COMPONENT CATALOGUE FOR
INDUSTRIAL BUILDINGS
IMPRINT

© KLH Massivholz GmbH

Publisher and responsible for the content: KLH Massivholz GmbH
Version: 01/2012. Component Catalogue for Industrial Buildings

The content of this brochure is intellectual property of the company and is protected by copyright. The statements are recommendations and proposals only; a liability on the part of the publisher is excluded. Any type of reproduction is strictly forbidden and only permitted after written approval of the publisher.
<table>
<thead>
<tr>
<th></th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>BASIC PRINCIPLE OF SUPPORT STRUCTURE</td>
</tr>
<tr>
<td>02</td>
<td>PENDULOUS WALL SYSTEM</td>
</tr>
<tr>
<td>03</td>
<td>PENDULOUS SUPPORT SYSTEM OF INDUSTRIAL HALL</td>
</tr>
<tr>
<td>04</td>
<td>SUPPORT STRUCTURE CONNECTIONS FOR HALL CONSTRUCTIONS</td>
</tr>
<tr>
<td>05</td>
<td>DETAIL BASE POINT AND LONGITUDINAL WALL JOINT - VERTICAL SECTION</td>
</tr>
<tr>
<td>06</td>
<td>DETAIL WALL - SUPPORT - HORIZONTAL SECTION</td>
</tr>
<tr>
<td>07</td>
<td>DETAIL EAVES AND ELEMENT JOINT - VERTICAL SECTION</td>
</tr>
<tr>
<td>08</td>
<td>DETAIL ATTIC DESIGN - VERTICAL SECTION</td>
</tr>
<tr>
<td>09</td>
<td>DETAIL WINDOW CONNECTION - VERTICAL SECTION</td>
</tr>
<tr>
<td>10</td>
<td>DETAIL FIRE SMOKE VENTILATION - VERTICAL SECTION</td>
</tr>
<tr>
<td>11</td>
<td>OVERHANGING ROOF PANELS - SEALING OF JOINTS</td>
</tr>
</tbody>
</table>
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.
01 BASIC PRINCIPLE OF THE SUPPORT STRUCTURE

1.1 OVERVIEW OF HALL AND INDUSTRIAL BUILDINGS

Trussed panel – straight or slightly curved

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

Ribbed panel element for flat roof or shed roof structures
2.1 Pendulous Wall System of a Hall

- Roof panels transverse to roof girders
- Roof support system possible in varied forms: gable roof, curved girders, shed roof, trussed systems, etc.
- Choose a rather narrow roof girder distance; this way very thin roof panels (6 to 8 cm) are possible
- Roof girders are fitted into wall niches (no steel parts necessary)
- 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
- Gable wall as a load-bearing component
- Very simple strip foundations with a base
With a sufficiently projecting roof also an exterior wall without a façade is possible if roof girders are set cantilever towards the outside, watch out for tightness where wall penetration takes place.

Without a canopy a façade is definitely necessary outside, e.g. metal façade, poly carbonate panels.

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

Rain incidence angle of 30° from vertical

Canopy edge

Base – lower edge of wooden parts at least 30 cm above external level

Without a canopy a façade is definitely necessary outside, e.g. metal façade, poly carbonate panels.

Caution: Paints are not a sufficient weather protection

Set roof girders as cantilever towards the outside, watch out for tightness where wall penetration takes place.

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.
7. Caution: Paints are not a sufficient weather protection
8. Set roof girders as cantilever towards the outside, watch out for tightness where wall penetration takes place
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 m 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
04 SUPPORT STRUCTURE CONNECTIONS FOR HALL CONSTRUCTIONS

1. KLH ceiling panel
2. KLH wall panels
3. Screw connection of the ceiling panels with the wall panels – transfer of forces from the roof section to the wall section (building reinforcement)
4. Install joint tape at all panel joints if required for airtight design
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
6. Laminated timber
7. Laminated timber structure, column, girder
8. Connection between column and girder
9. E.g. steel part for transmission of horizontal forces by means of self-drilling SFS dowel pins
10. Suction anchoring of the walls in the columns by means of SFS or fully threaded screws
11. E.g. back-ventilated façade (wood, metal)
12. Levelling of height difference using hardwood or metal
13. Protection against rising moisture
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
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
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
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
08 DETAIL ATTIC DESIGN – VERTICAL SECTION

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)

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

- KLH wall panel
- Laminated timber column
- KLH roof panel
Wall structure
Façade – metal sheet/wood/cement-bound chipboard
Back ventilation
Insulation between the battens
(8 cm insulation U = 0.35 W/(m²K))
KLH wall panel (approx. 60 to 108 mm
with column distance of approx. 400 to 550 cm)
E.g. window casement with opening possibility

Metal sheeting – window sill
Sealing tape
E.g. fixed glazing
KLH wall panel
Laminated timber column
10 DETAIL FIRE SMOKE VENTILATION – VERTICAL SECTION

Roof-top windows or fire smoke ventilation

1. KLH roof panels
2. Roof membrane
3. Suspension of the roof membrane
4. Insulated add-on element (see also the rule details of the individual manufacturers)
5. Internal cladding
6. Connection between the vapour barrier and the inside of the insulated add-on element
7. Pull the vapour barrier of the roof area inwards
8. Attachment elements for height compensation depending on skylight dome attaching element – often also serves as cross beam (often necessary for thin ceiling panels)
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