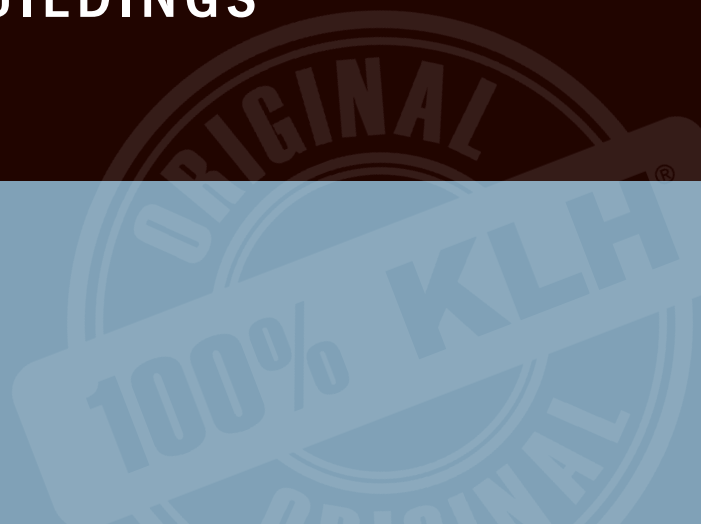




MADE FOR BUILDING
BUILT FOR LIVING

COMPONENT CATALOGUE FOR **INDUSTRIAL BUILDINGS**



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INDUSTRIAL BUILDINGS

With KLH® solid wood panels it is certainly possible to create simple and also economical construction systems for industrial buildings, halls and the like. In combination with a primary support structure, e.g. made of steel or laminated timber, even large spans can be bridged without supporting columns.

The biggest benefit for the building owner can be achieved if the building reinforcement can be realised by means of KLH® roof panels and KLH® wall panels. In this case, the construction can be made without fixed columns (e.g. mounted reinforced concrete columns) and the foundation can be implemented in a considerably simpler design. Particularly when the foundation soil is in a bad condition, considerable savings are the result.

With KLH® solid wood panels industrial buildings can be designed completely in wood, from the foundation edge upwards.

Halls with a length of up to 100 m have been constructed in this way. In the interior, the KLH® solid wood panels are usually left exposed. The result of this is a pleasant indoor climate and working atmosphere both in winter and during the summer months.

Furthermore, the assembly of installations, etc. becomes considerably easier, as there is loadable underground almost everywhere and the construction can usually be made without intermediate structures.

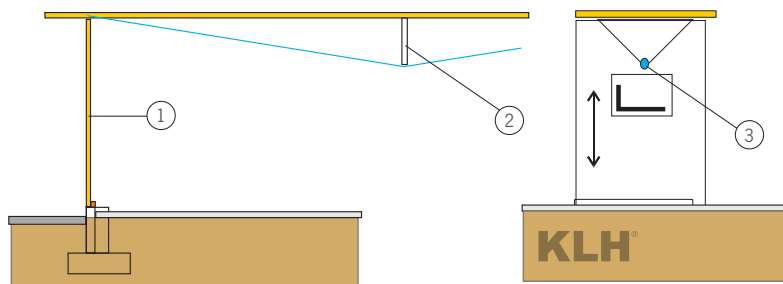


BASIC PRINCIPLE

01 BASIC PRINCIPLE OF THE SUPPORT STRUCTURE

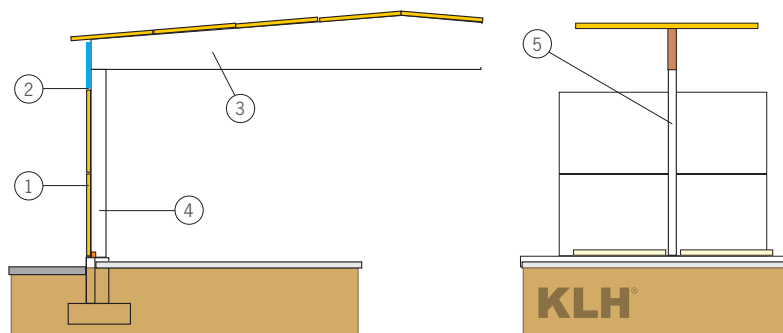
1.1 OVERVIEW OF HALL AND INDUSTRIAL BUILDINGS

Trussed panel – straight or slightly curved



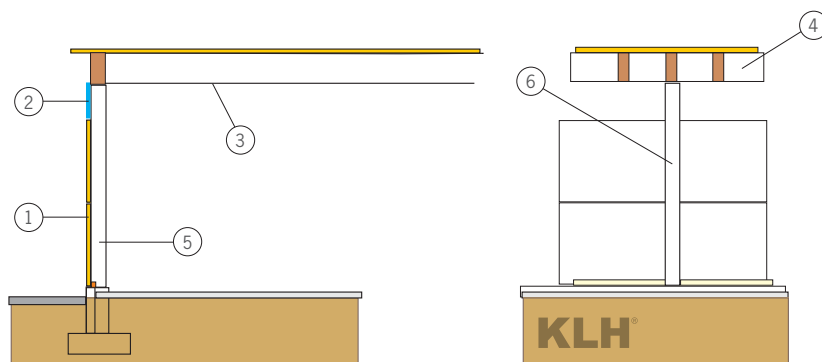
- ① Erected KLH® panels as wall (height approx. 400 to 500 cm)
- ② Height of trussing approx. $L/16$ th
- ③ Steel rod
1 x per element
 $e = 240$ to 290 cm

Skeleton structure with laminated timber – flat roof, gable roof or shed roof



- ① KLH® wall panels horizontally
- ② E.g. window slot
- ③ Beam height approx. $L/15$ th to $L/20$ th
- ④ Laminated timber column
- ⑤ Column grid approx. 400 to 550 cm

Ribbed panel element for flat roof or shed roof structures

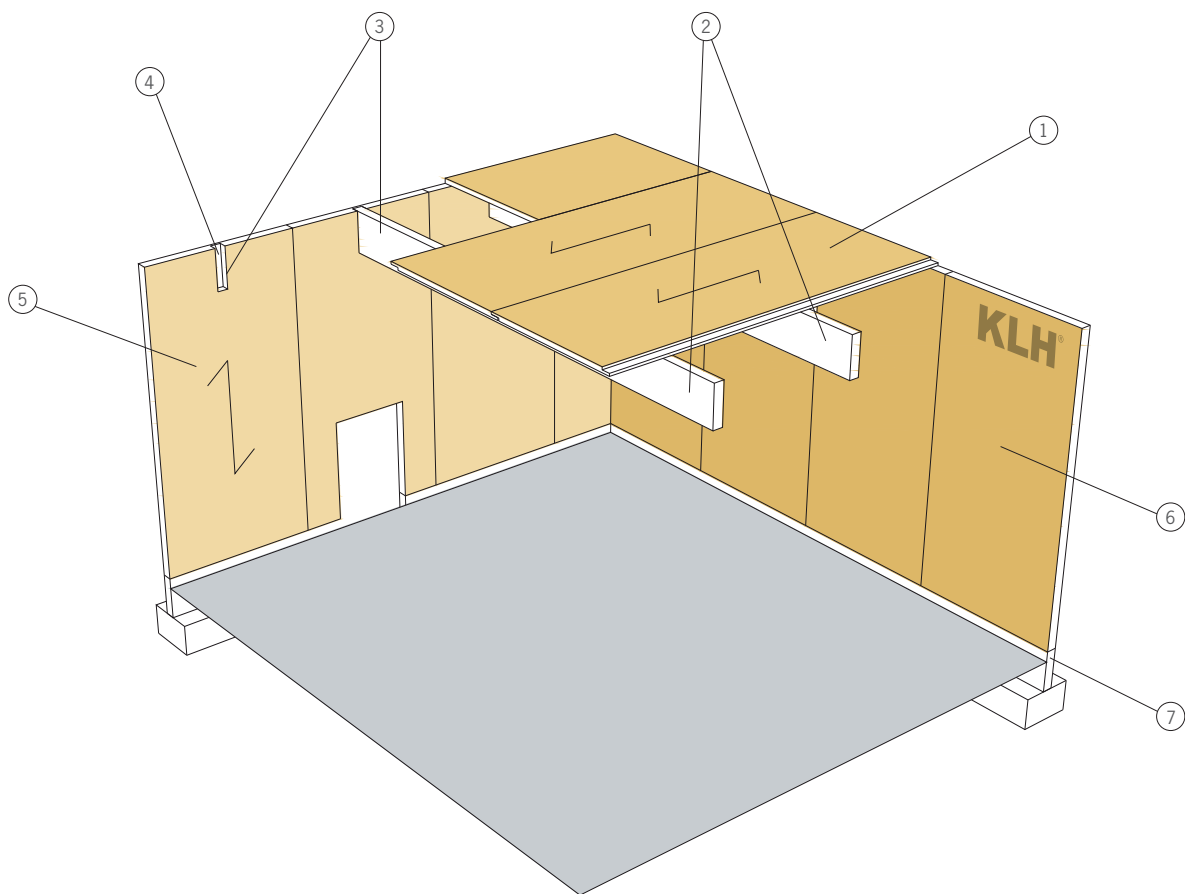


- ① KLH® wall panels horizontally
- ② E.g. window slot
- ③ Beam height approx. $L/25$ th to $L/35$ th, panel height approx. 10 to 15 cm
- ④ Ribbed grid 50 to 150 cm
- ⑤ Laminated timber column
- ⑥ Column grid approx. 400 to 550 cm

PENDULOUS WALL SYSTEM

02 PENDULOUS WALL SYSTEM

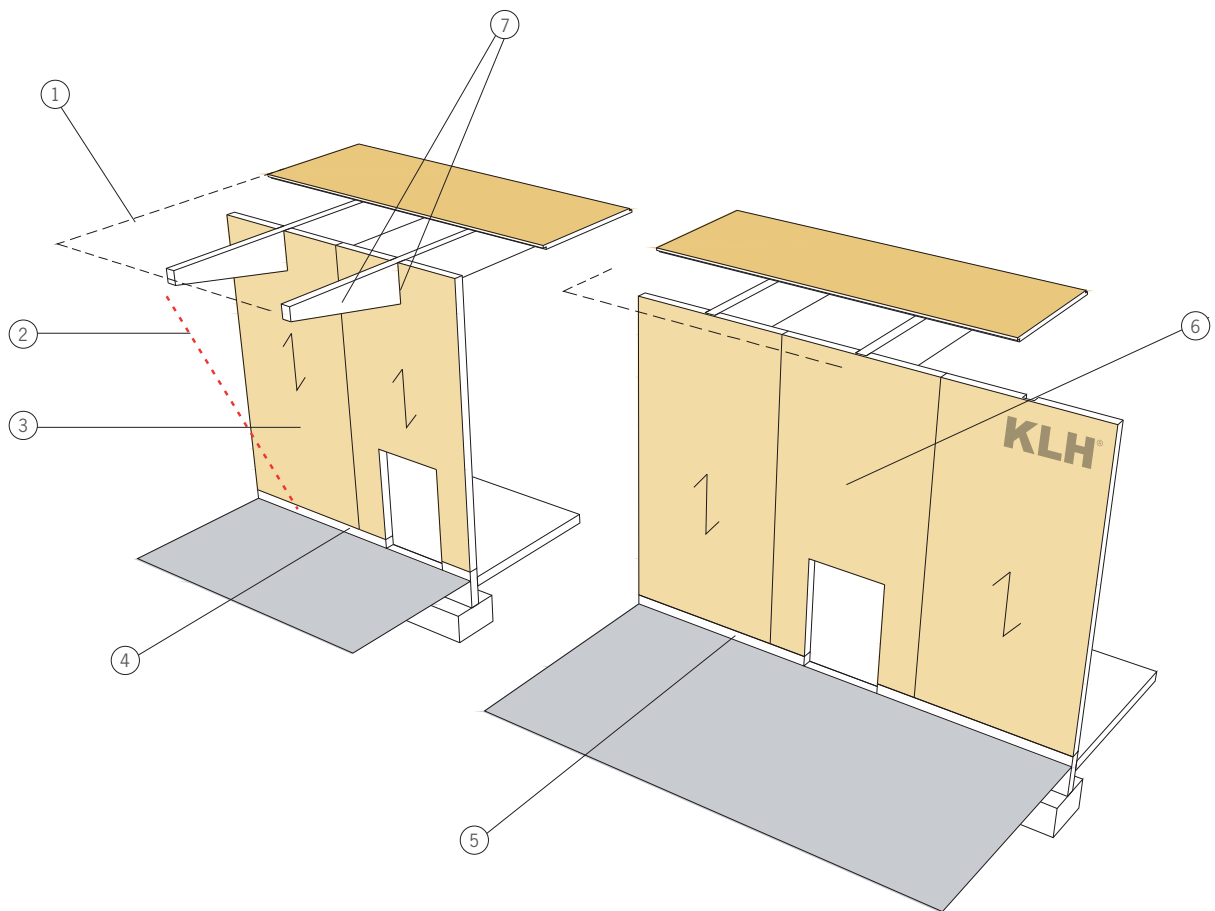
2.1 PENDULOUS WALL SYSTEM OF A HALL



- ① Roof panels transverse to roof girders
- ② Roof support system possible in varied forms: gable roof, curved girders, shed roof, trussed systems, etc.
- ③ Choose a rather narrow roof girder distance; this way very thin roof panels (6 to 8 cm) are possible
- ④ Roof girders are fitted into wall niches (no steel parts necessary)
- ⑤ Solid exterior walls for hall heights of 5 to 8 m; with wall thicknesses of 20 cm and more, also R90 fire resistance rating can be attained; 20 cm thick timber walls have a U-value of approx. 0.5, no further insulation level necessary – perfect for warehouses, industrial halls, etc.; the thicker walls are also very resistant to impact, e.g. with fork-lift trucks, cars, light trucks
- ⑥ Gable wall as a load-bearing component
- ⑦ Very simple strip foundations with a base

PENDULOUS WALL SYSTEM

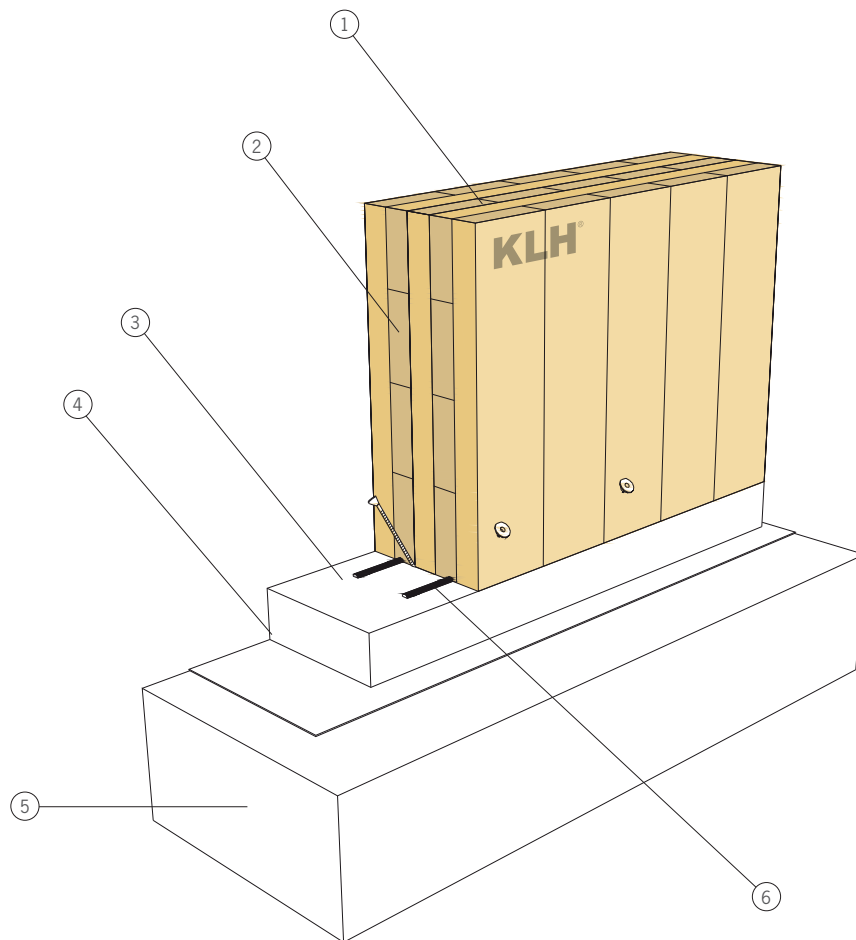
2.2 CANOPY – FAÇADE



- ① Canopy edge
- ② Rain incidence angle of 30° from vertical
- ③ With a sufficiently projecting roof also an exterior wall without a façade is possible
- ④ Caution: KLH® panels are only approved for utilisation classes 1 and 2; if the canopy protects the wall sufficiently (30-degree line from the canopy to the base), the wall can be assigned to utilisation class 2
- ⑤ Base – lower edge of wooden parts at least 30 cm above external level
- ⑥ Without a canopy a façade is definitely necessary outside, e.g. metal façade, poly carbonate panels
Caution: Paints are not a sufficient weather protection
- ⑦ Set roof girders as cantilever towards the outside, watch out for tightness where wall penetration takes place

DETAIL

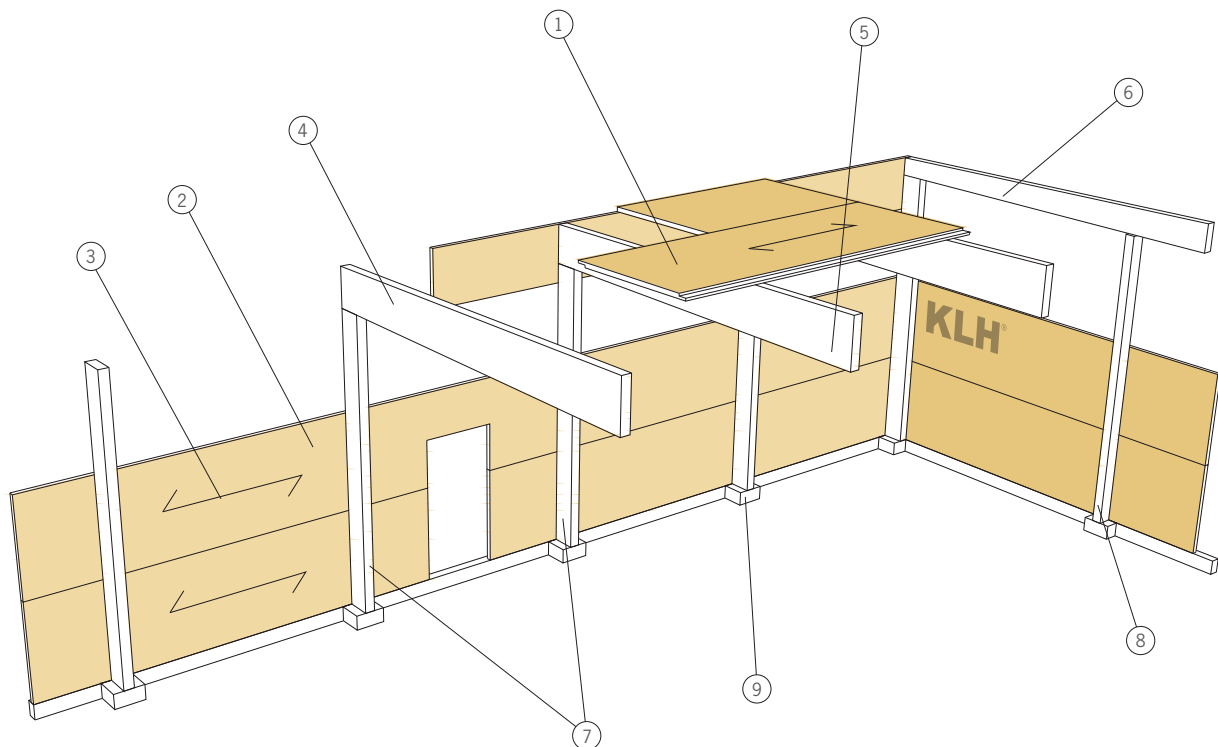
2.3 BASE DETAIL FOR MORE SOLID EXTERIOR WALLS



- ① KLH® wall element
- ② Wall thickness of 20 cm has a U-value of 0.5, fire resistance rating of e.g. REI 90 can be achieved
- ③ Put sill plate in mortar bed, tolerance compensation to concrete components
- ④ Lower edge of sill plate approx. 30 cm above external level
- ⑤ Concrete base
- ⑥ If there is no insulation level outside, it is important to guarantee joint tightness, e.g. 2 rows of joint tapes (directly under longitudinal layers); caution with vertical joints!

PENDULOUS SUPPORT SYSTEM

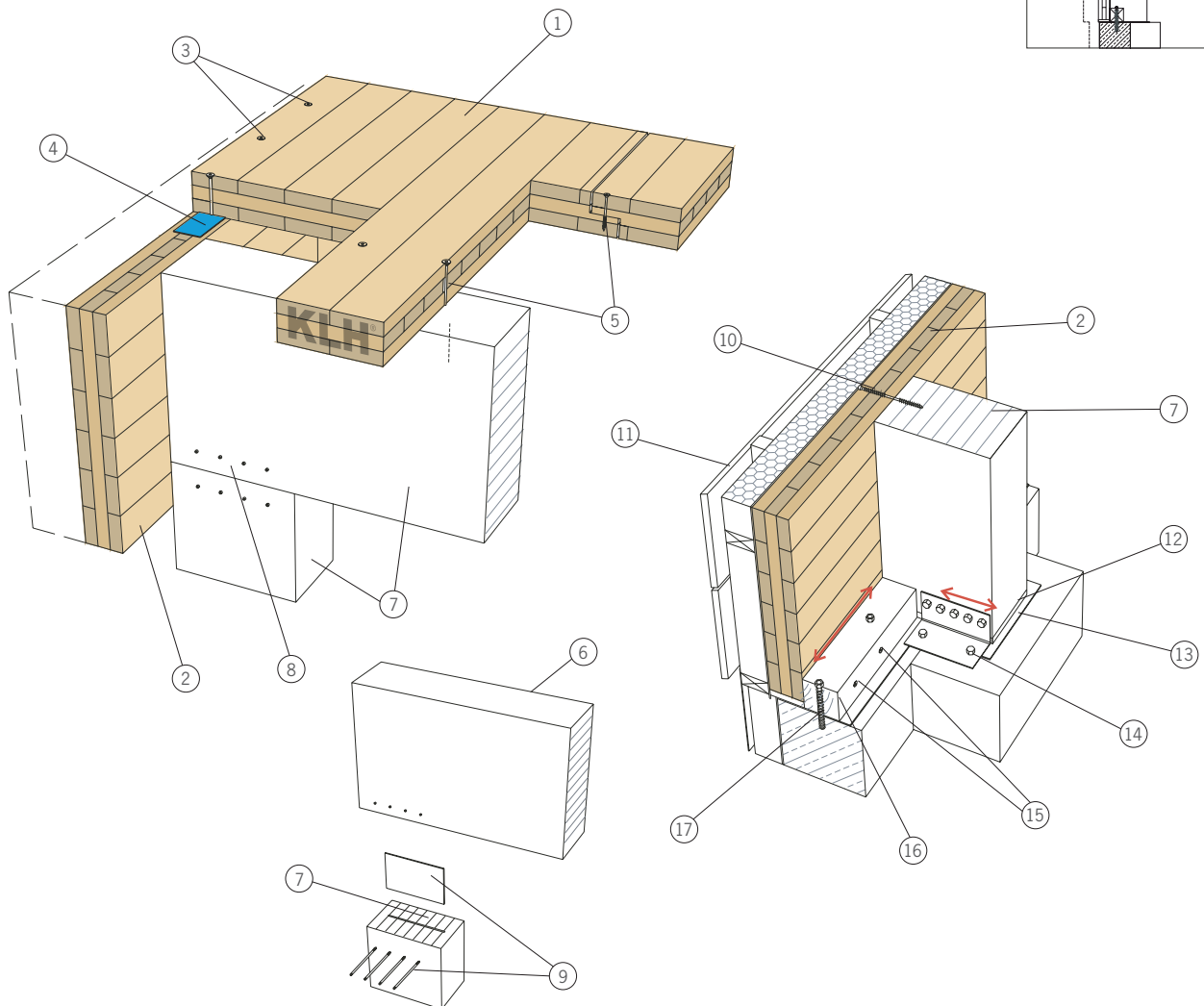
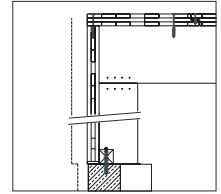
03 PENDULOUS SUPPORT SYSTEM OF AN INDUSTRIAL HALL



- ① Adjust roof panels to roof load and axis grid; panels up to 12 cm thickness are still economical, make use of the effect of continuity (3-span girder)
- ② Wall panels are usually additionally insulated outside, façade possible in varied forms
- ③ Wall panel horizontally oriented to deflect wind forces and for building reinforcement, thicknesses approx. 8 to 10 cm
- ④ Roof girder, e.g. of laminated timber
- ⑤ Roof support system possible in varied forms: gable roof beams, curved girders, trussed roof girders, etc.
- ⑥ Gable wall girder can usually be made thinner
- ⑦ Wooden columns in distances of approx. 4 to 5.5 m
- ⑧ Columns in the gable wall also in distances of 4 to 6 m
- ⑨ Simple individual footings, no fixing necessary, optimal for bad foundation soil

DETAIL

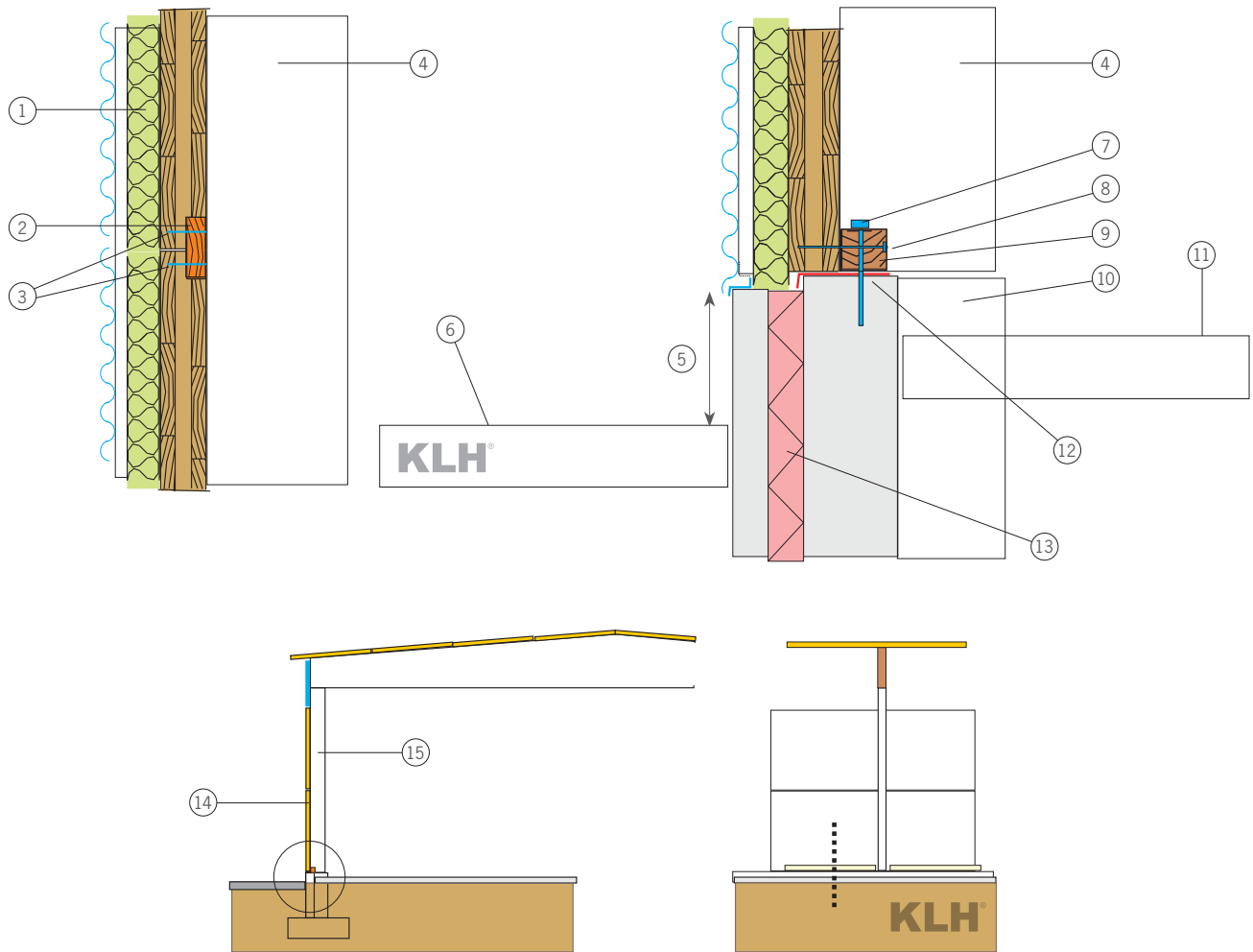
04 SUPPORT STRUCTURE CONNECTIONS FOR HALL CONSTRUCTIONS



- | | |
|---|---|
| ① KLH® ceiling panel | ⑧ Connection between column and girder |
| ② KLH® wall panels | ⑨ E.g. steel part for transmission of horizontal forces by means of self-drilling SFS dowel pins |
| ③ Screw connection of the ceiling panels with the wall panels – transfer of forces from the roof section to the wall section (building reinforcement) | ⑩ Suction anchoring of the walls in the columns by means of SFS or fully threaded screws |
| ④ Install joint tape at all panel joints if required for airtight design | ⑪ E.g. back-ventilated façade (wood, metal) |
| ⑤ Screw connection of the ceiling panels to each other and screw connection with the laminated timber girders according to static requirement; these two components together make up the roof section – bonds or pressure bolts are therefore no longer necessary | ⑫ Levelling of height difference using hardwood or metal |
| ⑥ Laminated timber | ⑬ Protection against rising moisture |
| ⑦ Laminated timber structure, column, girder | ⑭ Steel bracket – deflection of wind forces that have a direct effect on the walls in front of the column |
| | ⑮ Wood screws acc. to statics |
| | ⑯ S10 square timber |
| | ⑰ Concrete dowels, e.g. Hilti HVU M12 – distance acc. to statics |

DETAIL

05 DETAIL BASE POINT AND LONGITUDINAL WALL JOINT – VERTICAL SECTION

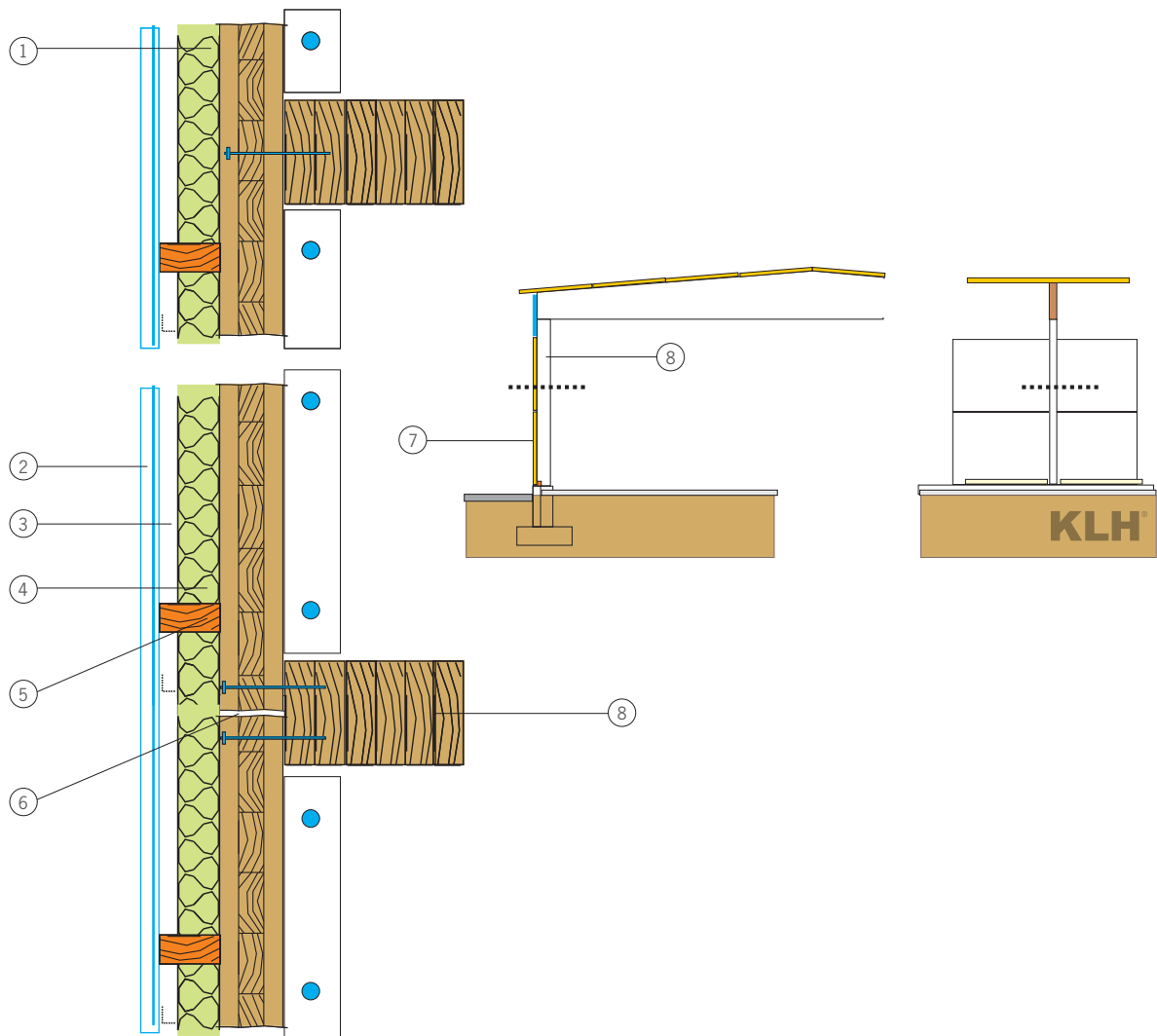


- ① Wall structure
Façade – metal sheet/wood/cement-bound chipboard
Back ventilation
Insulation between the battens
(8 cm insulation $U = 0.35 \text{ W/(m}^2\text{K)}$)
KLH® wall panel (approx. 60 to 108 mm with column
distance of approx. 400 to 550 cm)
- ② Plywood for joint covering
- ③ Nailing or screwing (according to static requirement)
- ④ Column
- ⑤ 30 cm protection against water splash
- ⑥ Upper edge of ground outside

- ⑦ Dowel/concrete screw
- ⑧ Self-drilling wood screw
- ⑨ S10 square timber (approx. 8/8)
- ⑩ Base for column
- ⑪ Level inside
- ⑫ Moisture sealing
- ⑬ E.g. prefabricated concrete component with insulating core
and exposed concrete outside
- ⑭ KLH® wall panel
- ⑮ Laminated timber column

DETAIL

06 DETAIL WALL – COLUMN – HORIZONTAL SECTION

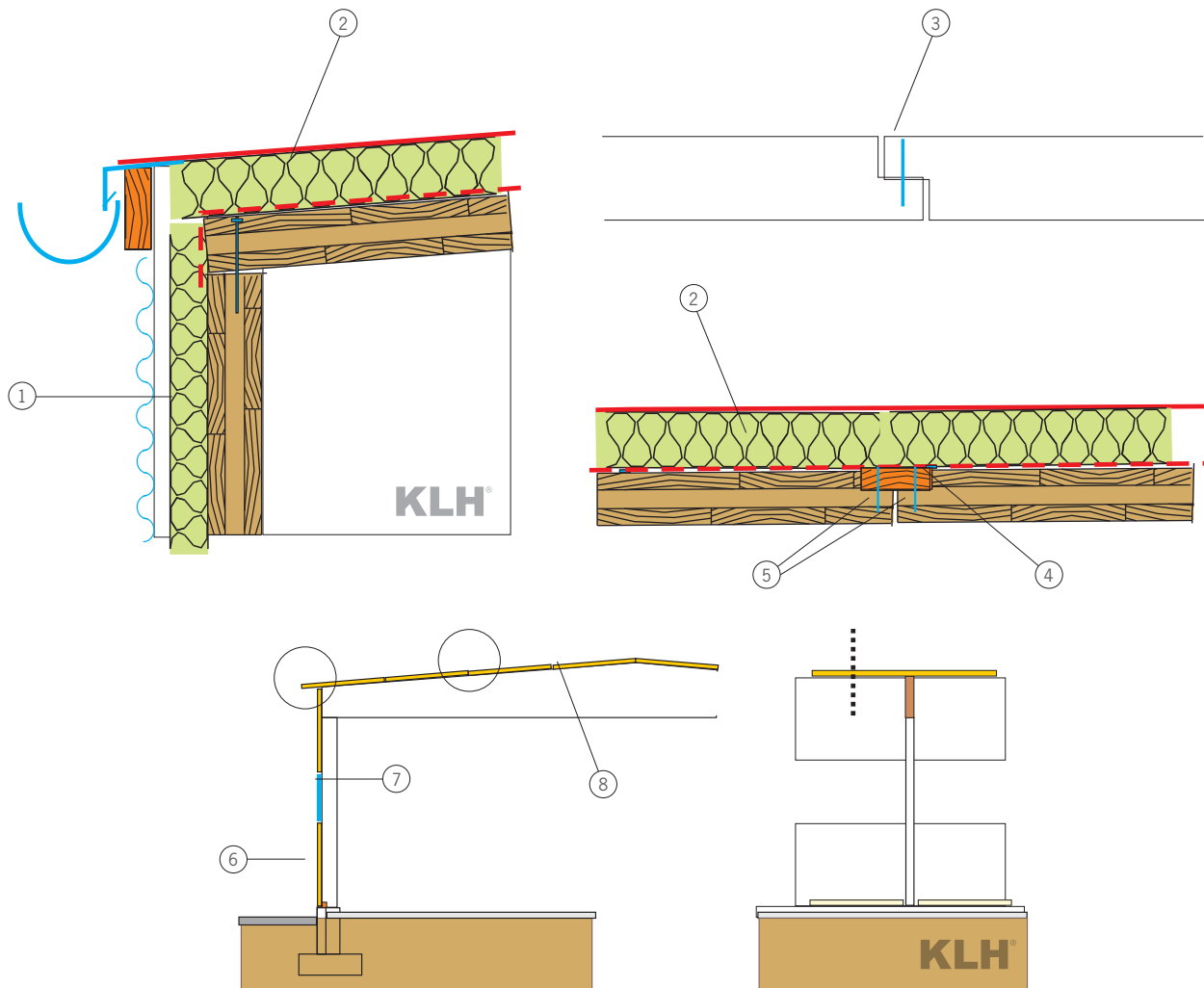


- ① Wall structure
Façade – metal sheet/wood/cement-bound chipboard
Back ventilation
Insulation between the battens
(8 cm insulation $U = 0.35 \text{ W/(m}^2\text{K)}$)
KLH® wall panel (approx. 60 108 mm
with column distance of approx. 400 550 cm)
- ② E.g. metal façade
- ③ Air space

- ④ Insulation
- ⑤ Battens
- ⑥ Butt joint of the panel elements
- ⑦ KLH® wall panel
- ⑧ Laminated timber column

DETAIL

07 DETAIL EAVES AND ELEMENT JOINT – VERTICAL SECTION

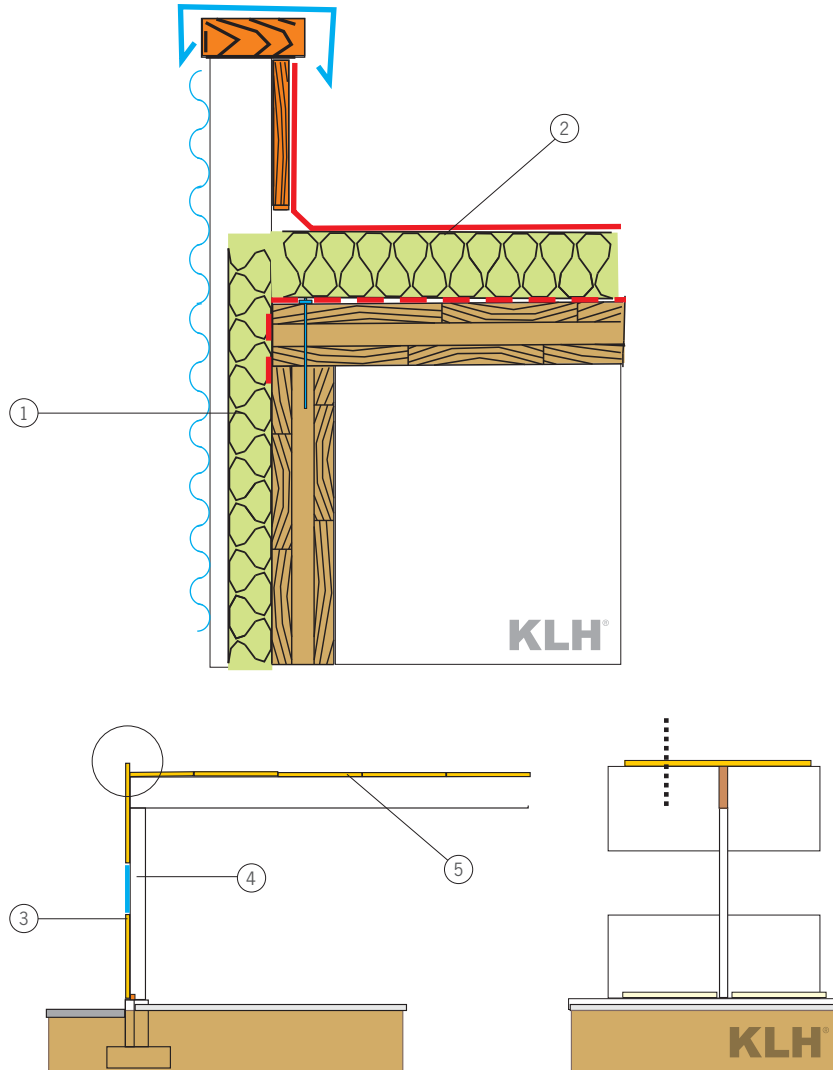


- ① Wall structure
Façade – metal sheet/wood/cement-bound chipboard
Back ventilation
Insulation between the battens
(8 cm insulation $U = 0.35 \text{ W/(m}^2\text{K)}$)
KLH® wall panel (approx. 60 to 108 mm
with column distance of approx. 400 to 550 cm)
- ② Roof structure
E.g. film roof
Insulation – loadable
Vapour barrier
KLH® solid wood panel

- ③ Shiplap edge as an alternative to butt board – particularly of benefit with higher loads
- ④ Plywood for joint covering
- ⑤ Nailing or screwing (according to static requirement)
- ⑥ KLH® wall panel
- ⑦ Laminated timber column
- ⑧ KLH® roof panel

DETAIL

08 DETAIL ATTIC DESIGN – VERTICAL SECTION

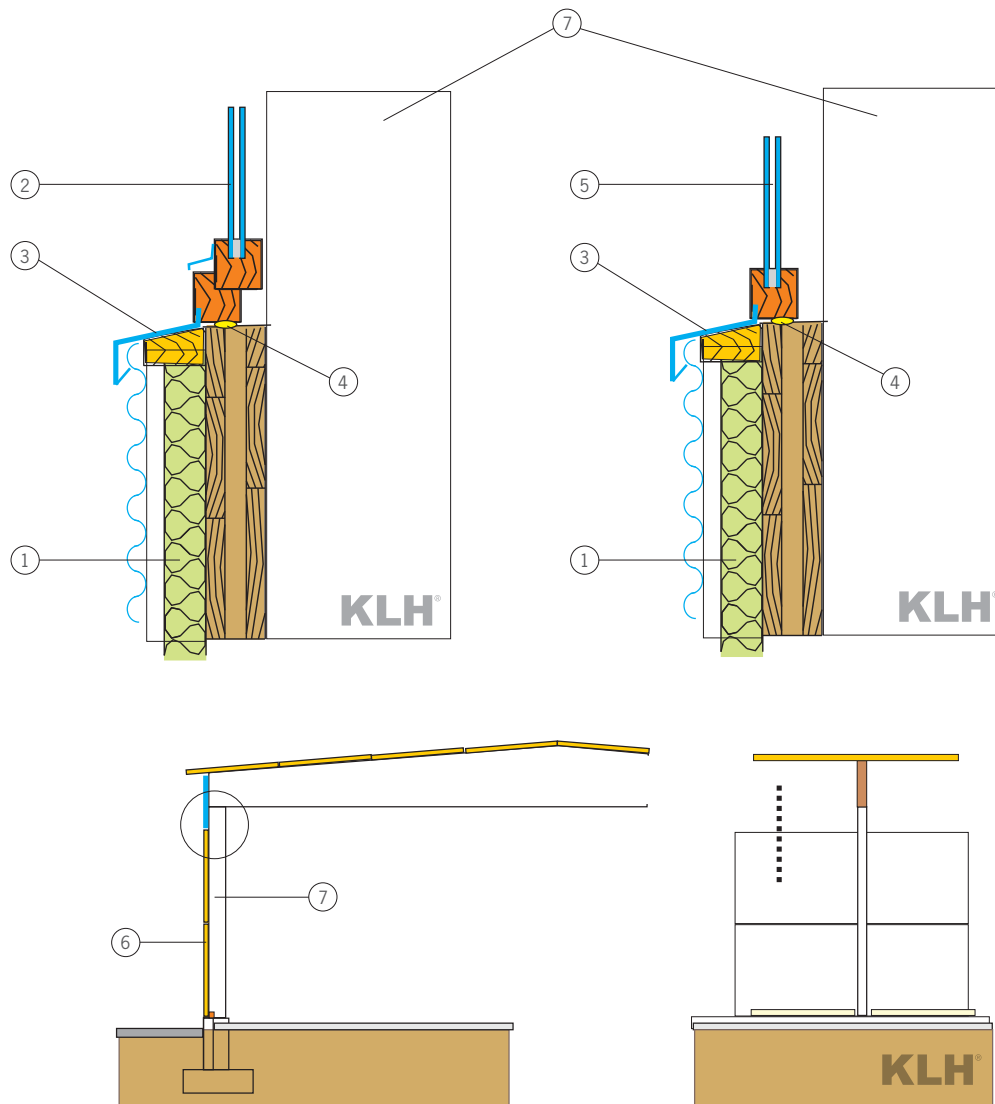


- ① Wall structure
 Façade – metal sheet/wood/cement-bound chipboard
 Back ventilation
 Insulation between the battens
 (8 cm insulation $U = 0.35 \text{ W}/(\text{m}^2\text{K})$)
 KLH® wall panel (approx. 60 to 108 mm
 with column distance of approx. 400 to 550 cm)

- ② Roof structure
 E.g. film roof
 Insulation – loadable
 (12 cm insulation $U = 0.25 \text{ W}/(\text{m}^2\text{K})$)
 Vapour barrier
 KLH® solid wood panel
- ③ KLH® wall panel
 ④ Laminated timber column
 ⑤ KLH® roof panel

DETAIL

09 DETAIL WINDOW CONNECTION – VERTICAL SECTION



- ① Wall structure
Façade – metal sheet/wood/cement-bound chipboard
Back ventilation
Insulation between the battens
(8 cm insulation $U = 0.35 \text{ W/(m}^2\text{K)}$)
KLH® wall panel (approx. 60 to 108 mm
with column distance of approx. 400 to 550 cm)
- ② E.g. window casement with opening possibility

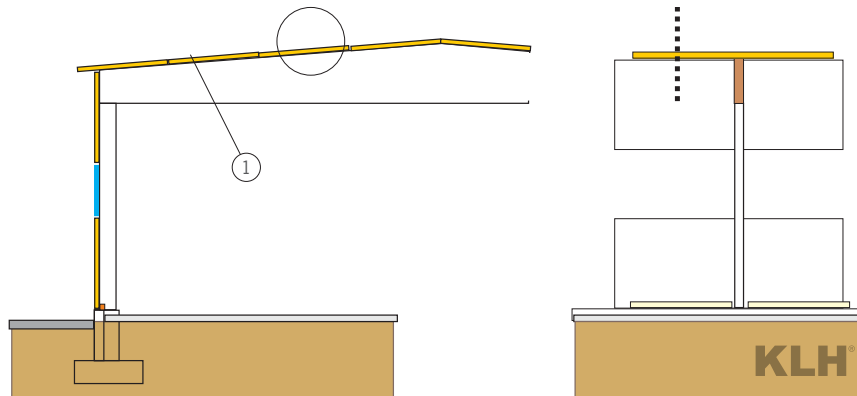
- ③ Metal sheeting – window sill
- ④ Sealing tape
- ⑤ E.g. fixed glazing
- ⑥ KLH® wall panel
- ⑦ Laminated timber column

Roof-top windows or fire smoke ventilation

This 3D cutaway diagram illustrates the internal structure of a roof-top window or fire smoke ventilation unit. The diagram is labeled with numbers 1 through 8, corresponding to the following components:

- 1: The main roof structure or base layer.
- 2: The insulation layer, depicted with a hexagonal pattern.
- 3: The window frame or mounting structure.
- 4: The window pane or glass unit.
- 5: The side wall or support structure.
- 6: The bottom support or base of the unit.
- 7: The internal frame or support structure.
- 8: The bottom seal or gasket.

The KLH logo is visible in the bottom right corner of the diagram.

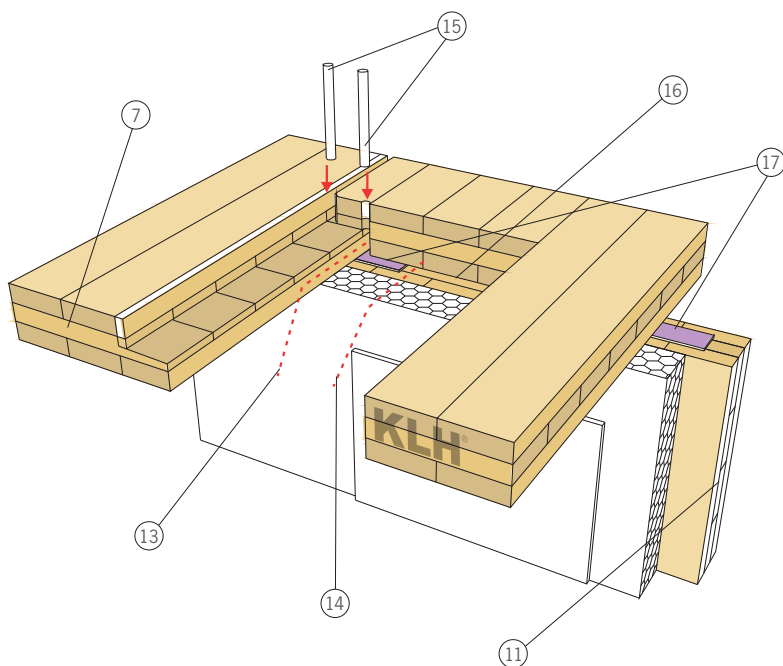
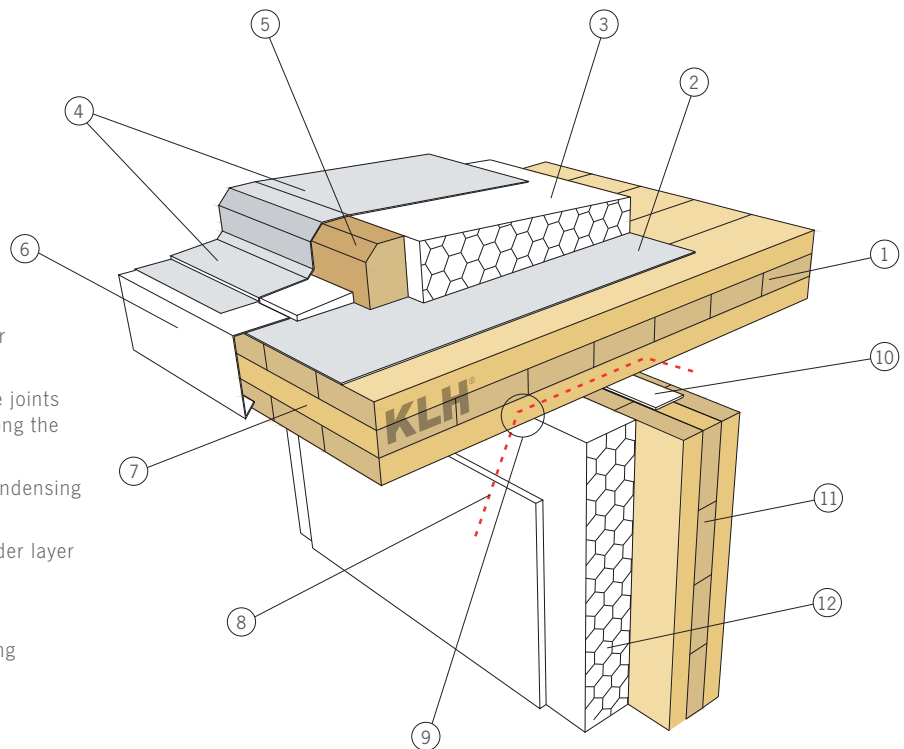


- 15

DETAIL

11 OVERHANGING ROOF PANELS – SEALING OF JOINTS

- ① KLH® roof panel
- ② Vapour barrier
- ③ Slope wedge insulation
- ④ Roof membrane
- ⑤ Margin strip for the fixing of the insulation
- ⑥ Edge metal sheeting
- ⑦ The roof panel is pulled outwards for use as direct projecting panel
- ⑧ Weakness: possible airway along the joints (between boards and panels and along the shiplap edge)
- ⑨ Risk of moisture damage through condensing humid interior air
- ⑩ Wide joint sealing if no vapour retarder layer has been used on the wall
- ⑪ KLH® wall panel
- ⑫ E.g. insulation with external rendering



- ⑬ Possible airway along the joint between the panels (e.g. at the shiplap edge) – cannot be fully avoided!
- ⑭ Possible airways also in the board joint area. Can only be prevented with living area surface!
- ⑮ Closure of the joints absolutely necessary, e.g. glue wooden dowels into the joints
- ⑯ There can be no tight joint without a joint tape
- ⑰ Wide sealing strips – for example, for the compensation of unevenness



NOTES





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