160 mm cellulose-fibre thermal insulation
between 60/160 mm timber studs
12 mm plywood construction board
polythene sheet vapour barrier
60 mm thermal insulation between 60/60 mm
timber battens, 12.5 mm plasterboard

3 larch strips splay cut on both edges;
white glazed on edges and rear lace



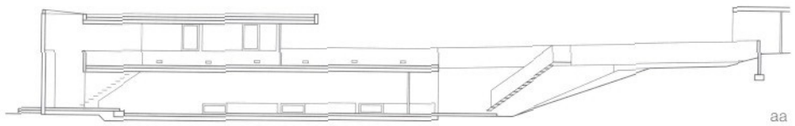
Church Community Centre and Youth Centre in Lenting

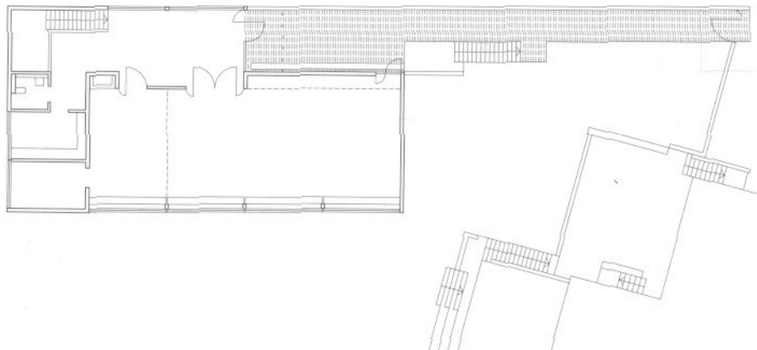
Andreas Meek und
Stephan Köppel, Munich

This lightweight, largely prefabricated timber structure was erected close to the site boundary, with the hall and group rooms overlooking the garden. Access from the road is via an elevated walkway, with the entrance to the community centre at upper floor level. The large hall can be divided into smaiier units by sliding partitions that disappear into recesses in the wall.

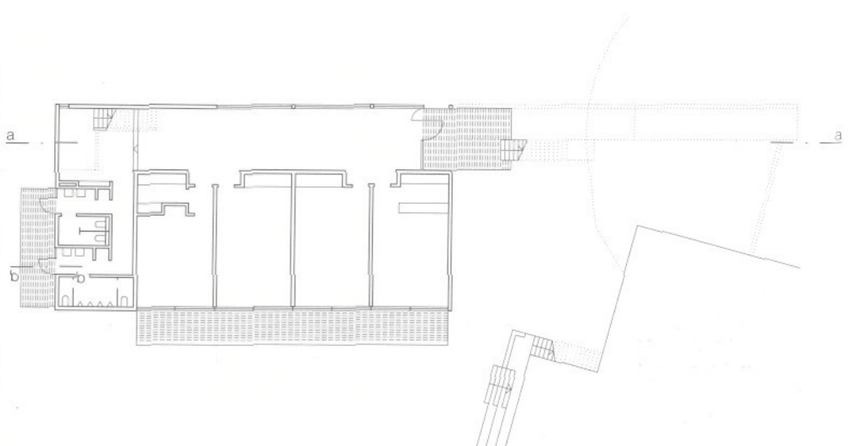
The youth centre on the lower floor has its own entrance, but is linked with the main foyer by an internal staircase. The walls are in timber stud construction braced on both faces with oriented-strand board sheets. The roof over the hall is a nailed beam structure, while the floors are in a stacked plank form of construction, The external walls and foyer walls are clad in larch boarding in a warm red tone.

CP DETAIL 1/2000



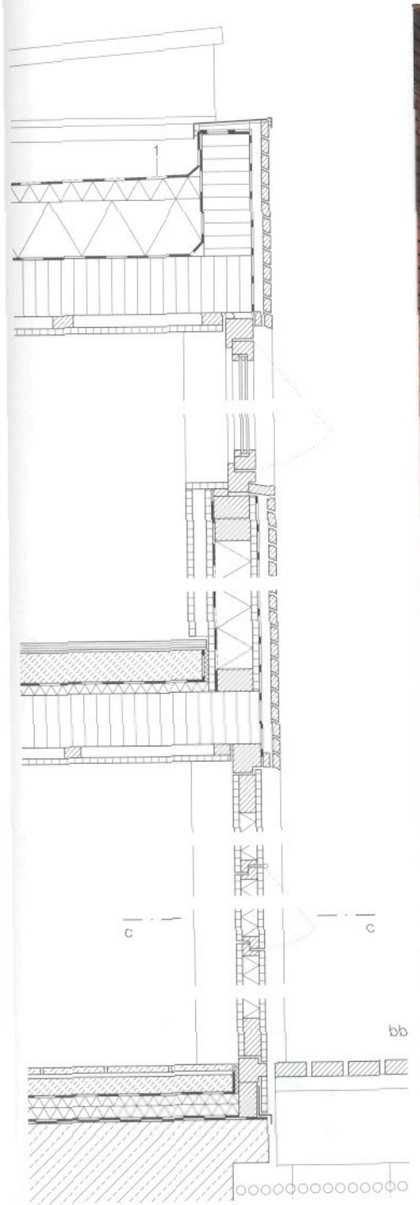


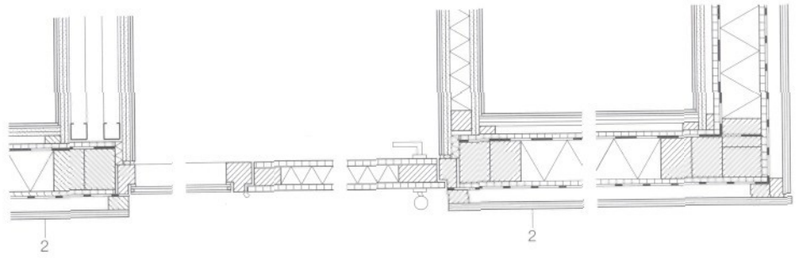
Longitudinal section
Uppel floor plan
Ground tloor plan
scale 1:400



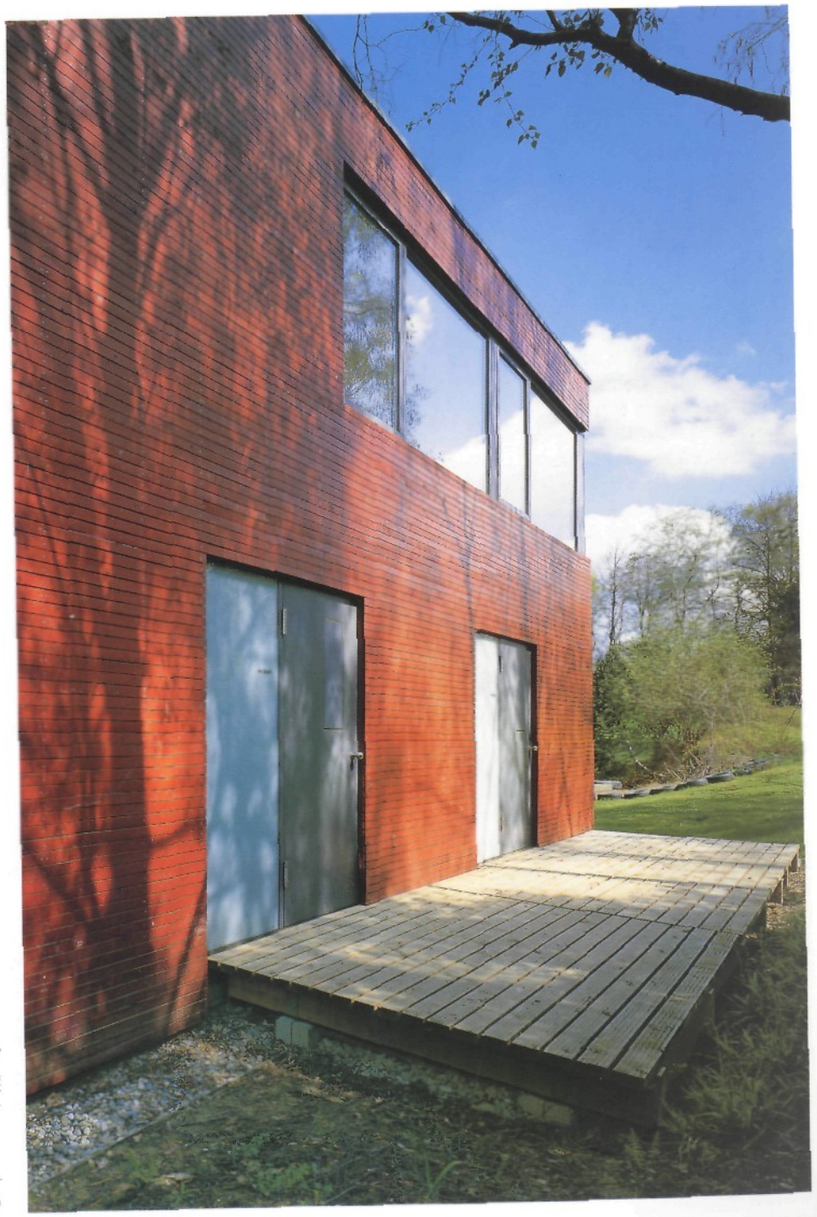
1 roof construction:
2 mm plastic sealing layer
180-280 mm insulation finished to falls
vapour barrier
180 mm vertically stacked plank floor
30/50 mm battens
18 mm beech-laminated board

2 wall construction:
24/52 mm larch cladding
40/60 mm battens
windproot layer
15 nim onented-strand board
130 mm thermal insulation
vapour barrier
15 mm oriented-strand board
30/50 mm battens
2x 12.5 mm plasterboard
8 mm mosaic tiles





Horizontal section • vertical section scale 1:20



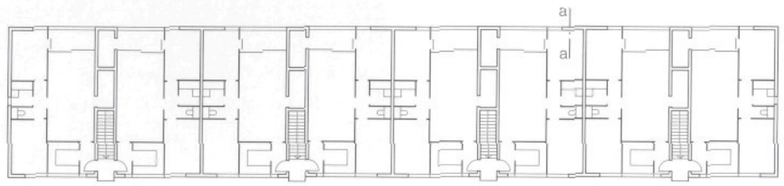
Housing Development in Trofaiach

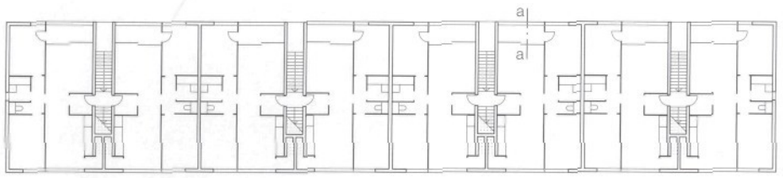
Hubert Riess, Graz

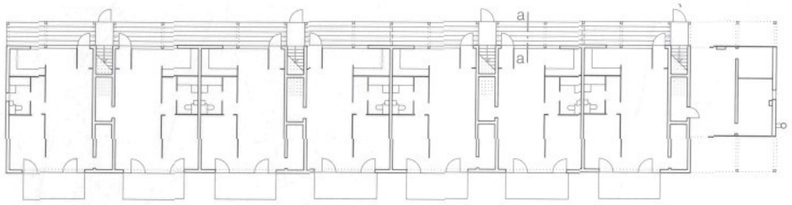
This housing development, which occupies an entire street block, comprises two three-storey linear tracts with a protected landscaped zone between them. The strips are divided by straight-flight staircases Ihat extend over the full width ot the blocks. Each staircase provides access from the courtyard side to two dwellings on each floor. The dwellings themselves have an east-west orientation.

All external walls and party cross-walls are load-bearing and were prefabricated in storey-height units. The facade elements, extending over the full width of a dwelling, are connected by laminated timber beams and fixed to the floors. The roofs and staircases are also in a prefabricated unit construction system.

V DETAIL 4/2001



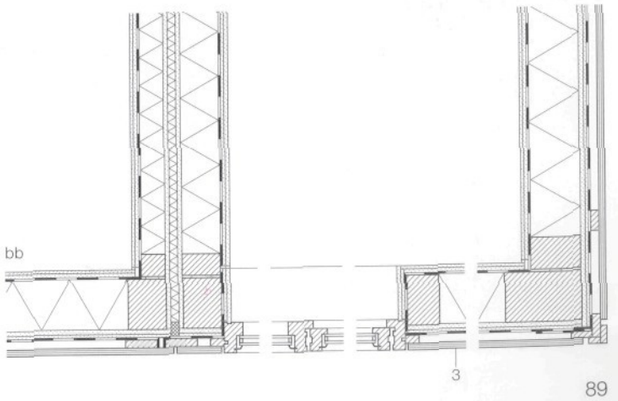




Floor plans
scale 1:500

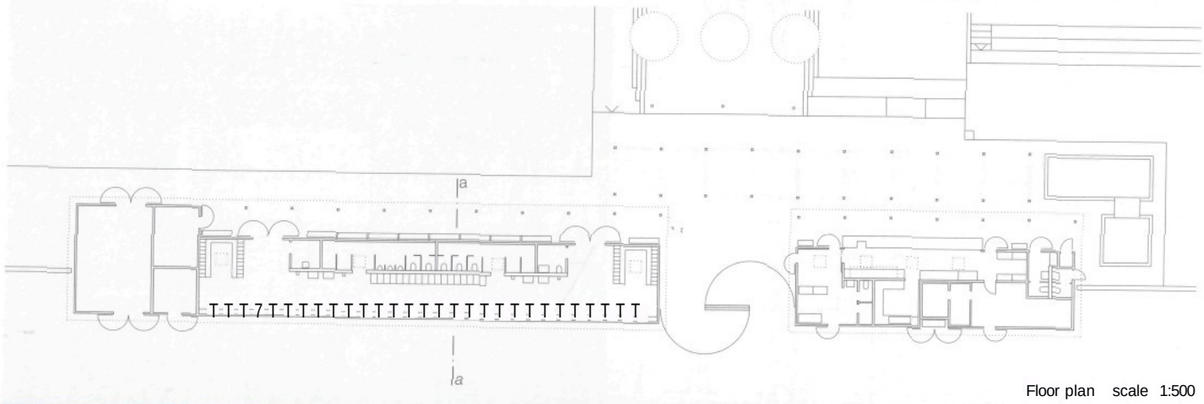
Horizontal section
Vertical section
scale 1:20

1 stainless-steel standing-seam roofing, leaded
30 mm sawn timber boarding
80/180 mm limber rafters, ventilated
windproof building paper
19 mm chipboard
240 mm thermal insulation between 100/240 mm softwood purlins
polythene sheeting
19 mm chipboard
24 mm open-joint boarding
15 mm gypsum fibreBoard
2 160/480 mm laminated timber beam
3 19 mm larch boarding
30/60 mm battens
windproof building paper
10 mm gypsum fibreboard
12.5 mm gypsum fibreboard
160 mm thermal insulation between 80/160 mm softwood posts
polythene sheeting with welded joints
12.5 mm gypsum fibreboard
10 mm gypsum fibreboard

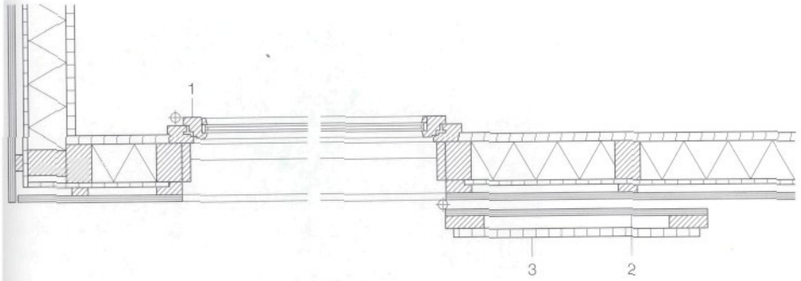


Lakeside Bathing Facilities in Zug, Switzerland

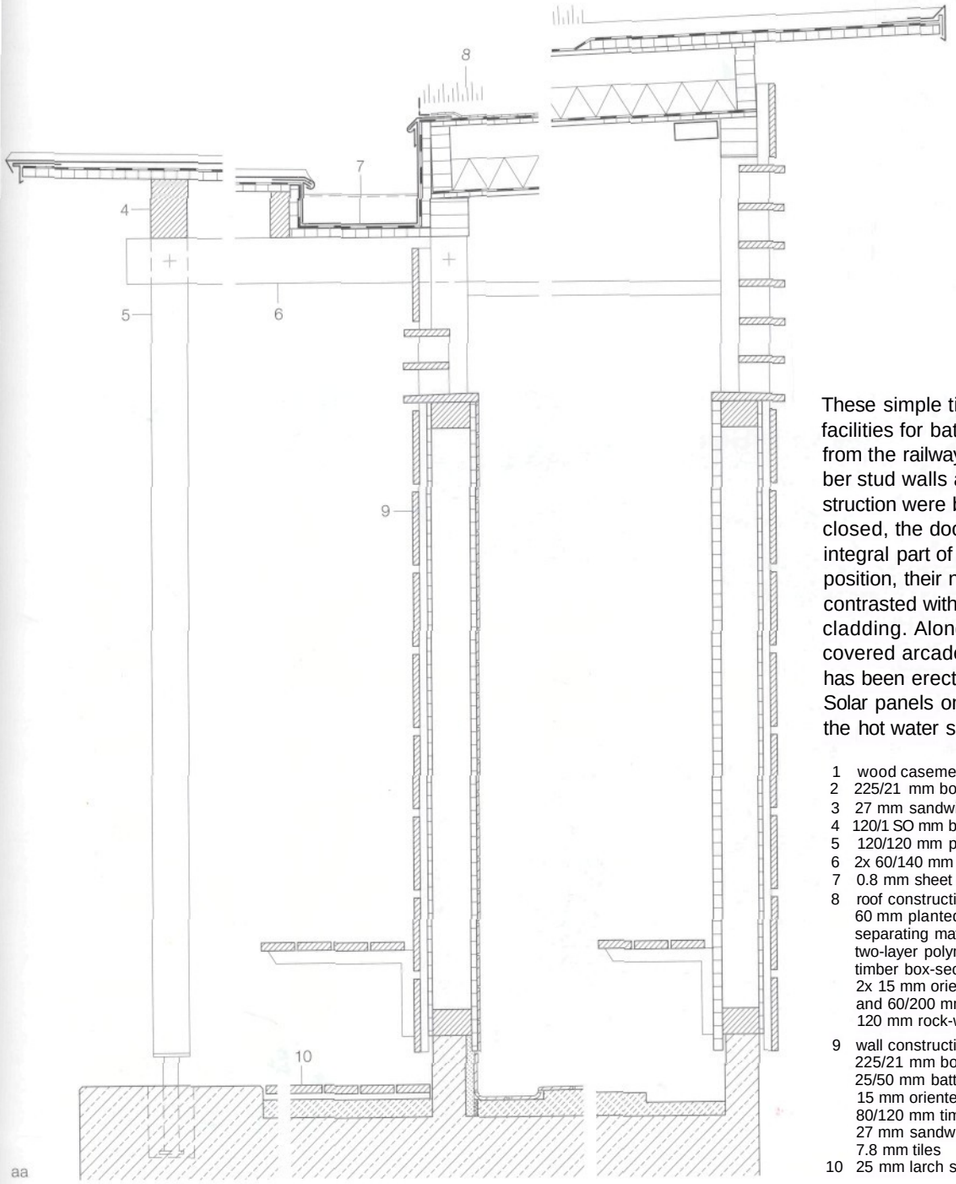
Alfred Krähenbühl, Zug



Floor plan scale 1:500



Horizontal section
Vertical section
scale 1:20



These simple timber structures, housing facilities for bathers, screen the lake shore from the railway line to the north. The timber stud walls and the box-beam roof construction were both prefabricated. When closed, the doors and shutters form an integral part of the facade. In an open position, their natural wood inner faces are contrasted with the continuous white board cladding. Along the south side is an open, covered arcade; and a shading pergola has been erected in front of the kiosk. Solar panels on the planted roof augment the hot water supply. QJ DETAIL 1/2000

1 wood casement with double glazing
2 225/21 mm boarding
3 27 mm sandwich slab
4 120/1 SO mm beam
5 120/120 mm post
6 2x 60/140 mm pairs Of beams
7 0.8 mm sheet copper gutter
8 roof construction:
60 mm planted layer
separating mat
two-layer polymer-bitumen waterproof membrane
timber box-section element:
2x 15 mm oriented-strand board
and 60/200 mm wood framing
120 mm rock-wool insulation
9 wall construction:
225/21 mm boarding
25/50 mm battens
15 mm oriented-strand board
80/120 mm timber stud posts
27 mm sandwich slab
7.8 mm tiles
10 25 mm larch strip paving

School Building in St Peter, Switzerland

Conradin Clavuot, Chur

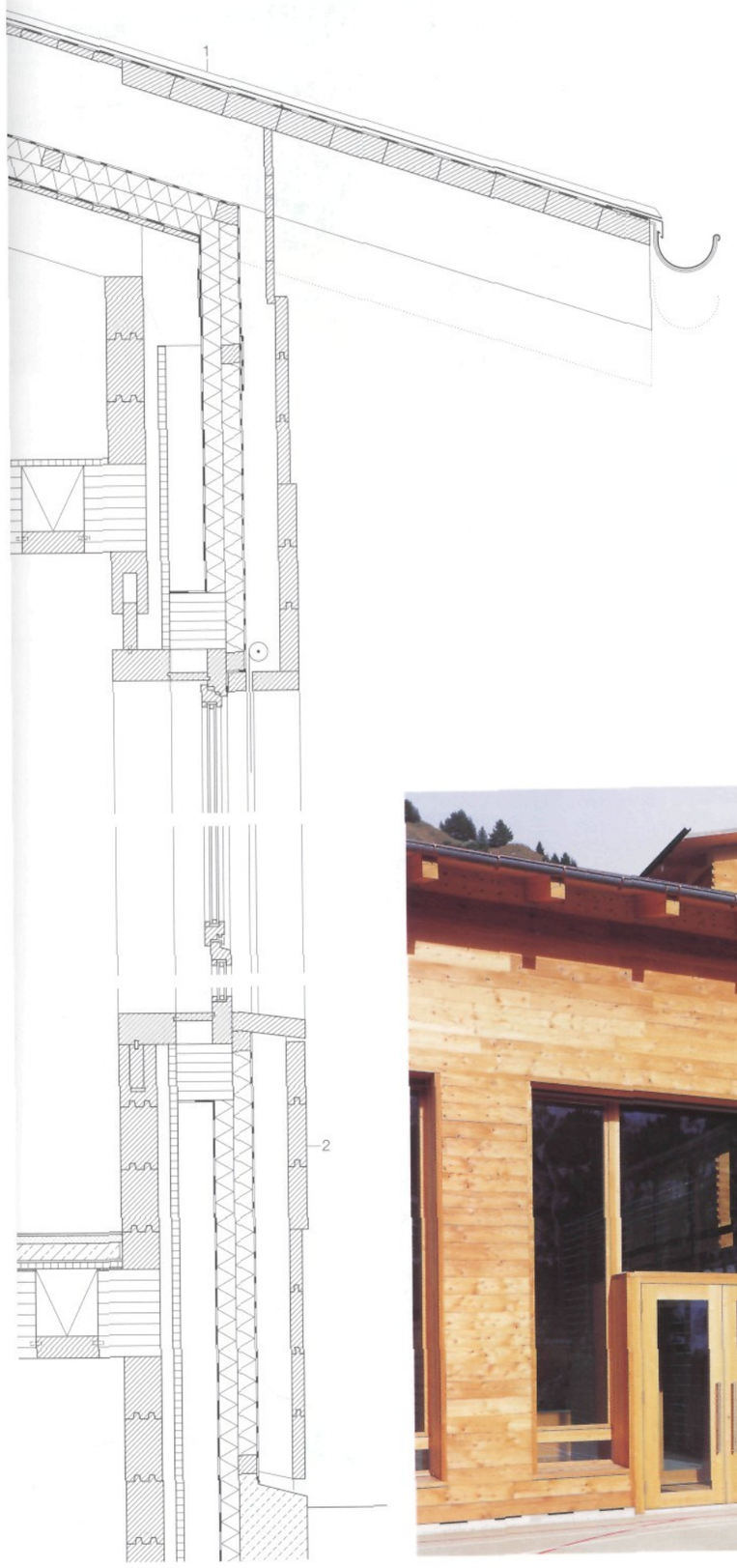
The new complex is well integrated into the intact local vernacular. The external walls of the school building are in a two-layer form of conslruction. The inner layer consists of a flexible system of 11.5 x 20 cm planed, tongued-and-grooved, but otherwise untreated horizontal beams. Shrinkage in the beams, caused by the drying out of residual moisture, together with heavy snow loads in winter, resulls in movement within the walls, which are up to 36 m long and 7.5 m high. To allow the wall beams to settle and still perform a load-bearing function, Ihey are flexibly "laced" to fan-dovetailed sections screwed to a rigid system of vertical posts. The thermal insulation, casements and larch facade boarding are also fixed to the rigid posts. CP DETAIL 1/2000

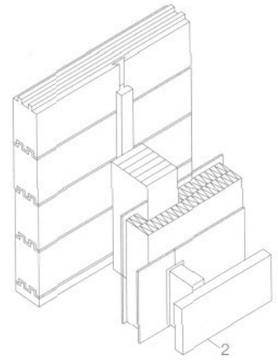
Sections
Fourth floor plan
Second floor plan
scale 1:800

Section through facade of school building
scale 1:20

1 roof construction: sheet copper roofing
separating layer
27 mm boarding; 75 mm to projecting eaves
260/310 (160) mm beams
waterproof membrane
2x 60 mm rock-wool insulation
vapour barrier
27 mm boarding
120/200 mm joists

2 wall construction:
40 and 60 mm larch boarding
battens/ventilated cavity
wind proof paper
2X BO mm rock-wool insulation
vapour barrier
120 mm cavity between posts
26 mm sandwich slat),
as bracing only in casement area
45 mm space for service runs
115/200 mm horizontal laced
softwood beams

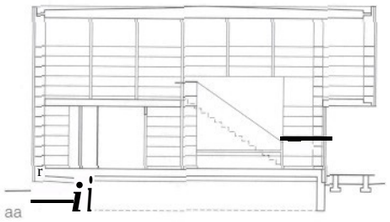


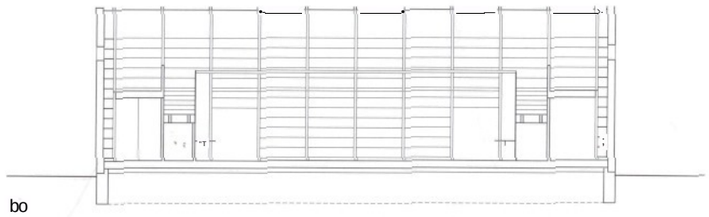


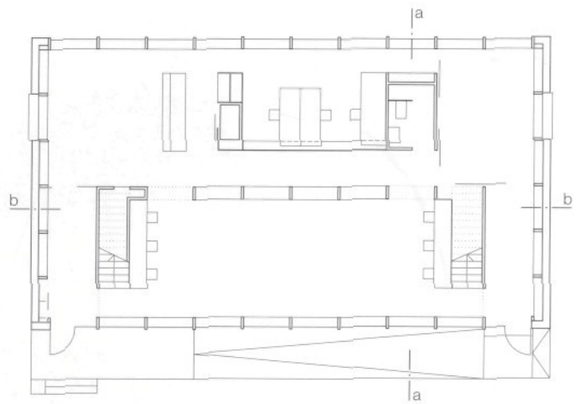
Isometric of standard wall construction

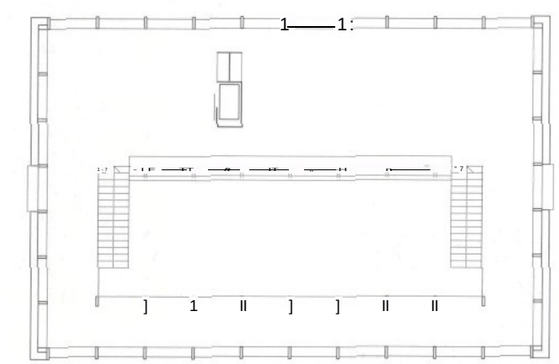
Media Library in the Cantonal School in Kiisnacht

Marie-Claude Betrix &
Eraldo Consolascio
Eric Maier, Erlenbach









Sections • Floor plans scale 1:250

In this new building, which seeks to evoke the spatial atmosphere of classical libraries, the shelving forms part of the load-bearing structure. The closed side walls, the intermediate floor and the roof consist of prefabricated timber box elements. The sides of the shelving, in laminated timber sheeting, function as vertical columns, As tension elements, they also bear the loads from the cantilevered section of the upper floor, which is suspended from the roof. The highly insulated external walls and roof, the extremely low U-value of the glazing, and the controlled ventilation of the internal spaces coupled with a heat recovery system ensure a low energy consumption that complies with the Swiss "minergie" standard. CP DETAIL 5/2002

Details section scale 1:20

1 40 mm fine stone chippings on separating layer
two-layer waterproof membrane with
root-resisting layer
27 mm laminated timber sheeting
330-440 mm cellulose thermal insulation
33 mm laminated limber sheeting
2 demountable masking sheet
3 100/431 mm lam. timber sheet column
4 33 mm lam. timber shelf
5 6 mm linoleum with cork backing
27 mm lam. timber sheeting
230 mm expanded clay filling
27 mm lam. timber sheeting
6 fabric blind
7 low-E glazing; U = 0.54 W/m=K
a 10 mm screen-printed toughened safety glass
9 sheet-copper gutter and covering
10 softwood cover strip

Parquet Showrooms in Lindau

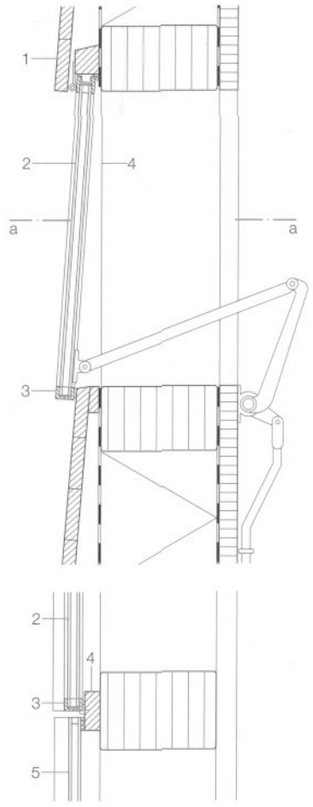
Karl Theodor Keller, Munich

Based on a rectangular plan, this simple building replaces an earlier house of the same form. On the ground floor is a sales area and a store; on the upper floor, an office and exhibition space. The load-bearing structure consists largely of a thermally insulated timber skeleton frame. In the area of the shop, however, the outer walls and the first floor are in a solid form of construction. Externally, the building is clad with common formwork planks articulated by glass strips of the same size. This determined not only the dimensions of the external grid, but also the form of construction. A continuous horizontal band of glazing - openable in part - extends along all faces of the building. It is complemented by conventional windows.

IAJ DETAIL 7/1998

Standard facade details
scale 1:10

1 wall construction: impregnated formwork panels
with galvanized steel edge strips
saw-tooth battens/cavity
wmdproof sheeting
rock-wool insulation belween 1007180 mm
posts and rails
vapour barrier
16 mm untreated lam. building board
2 double-glazing strip; opening light
3 stainless-steel frame
4 saw-tooth battens
5 fixed double glazing



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Appendix

Grading criteria for squared timber, visually graded in accordance with DIN 4074-1

Grade characteristics	Grade S7	Grade S10	Grade S13
1. Wane	all four sides must be stripped continuously with a cutting tool	up to 1/3; in each cross-section at least 1/3 of each cross-section side must be wane free	up to 1/8; in each cross-section at least 2/3 of each cross-section side must be wane free
2. Knots	up to 3/5	up to 2/5, not exceeding 70 mm	up to 1/5, no more than 50 mm
3. Avg. width of annual rings for Douglas fir	– -	up to 6 mm up to 8 mm	up to 4 mm up to 6 mm
4. Grain slope	up to 200 mm/m	up to 120 mm/m	up to 70 mm/m
5. Cracks: • Radial shakes (checks) • Lightning shakes Frost cracks Round shakes	permissible not permissible	permissible not permissible	permissible not permissible
6. Stains: • blue-stain • brown and red stripes: low nail-holding capacity • red rot • white rot	permissible permissible for up to 3/5 of the cross section or the surface not permissible	permissible permissible for up to 2/5 of the cross-section or the surface not permissible	permissible permissible for up-to 1/5 of the cross section or the surface not permissible
7. Compression wood	permissible for up to 3/5 of the cross-section or the surface	up to 2/5 of the cross-section or permissible for the surface	permissible for up to 1/5 of the cross-section or the surface
8. Insect holes	boreholes, caused by insects attacking green wood, of up to 2 mm in diameter permissible	boreholes, caused by insects attacking green wood, of up to 2 mm in diameter permissible	boreholes, caused by insects attacking green wood, of up to 2 mm in diameter permissible
9. Misteltoe attack	not permissible	not permissible	not permissible
10. Camber, longitudinal curvature, twisting	up to 15 mm/2 m	up to 8 mm/2 m	up to 5 mm/2 m

Maximum values for the moisture of woods for load-bearing and reinforcing building elements; these values must not be exceeded during the period of use. (Table 2 DIN 68800-2)

Material class	Moisture max u	
20	15% (12 for fibreboard)	The boards must not become moist, or only to the extent that their moisture content increases over a short period and does not exceed 15 mass-% at any point, Penetrating moisture must be able to escape unhindered.
100	18 %	If surrounding air conditions permit either a higher long-term equilibrium moisture content (EMC) in the boards or a short-term increase in their moisture content provided the latter does not exceed 18 mass-% at any point and any additional penetrating moisture can escape unhindered.
100 G	21 %	If surrounding air conditions permit a higher long-term EMC or higher moisture content in boards and penetrating moisture can only escape over an extended period of time.

Required material classes (Table 3 DIN 68800-2)

Line	Material class	Area of Application
1		Cladding on the room side of walls, as well as on ceilings and roofs in residential buildings and in buildings used for comparable purposes.
1.1	20	In general:
1.2		Surface panelling as well as load-bearing or reinforcing panelling of ceilings below attic floors that have not been fitted out.
	20	a) ventilated ceilings
	100	b) non-ventilated ceilings
	20	- without an adequate insulation layer -with an adequate insulation layer (1/A £0.75 m^2K/W)
2		Outside panelling on exterior walls
2.1	100	Ventilated cavity between exterior cladding and weatherproofing skin.
2.2	100	Weatherproofing skin, cavity insufficiently ventilated, diffusion-open, and water-draining covering over the panelling.
2.3	100	Thermal-insulating composite system directly attached to panelling.
2,4		Masonry facing shell, cavity insufficiently ventilated, panel covering with;
	100	a) water-draining layer with $s_o > 1$ m
		b) HR-foam panels at least 30 mm thick.
3		Top panelling of roofs, load-bearing or reinforcing roof-boarding
3.1		Panelling or boarding in contact with the room air
3.1.1	20	Attached thermal -insulating layer (e.g. in residential buildings, heated halls)
3.1,2	100G	Without attached thermal -insulating layer (e.g. flat roofs on unheated halls)
3.2		Roof cross-section ventilated beneath the panelling or boarding
3.2.1	100	Pitched roof with covering
3.2,2	100G	Flat roof with moisture-proof roofing
3.3		Roof cross-section not-ventilated beneath the panelling or boarding
3.3.1	100G	Ventilated cavity above the panelling or boarding, material covered on the upper side with water-repelling foil or similar material
3.3.2	100	No vapour-barriers (e.g. foils) beneath the panelling or boarding, thermal insulation mainly above the panelling or boarding

Cases not mentioned here are to be classified in accordance with the above when determining the required material class. Classes 20 or 100, which have been determined in this way, may not- under any circumstances - be replaced by class 100 G.
According to DIN 68800-5, wood-based materials serving as load-bearing and reinforcing elements must be protected against fungi in cases where moisture loads are high; this measure is expedient for wood-based materials not used as load-bearing elements.

The German Ordinance on Energy Saving (EnEV 2002), thermal insulation ordinance, the ordinance on energy-saving thermal protection in buildings.

Standards

DIN 1052 Part 1: Structural use of timber; design and construction

DIN 1052 Part 2: Structural use of timber; mechanically fastened joints

DIN 1055 Action on structures

DIN 1101 Wood wool slabs and multi-layered slabs as insulating materials in building

DIN 4070-1 Softwood; cross-sectional dimensions and static values for sawn timber, square timber stock and roof battens

DIN 4070-2 Coniferous timber; dimensions of cross-sections and static values, goods sawn for dimensions and specification

DIN 4071-1 Unplaned boards and planks made of coniferous timber; dimensions

DIN 4072 Boards tongued and grooved, made of coniferous timber

DIN 4073-1 Planed boards and planks, made of coniferous timber; dimensions

DIN 4074-1 Strength grading of wood; coniferous sawn timber

DIN 4102 Fire behaviour of building materials and building components

DIN 4108Thermal protection and energy economy in buildings

DIN 4109 Sound insulation in buildings; - requirements and testing

DIN 17440 Stainless steels - technical delivery conditions for drawn wire

DIN 18161-1 Cork products as insulating building materials; insulating materials for thermal insulation

DIN 18164-1 Cellular plastics as insulating building materials - Part 1: Insulating materials for thermal insulation

DIN 18165 Fibrous insulating building materials

DIN 18180 Gypsum plasterboard; types, requirements and testing

DIN 18182 Accessoires for use **with** gypsum plasterboards

DIN 18195-1-5 Water-proofing of buildings

DIN 18203-3 Tolerances for building; building components of timber and wood based panel products

DIN 18334 Contract procedures for building works - Part C: General technical specifications for building works: carpentry and timber construction work

DIN 18542 Sealing of outside wall joints with impregnated sealing tapes made of cellular plastics - Impregnated sealing tapes - Requirements and testing

DIN 18560 Screeds in building construction

DIN 68100 Tolerance system for wood working and wood processing; concepts, series of tolerances, shrinkage and swelling

DIN68122Tongued-and-grooved chamfered boards of coniferous timber

DIN 68123 Weatherboards made of coniferous timber

DIN 68126-1 Profile boards with chamfer and broad root: dimensions

DIN 68126-3 Profile boards with chamfer and broad root; grading for white-wood and redwood

DIN 68364 Properties of wood species: density, modulus of elasticity and strength

DIN 68365 Structural timber for carpentry; quality conditions

DIN 68705-2 Plywood - Part 2; Blockboard and laminboard for general use

DIN 68705-3 Plywood; structural plywood

DIN 68705-5 Plywood; structural plywood made of beech

DIN 68755 Wood-fibre products for insulation of buildings

DIN 68762 Chipboard for special purposes in building construction; concepts, requirements, testing

DIN 68764 Particle boards; extruded boards for the building; terms, properties, testing, supervision

DIN 68765 Particle boards; decorative laminated particle boards; terms, requirements

DIN 68800-1 Protection of timber used in buildings; general specifications

DIN 68800-2 Protection of limber; preventive constructional measures in buildings

DIN 68800-3 Protection of timber; preventive chemical protection

DIN 68800-5 Protection of timber used in buildings; preventive chemical protection for wood-based materials

DIN EN 300 Oriented Strand Boards (OSB) - Definitions, classification and specifications; German version

DIN EN 309 Particleboards; definition and classification

DIN EN 312 Particleboards - specifications

DIN EN 313 Plywood - classification and terminology

DIN EN 316 Wood fibreboards - definition, classification and symbols

DIN EN 335 Durability of wood and derived materials; definition of hazard classes of biological attack

DIN EN 338 Timber structures - strength classes

DIN EN 350 Durability of wood and wood-based products - natural durability of solid wood

DIN EN 351 Durability of wood and wood-based products - preservative-treated solid wood

DIN EN 384 Structural timber - determination of characteristic values of mechanical properties and density

DIN EN 386 Glued laminated timber - performance requirements and minimum production requirements

DIN EN 460 Durability of wood and wood-based products - natural durability of solid wood - guide to the durability requirements for wood to be used in hazard classes

DIN EN 622 Fibreboards - specifications

DIN EN 633 Cement-bonded particleboards: definition and classification

DIN EN 634 Cement-bonded particleboards - specifications

DIN EN 635-1 Plywood - classification by surface appearance - Part 1: General

DIN EN 636 Plywood - specifications

DIN VENV 1995-1-1 Eurocode 5: design of timber structures; Part 1-1: general rules and rules for building

DIN V ENV 1995-1-2 Eurocode 5 - design of timber structures-Part 1-2: General rules; structural fire design

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