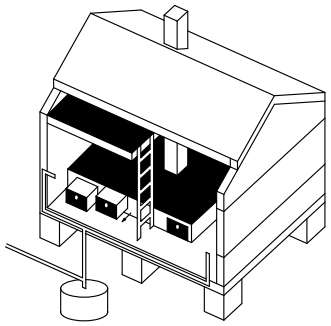
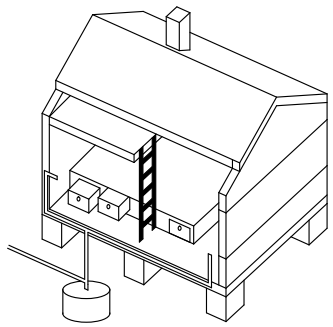
CONTENT

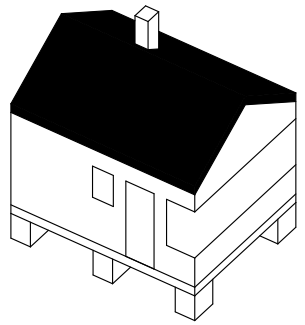
Content according to individual structural elements



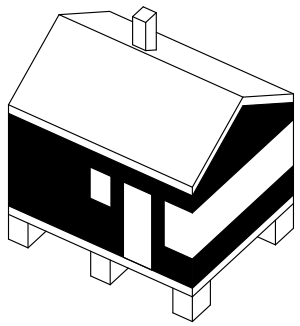
Storage spaces
235 - 247



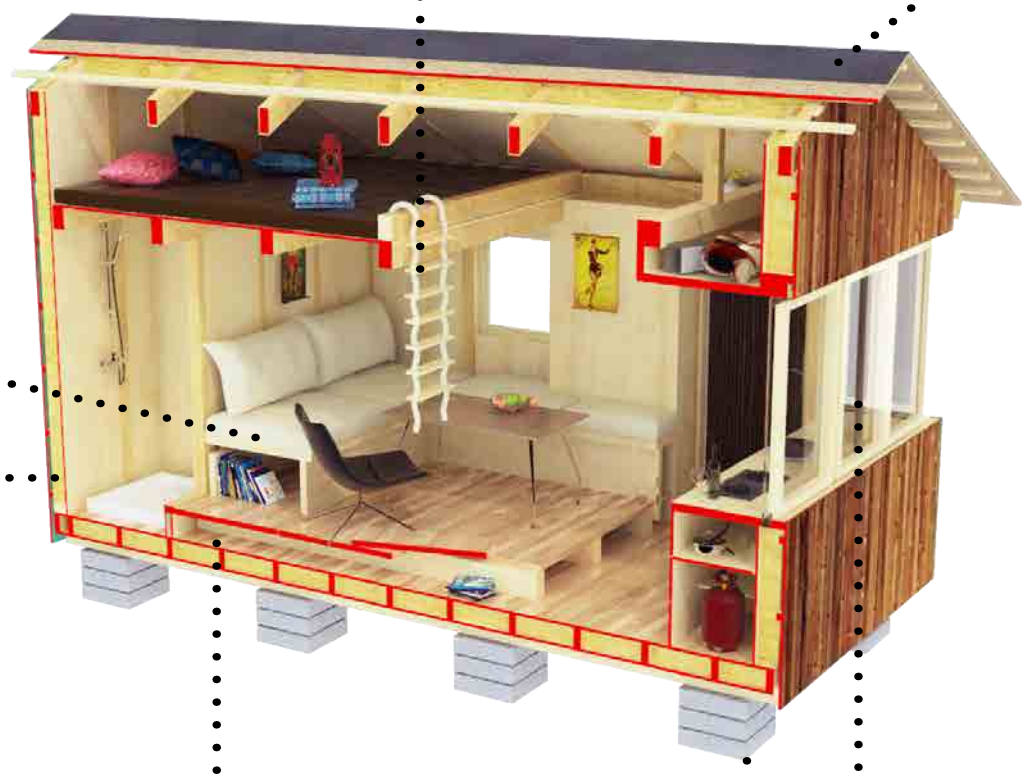
Stairs
222 - 233

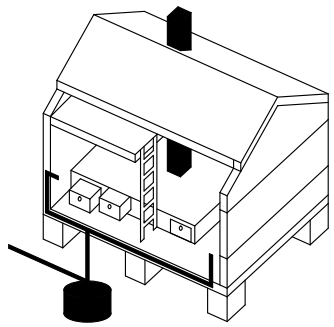


Roof
168 - 203

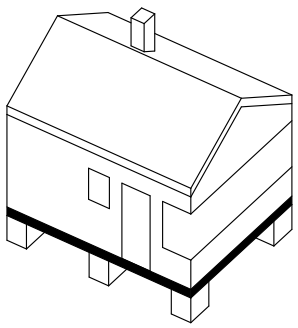


Walls
122 - 167

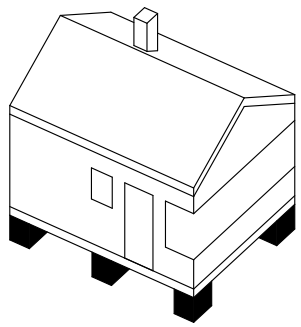




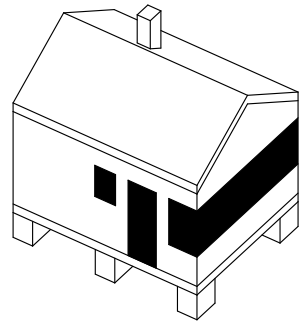
Plumbing & heating
248 - 271



Floors
98 - 121



Foundations
68 - 97

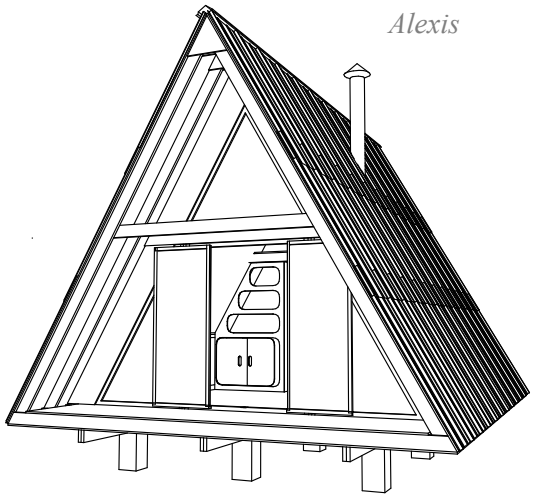


Openings
204 - 221

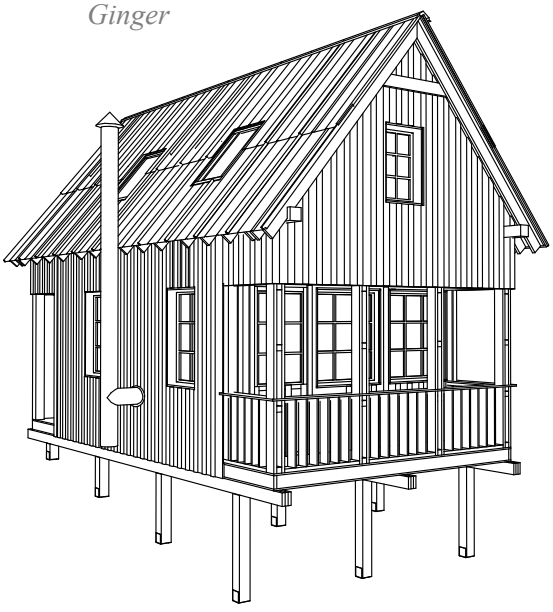
• Tiny A-frame house

The so-called A-frame is an object defined by a gable roof and floor. The "Alexis" design even shows an equilateral triangle on a cross section. Logically, the interior space includes corners with less than walking height. However, a good design using such places for storage or seating/bedding furniture can make full use of all space and the basic concept of a house with no interior walls is maintained.

Alexis



Ginger



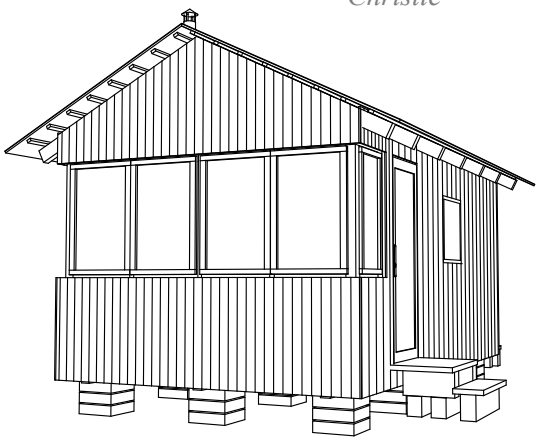
• Gable roof

A traditional mass design with two floors and a covered deck can accommodate a small group of people year-round. The design emphasises primarily the function of the building and its load-bearing structure which must be easy to assemble. The attic is designed for stand-up height; however, its classic proportions have kept its cosiness and romantic nature of attic spaces.

• Cottage

The slightly sloping gable roof creates an impression of a traditional, holiday camp building. The single-storey cabin with its typical generous floor area also hides a mini-loft for sleeping. The face of the cottage opens out to the landscape, providing an undisturbed panoramic view from almost all corners within. The back part of the house offers a covered safe zone. The cottage is intended for occasional holidays; the availability of all amenities makes it suitable for living year-round. The basic cottage shape stems from traditional Czech holiday houses.

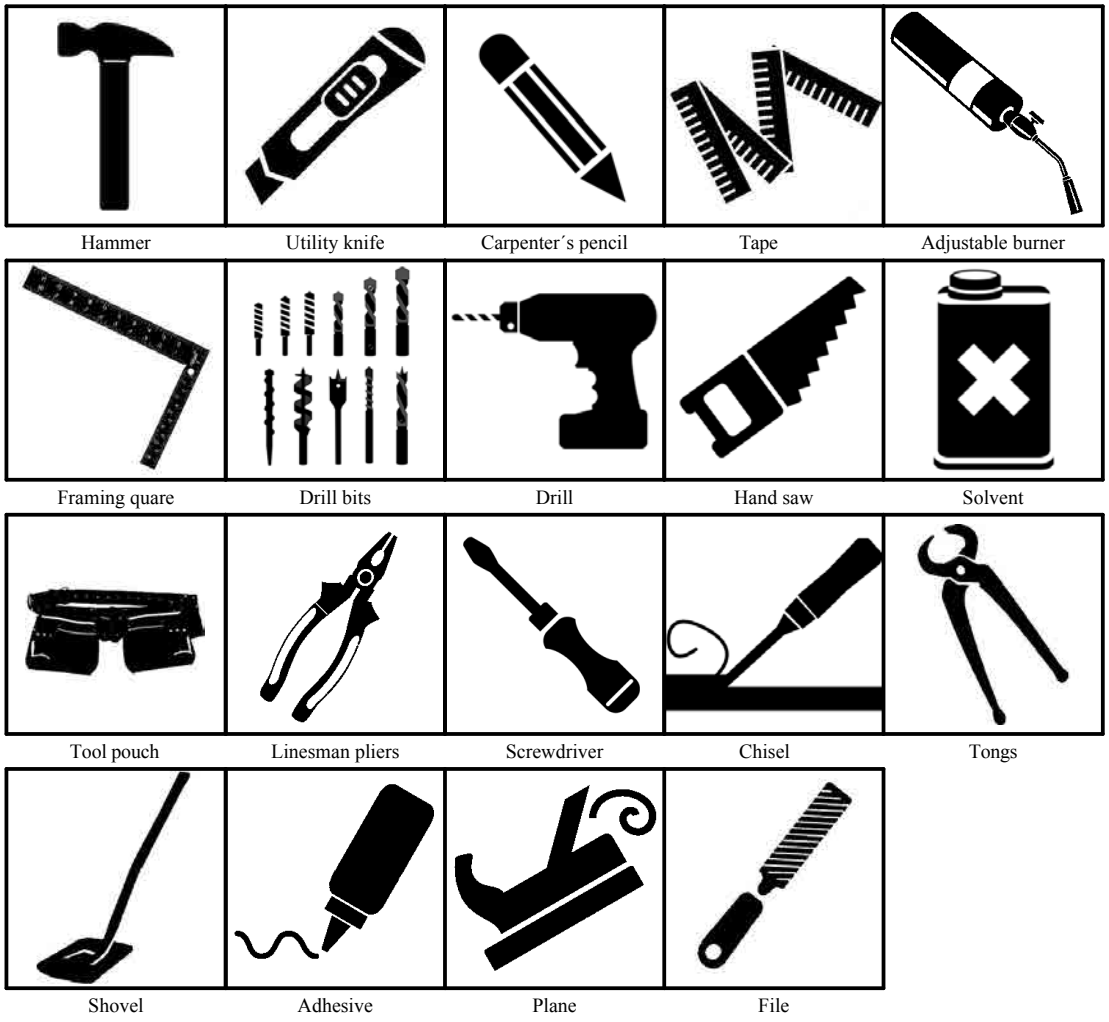
Christie

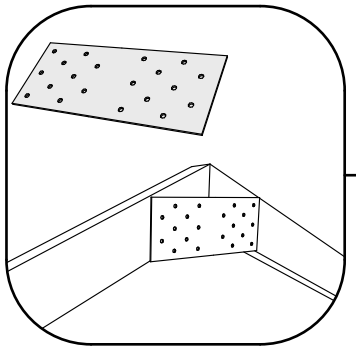


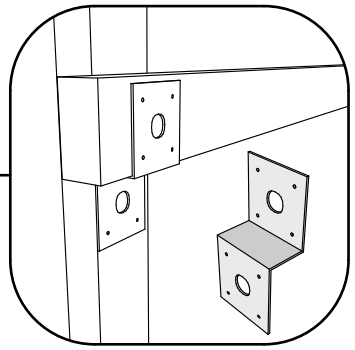
Tools

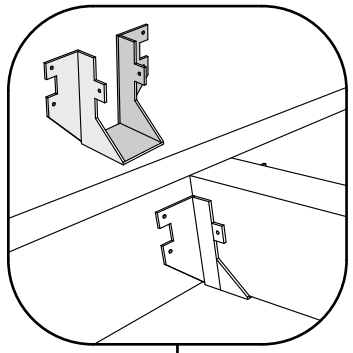
I recommend purchasing the best quality tools commonly available to non-professional builders. Good quality tools usually save your time and your work proceeds faster. I have compiled a list of tools which are commonly used in a tiny house construction process.

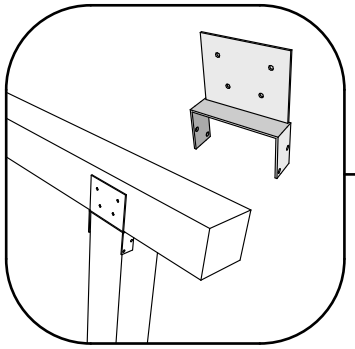
Besides various tools, you will need a huge quantity of cabinet clamps. These perfect helpers are practically irreplaceable in case of a “solo construction”. They are used in every construction stage. I recommend preparing clamps from the smallest to the largest dimensions (with arms even longer than 1 m).

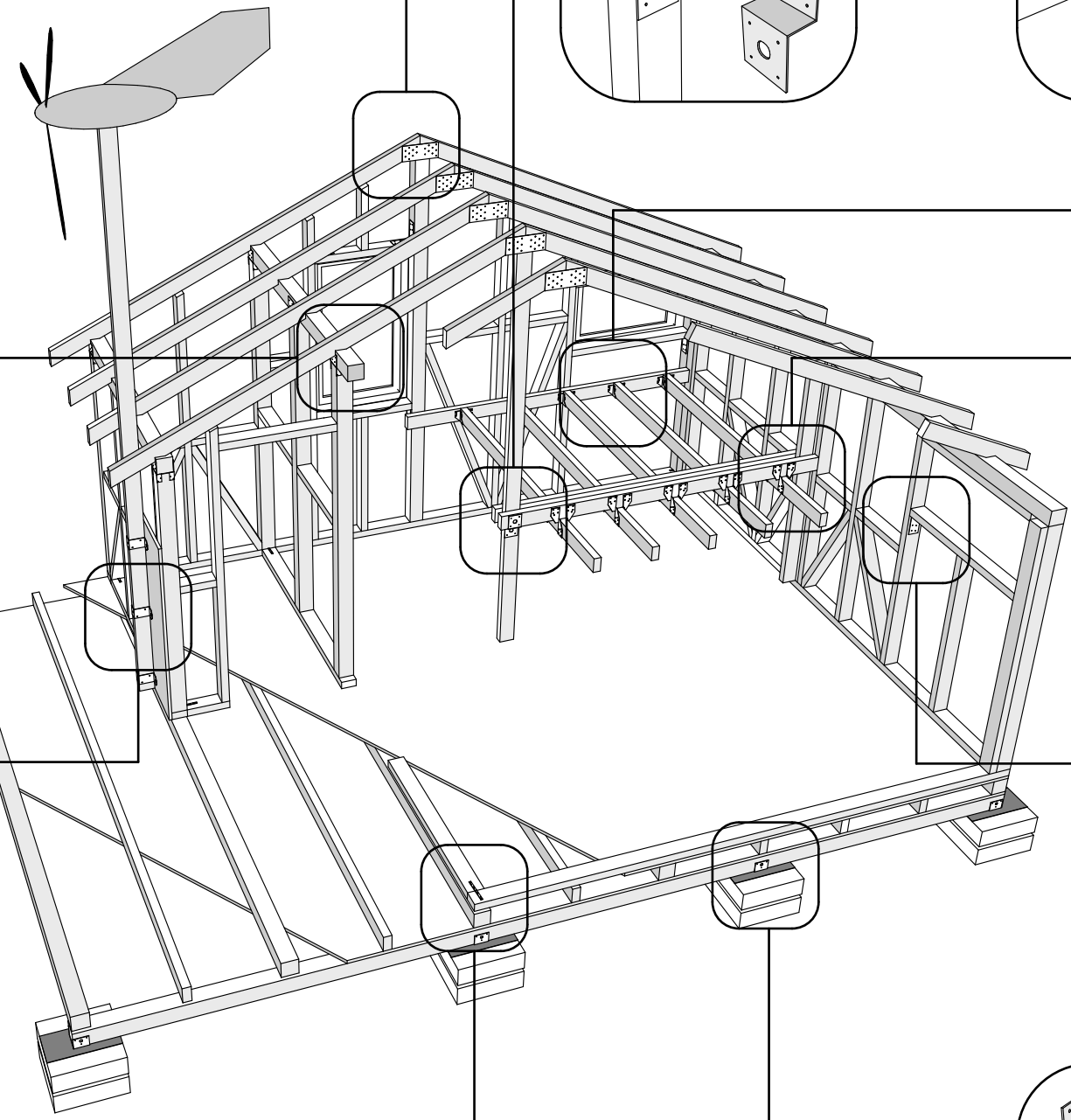


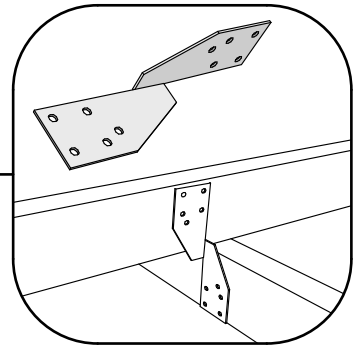


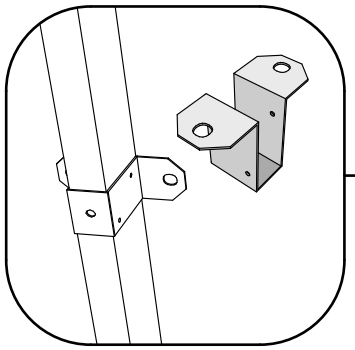


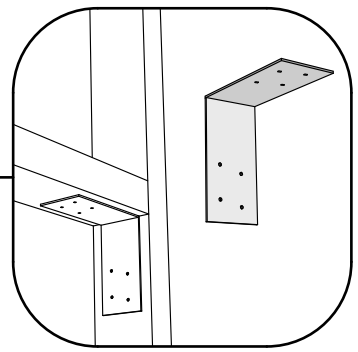


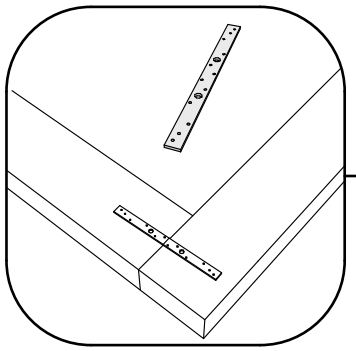


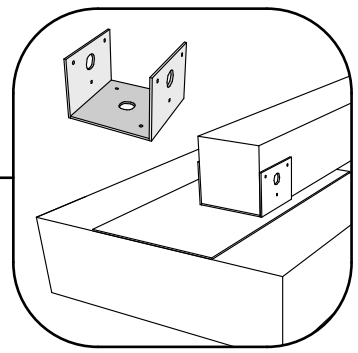




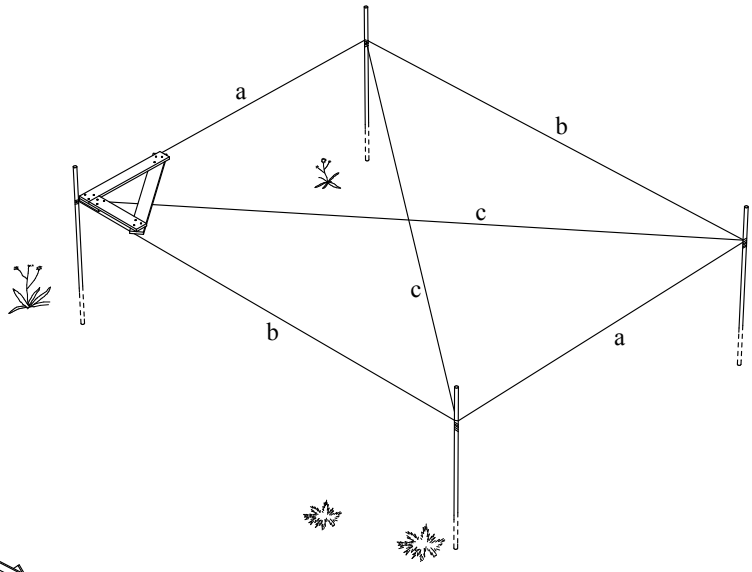


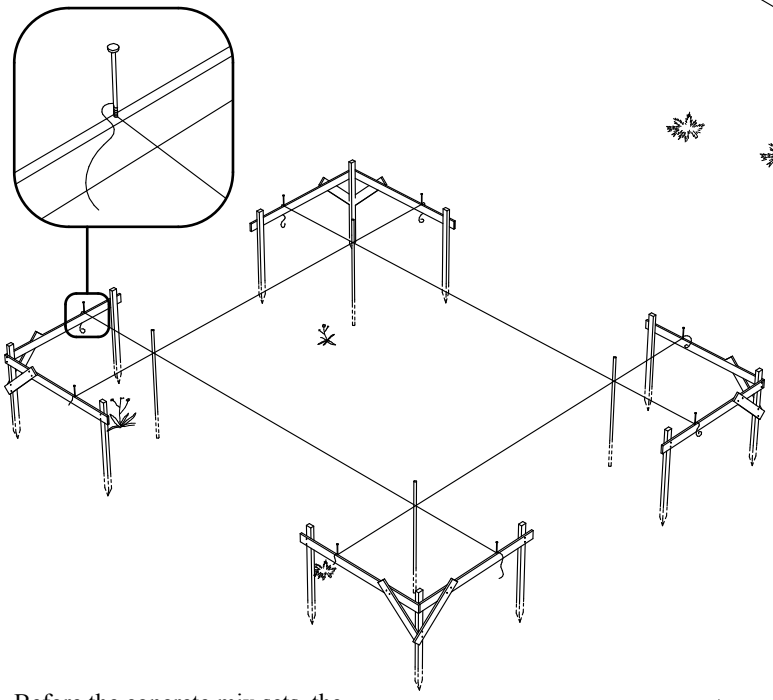






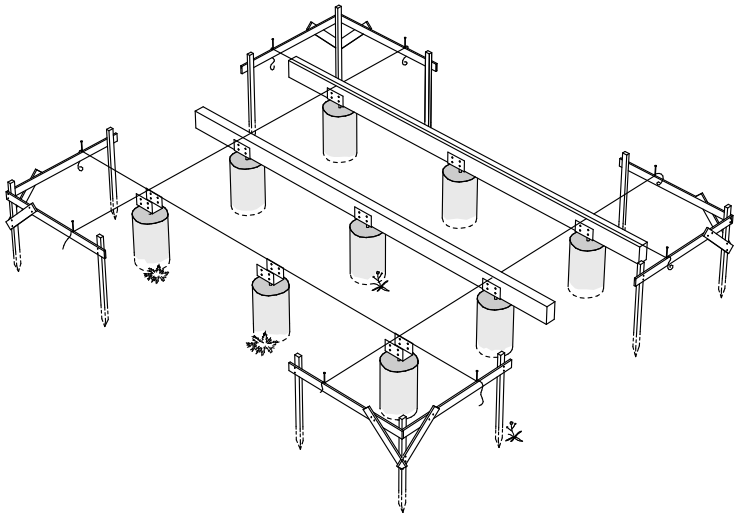
The next step is adding the remaining points. For an orthogonal rectangular shape with side lengths (a) and (b), as in the figure, we can check using the diagonals and any imperfections in the surveying can be rectified. The diagonal lengths, (c), should be identical. In the case of a square shape, the diagonals should even be perpendicular to each other.





Another possible step is constructing so-called benches. These are used to mark distances with a line. The stakes can then be removed and we can start working on the foundations. If necessary, ropes can be tied to the nails in the benches again to check precision of your construction work.

Before the concrete mix sets, the positions of the metal anchors to which the fundamental load-bearing flooring will be fastened, must be finalised. Again, the precise locations according to the plans can be detected from the positions already marked on the auxiliary structures - benches. The final surveying must be checked properly as the bench positions can sometimes be disturbed during construction work.



Foundation slab - Ann; East Pennsylvania

• Concrete foundation blocks

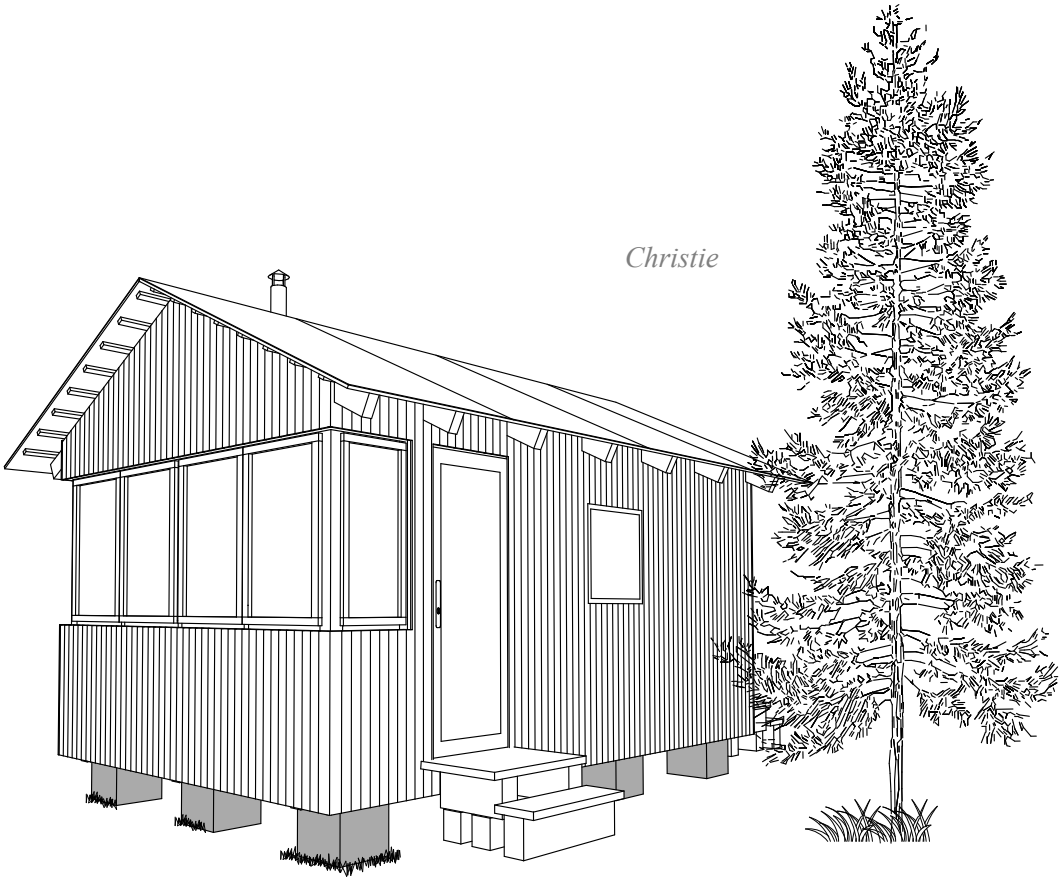
Material:

1.) Concrete (binder/sand/gravel/water) or complex dry concrete mix
2.) Boards/planks
3.) Anchor bolts
4.) Metal fasteners - basic

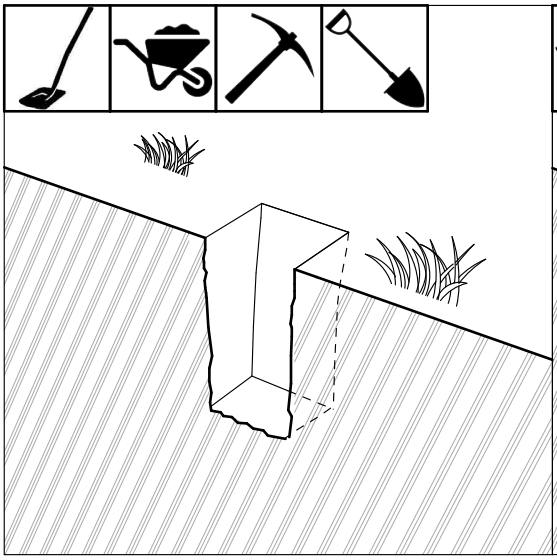
Postup instalace:

The dimensions of concrete foundation blocks for simple, single-storey wooden houses are usually about 14" x 14"/ 350 x 350mm with a depth of about 24"/ 600mm. After precise surveying, dig a pit and make sure the size of the future foundations corresponds with the project documents (fig. a). Prepare the formwork with inside dimensions according to the dimensions of the future foundation (fig. b). Then install the formwork in place and prepare your concrete mix. Pour in the opening.

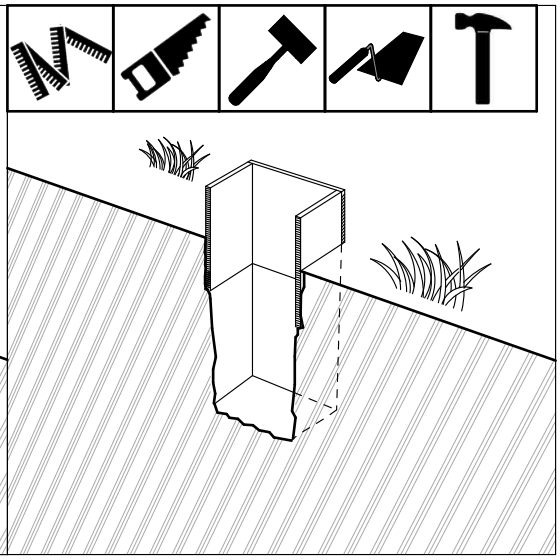
Prior to pouring the concrete, make sure that the formwork is well fixed in its place. Install the metal fasteners in the concrete while curing; adjust its height and position to prepare it for attaching the relevant floor joist (fig. c/d). Leave the concrete to cure properly. Remove the formwork and add gravel for aesthetic finish in the surroundings.



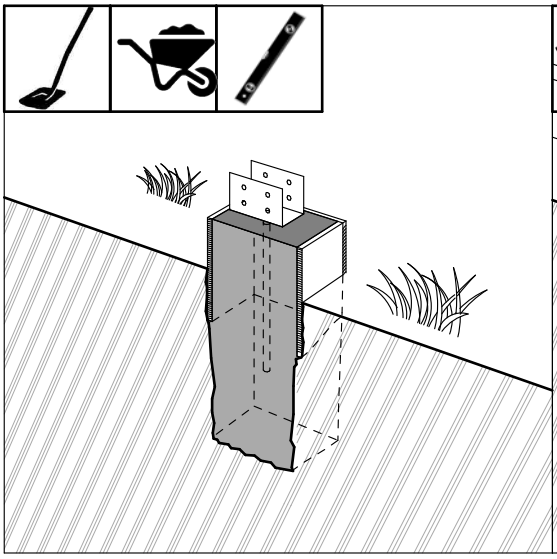
Christie



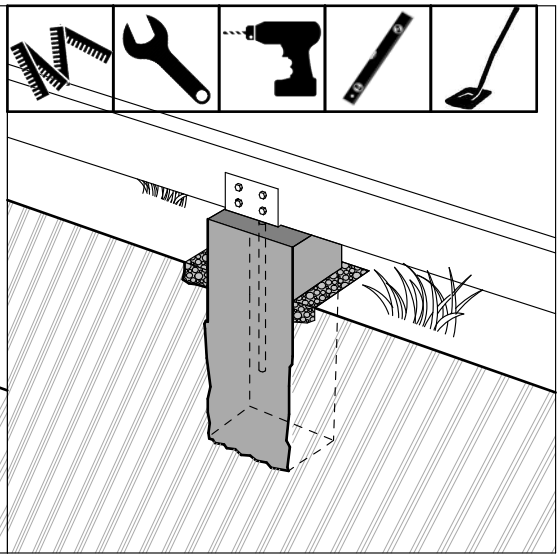
a.) Dig a hole for the foundations.



b.) Prepare the formwork for the block part above the ground.

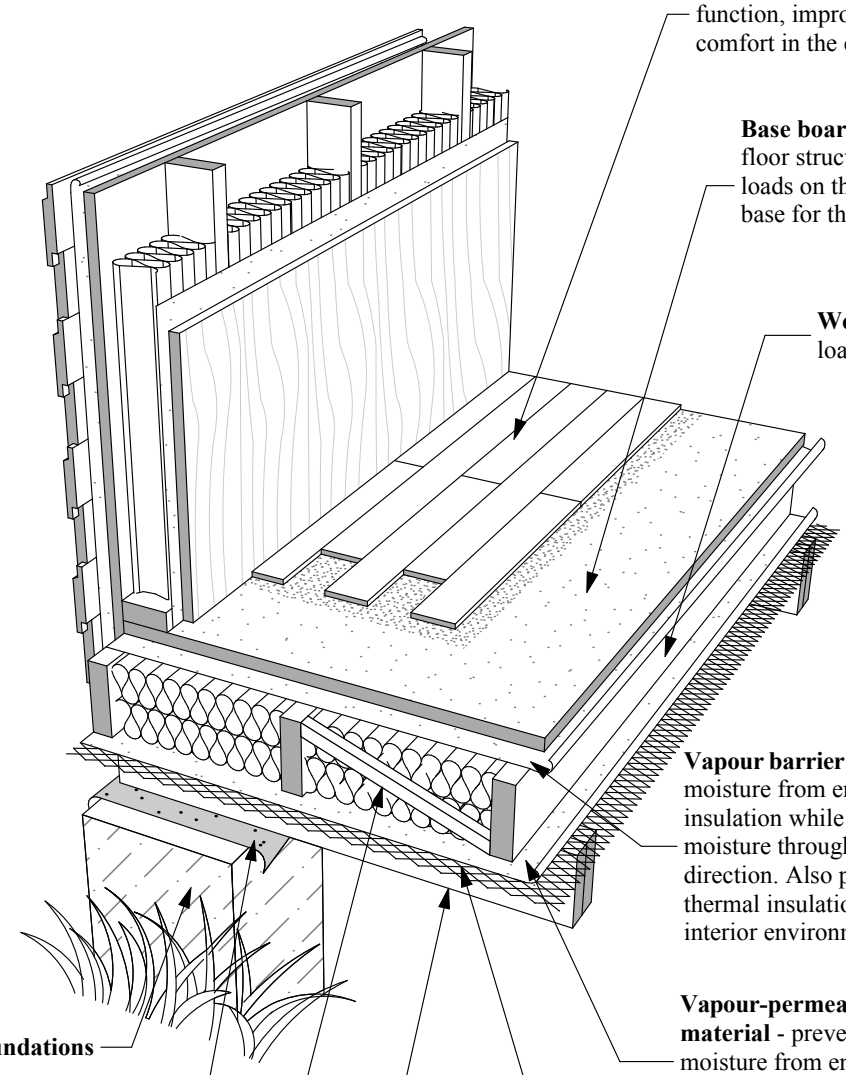


c.) Pour concrete in and install the anchor in the fresh concrete.



d.) Once the concrete has cured, remove the formwork and install floor joists.

• Individual components and functions thereof



Finish flooring - this floor layer has primarily an aesthetic function, improving the user comfort in the environment

Base board - bracing the entire floor structure, distributing the loads on the walls, acting as base for the finish flooring layer

Wood floor joist - load-bearing function

Vapour barrier - preventing interior moisture from entering the thermal insulation while letting undesired moisture through in the opposite direction. Also prevents small parts of thermal insulation from entering the interior environment of the building

Vapour-permeable air barrier material - preventing exterior moisture from entering the structure while letting moisture from the structure out into the exterior

Wire lath - separating thermal insulation from the exterior environment, preventing rodents from entering etc. Other materials can substitute for the lath - OSB/plywood or other suitable material - however, they must be permeable to facilitate vapour elimination - this may be achieved e.g. by drilling holes in the boards

Foundations

Asphalt sheet - insulating the joists from rising moisture from the ground

Blocking - used as bracing for individual floor joists

Multiple joist - this structure distributes loads directly to the building foundations

Floor framing - cabin Bettie; Texas

Walls

Walls define the interior space of the house and, together with the ceiling and floor, constitute our "third skin" next to our clothes. It is very important how we treat this layer, particularly if we live in a cooler part of the Earth where more than half of our life is spent in the interior environment.

There are many factors applicable to wall assessment. The most important information on walls includes the height, load-bearing capacity, or the interior and exterior finish. Walls can be plain white, with rough wooden patterns, glossy, transparent, soft, or sliding. This complex topic has been narrowed down in this tiny house construction guide to cover primarily technical details one must know when intending to build a tiny house.

If the foundations and the board that forms the first upper storey floor are ready, the time has come to start on the load-bearing structure of the walls which will support the floor of the second storey or the roof structure. The load-bearing wall structure is accompanied by other components depicted in the picture on the next page. This chapter will summarise the basic construction principles for various types of walls, with an emphasis on wooden houses. We will explore individual material and aesthetic solutions of the façade and interior. There are many types of walls so the most important types best suited for tiny house construction have been selected for this book.

Erecting the first two wall frames

• Individual components and functions thereof

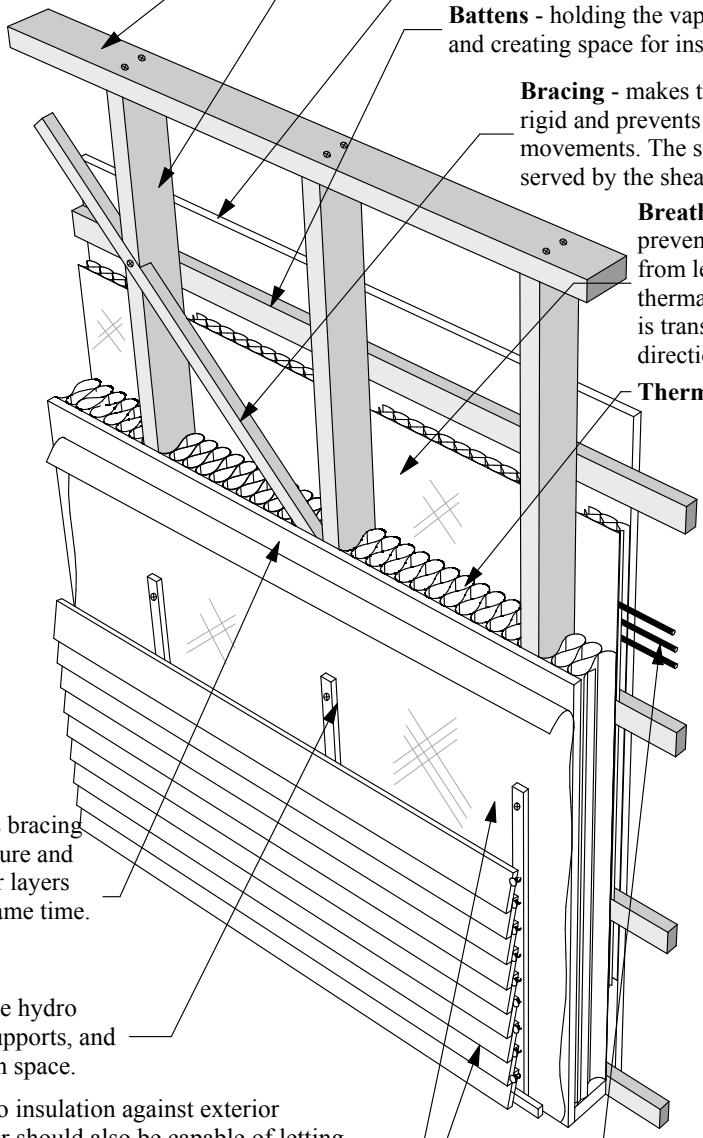


Plate - part of the load-bearing frame

Stud - part of the load-bearing frame

Interior deck - aesthetic function; covers the installations behind it.

Battens - holding the vapour barrier and creating space for installations

Bracing - makes the structure more rigid and prevents undesired movements. The same function is served by the sheathing.

Breathable membrane - prevents interior moisture from leaking into the thermal insulation. Moisture is transported in the other direction.

Thermal insulation

Sheathing - acts as bracing for the entire structure and protects the interior layers of the wall at the same time. However, it is not mandatory.

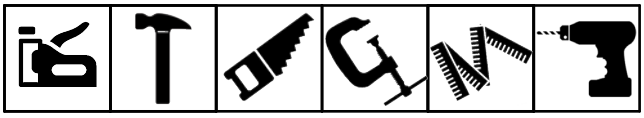
Battens - fixing the hydro insulation to the supports, and creating ventilation space.

Rainscreen - hydro insulation against exterior dampness; the layer should also be capable of letting through any moisture from the inside of the wall outwards.

Exterior cladding - protects the building from exterior weather influences and has an aesthetic function.

Installations - this part of the structure accommodates the power, water, sewerage and other mechanical installations.

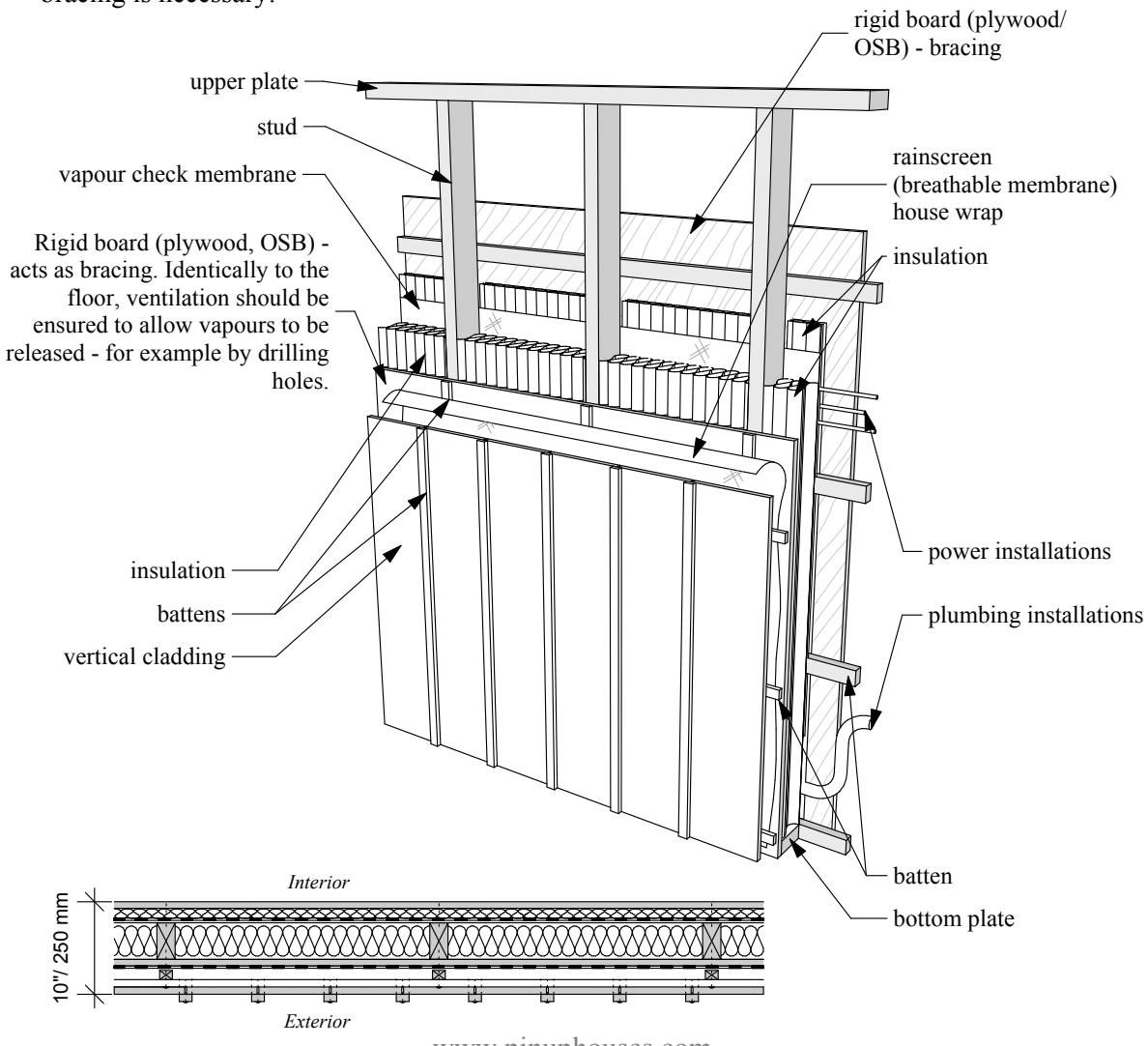
- **Wall with installations and vertical cladding**

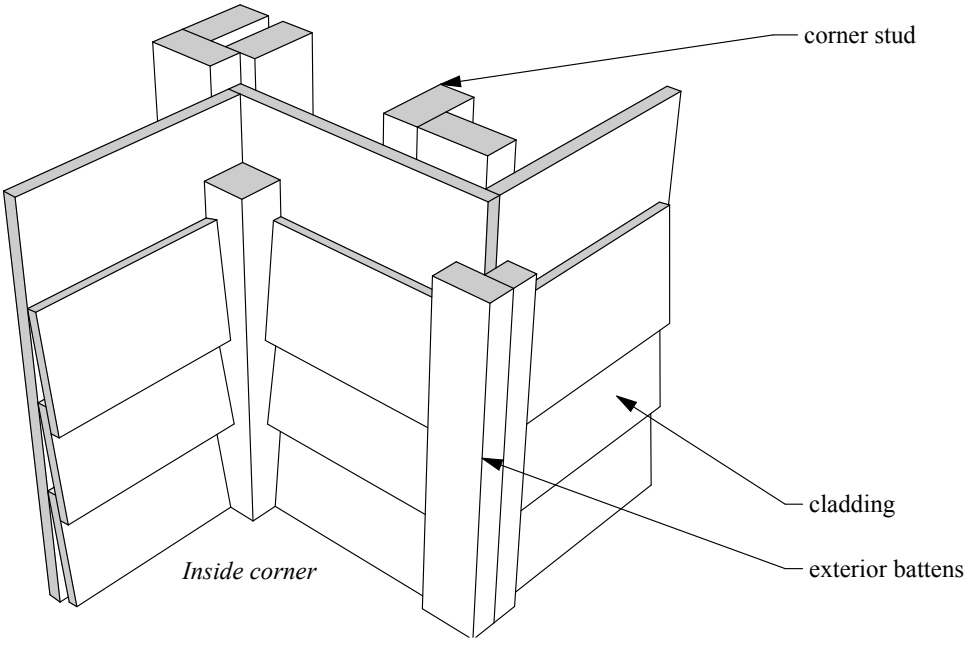


Material:

Interior deck (osb/ plywood/ boards etc.)
Vapour check membrane
Battens 1"x2"/ 25x50mm + installations + insulation
Lumbers 2"x4"/ 50x100mm + insulation
OSB 23/32"/ 18mm
Battens 1"x2"/ 25x50mm
Rainscreen
Battens 1"x2"/ 25x50mm
Cladding 3/4"x4 1/2"/ 20x115mm (boards) + finish battens 1"x2"/ 25x50mm

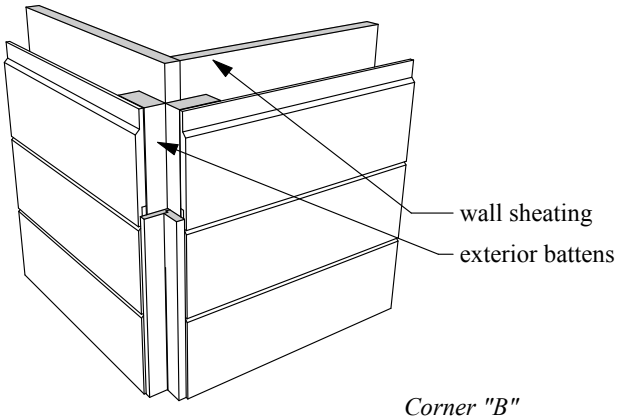
This type of walls offers space for installations. It is braced by osb boards, so no other bracing is necessary.



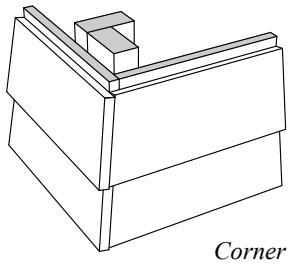


Corner "A"

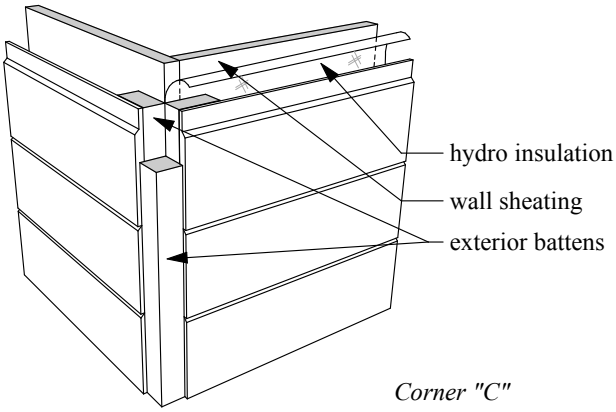
Examples of exterior connection of two walls



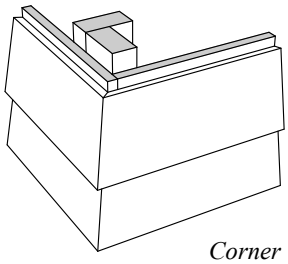
Corner "B"



Corner "D"



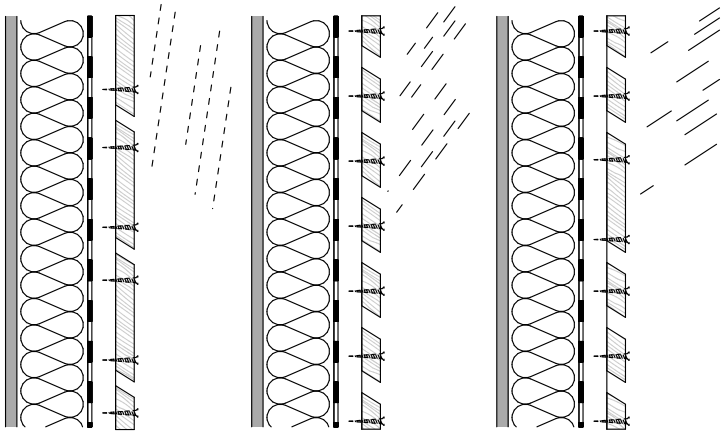
Corner "C"

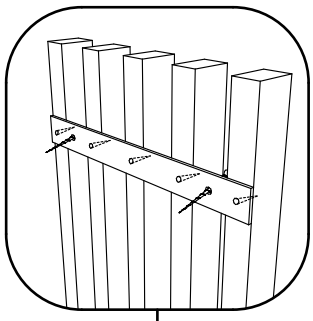


Corner "E"

When assembling a façade from horizontally positioned wood profiles, they must always be slanted "along with the water". That makes rainwater flow along the outside of the façade components.

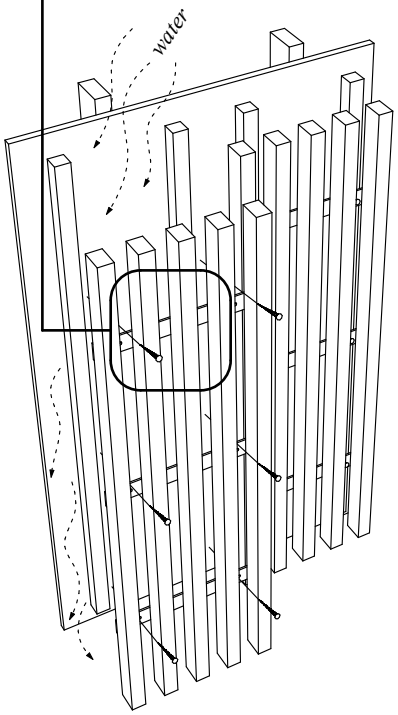
Boards (bevelled) *Battens (bevelled)* *Boards and battens (bevelled)*



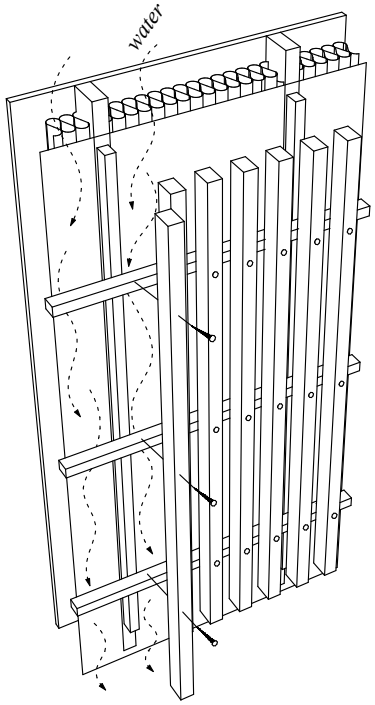


Battens can be screwed on to a steel strap, creating a panel which can be attached to vertical battens as a unit. Another method is making a grid of vertical and horizontal auxiliary battens and screwing, or nailing the individual exposed façade battens on to that.

Façade panel assembly



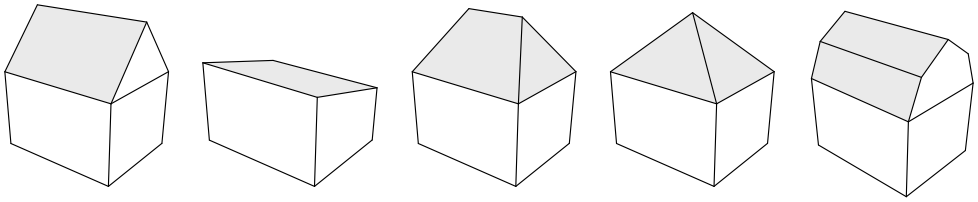
Sequential assembly of individual battens



Roof structure

The roof truss is defined as the load-bearing structure which mainly carries the roofing, including the batten systems, and any possible insulation-related structures. The most important parts of the roof truss systems are the wall beams, purlins, beams, rafters, tie beams, straps and various types of bracing. The roof truss must be stable in lengthwise as well as crosswise - this is facilitated by the windbracing structures and gable walls.

Most common roof types:

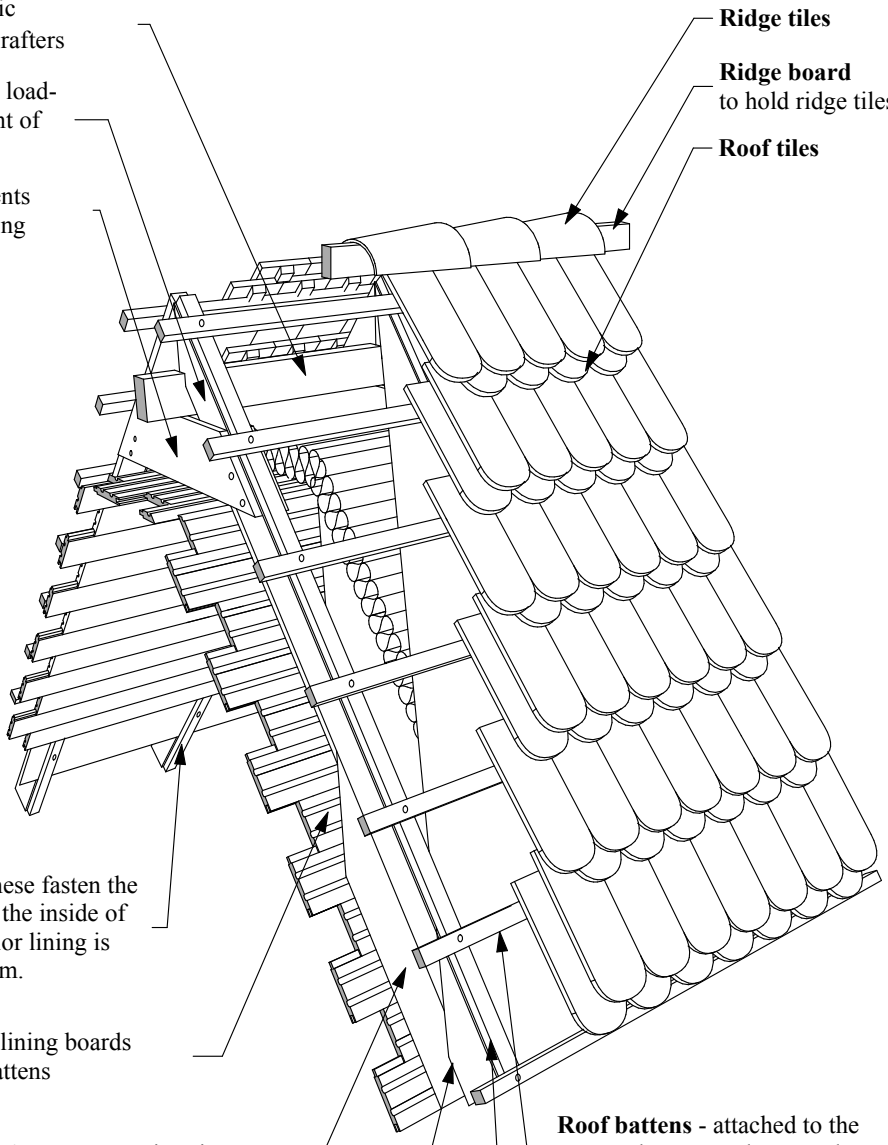


Gable roof *Shed roof* *Hip roof* *Pyramid hip roof* *Gambrel roof*

The roof truss systems of light-weight wooden houses are slightly different from those in classic European brick houses. They are characterised primarily by short axial distances between individual rafters and profiles which are usually identical to those of perimeter wall stud dimensions, i.e. 4"x2"/ 100x50mm, or 6"x2"/ 150x50mm.

Constructing the trusses, Cheryl, Czech Republic

• Individual components and functions thereof



Ridge truss - static connection of the rafters

Rafter - the basic load-bearing component of the roof

Collar tie - prevents rafters from moving

Ridge tiles

Ridge board to hold ridge tiles

Roof tiles

Roof battens - these fasten the vapour barrier to the inside of the rafters. Interior lining is fastened onto them.

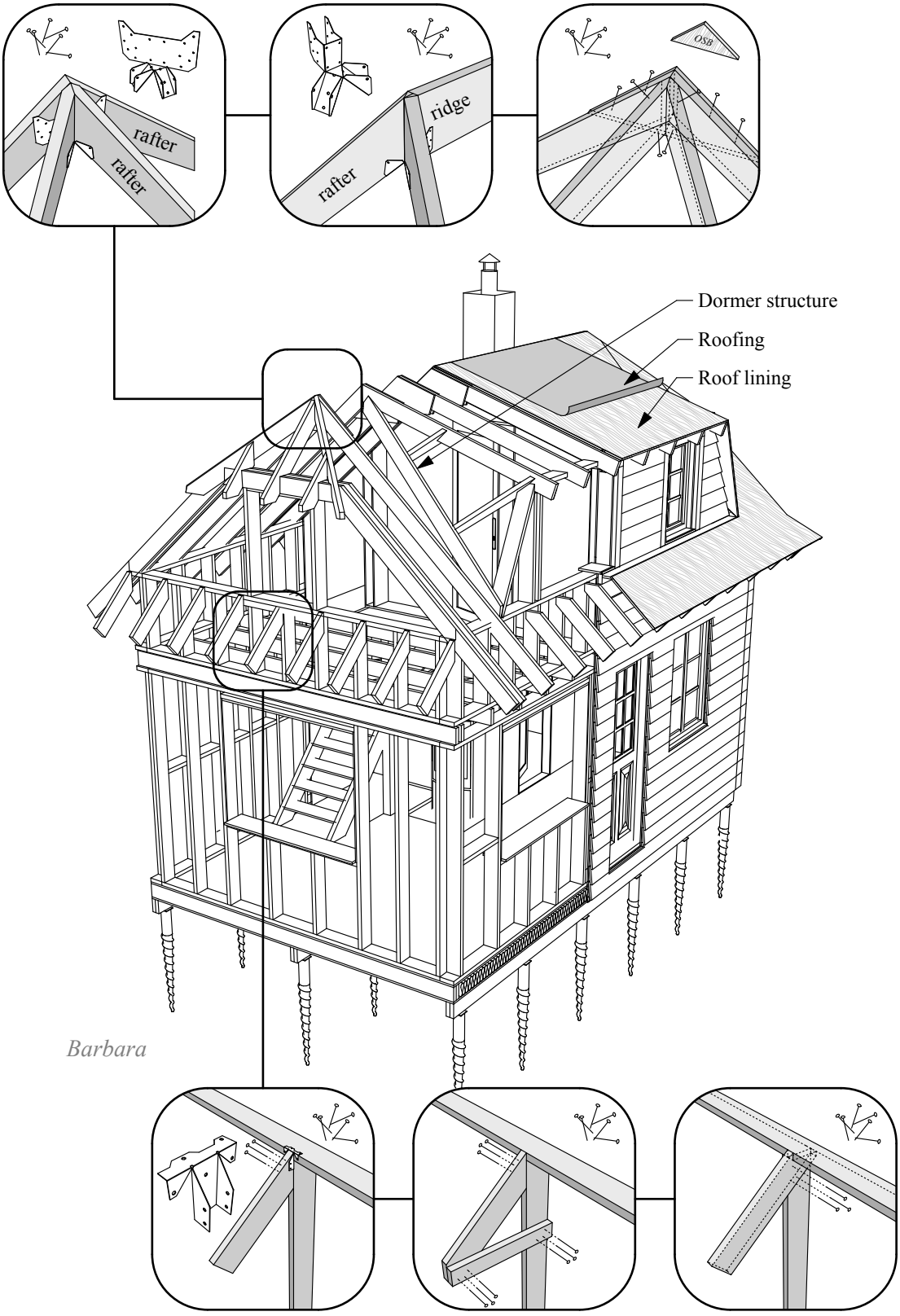
Interior lining - lining boards fastened to the battens

Vapour barrier - prevents interior moisture from entering thermal insulation. Moisture is transmitted in the opposite direction.

Vapour-permeable air barrier material - prevents exterior moisture from entering the structure. Moisture is transmitted from the structure outwards.

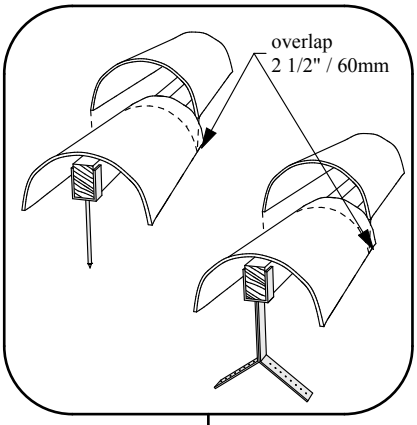
Roof battens - attached to the counter battens and are used to fasten the roof tiles

Counter battens - these battens create a ventilated gap between the roof battens and the vapour-permeable air barrier. They also attach the air barrier to the rafters.

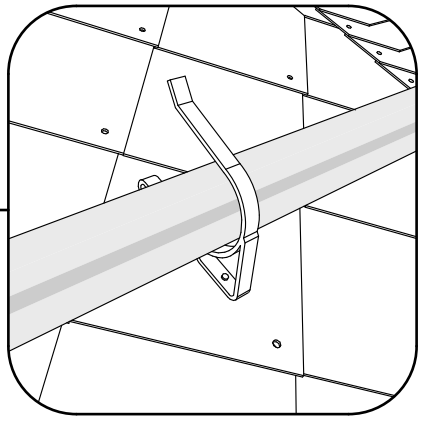

rafter
rafter
ridge
rafter
OSB
Dormer structure
Roofing
Roof lining

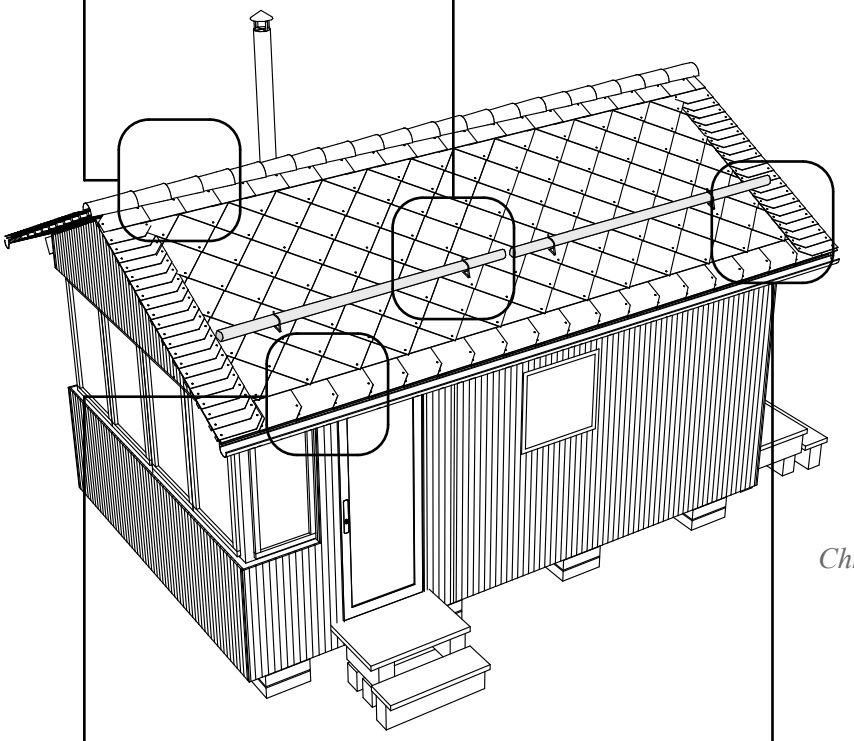
Barbara

Fixing ridge battens to the roof truss

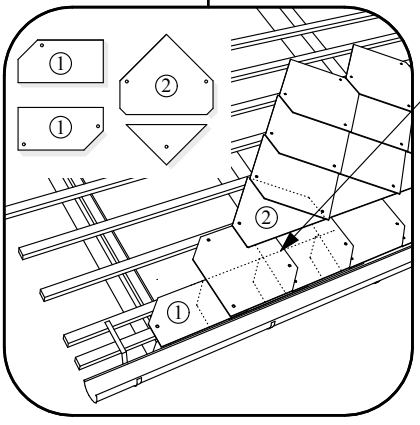


Fixing the snow barrier





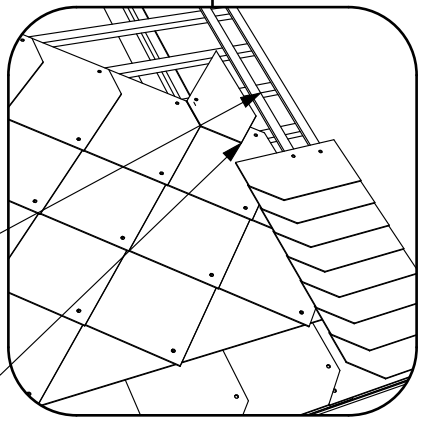
Christie

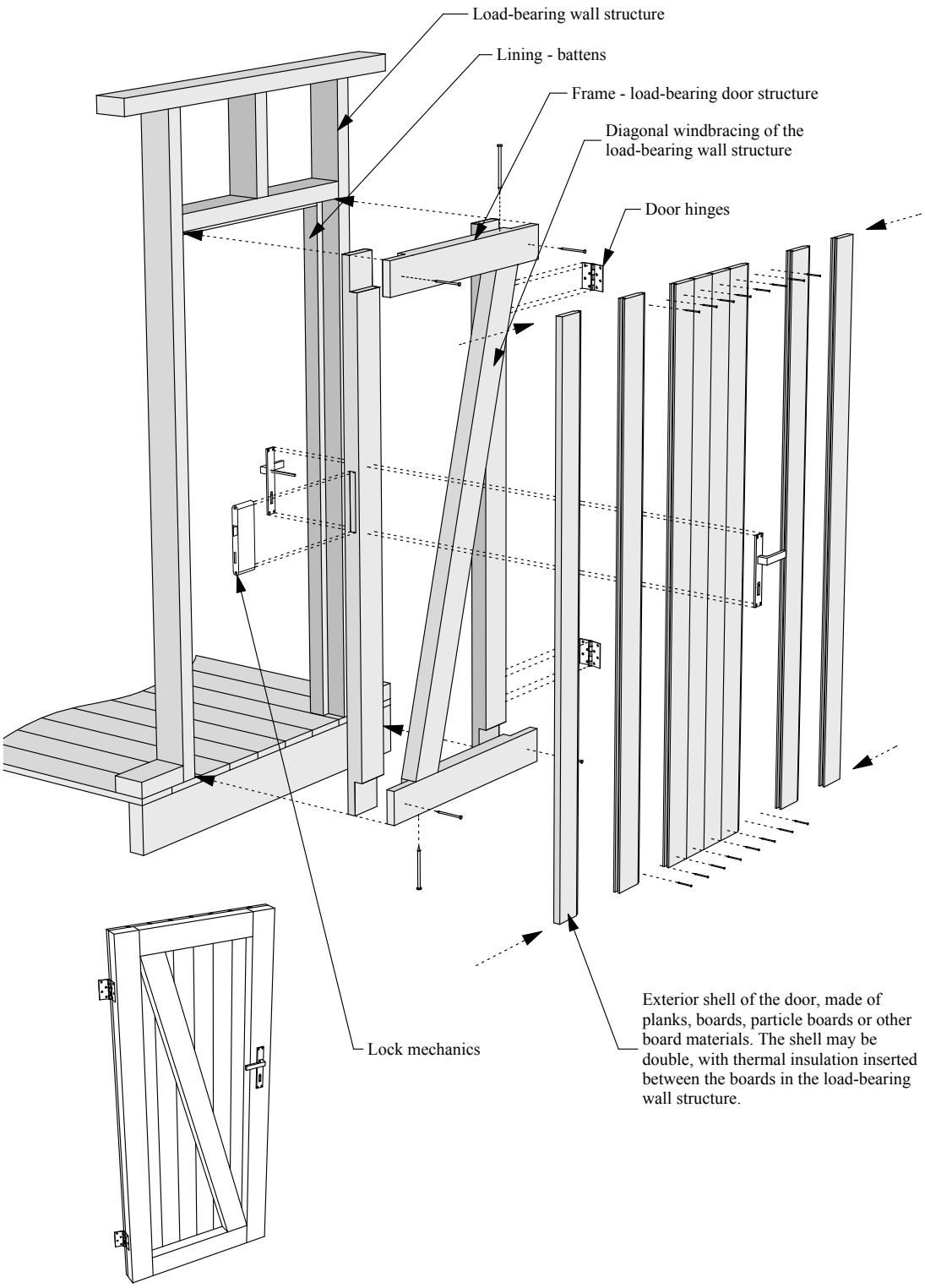


One of the ways of starting the bottom edge of composite shingle roof without sheet metal

1/2" / 1 cm tall battens to even out the base for the initial row of half-sized shingles

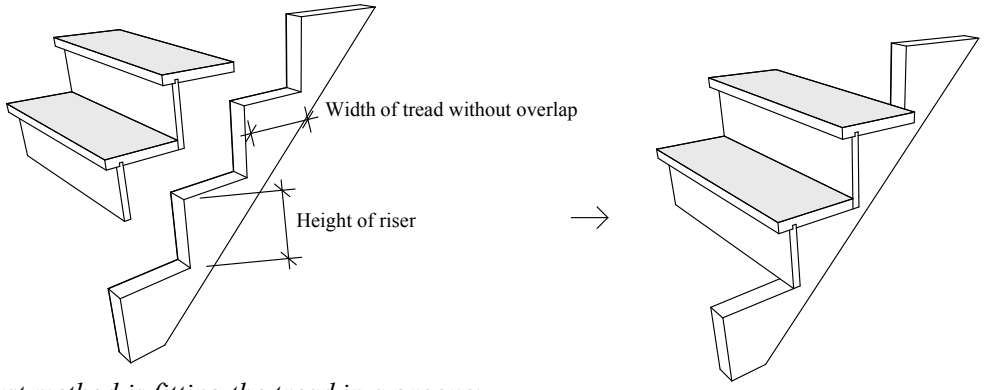
Shortening the edge to prevent water leading under the roofing by the edge



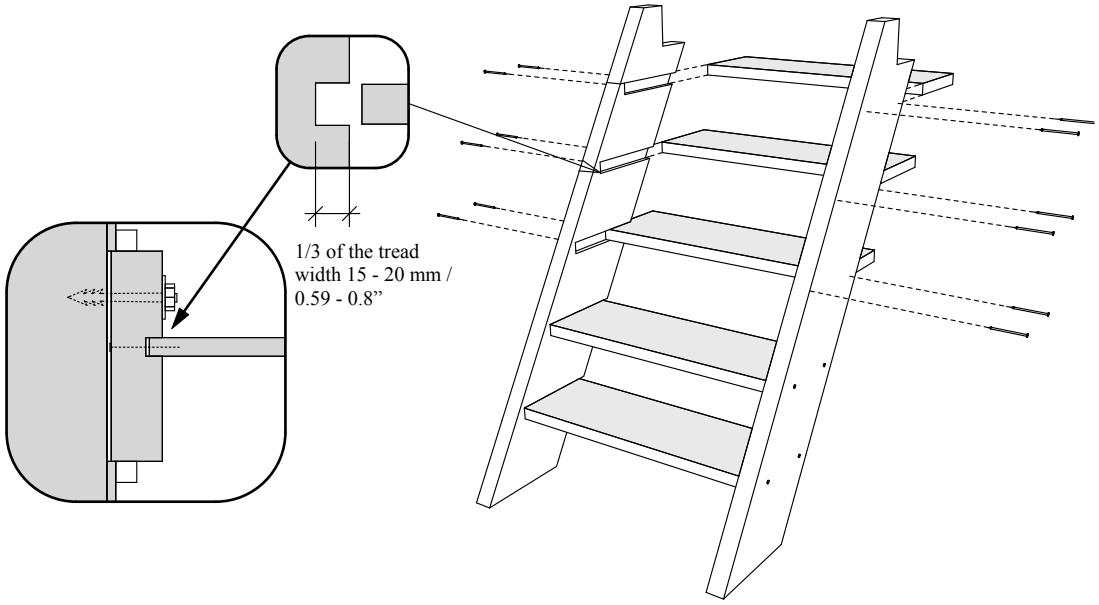


View of the door wing from the interior

Or, the stringer can be trimmed and the treads with risers can be installed thereon.

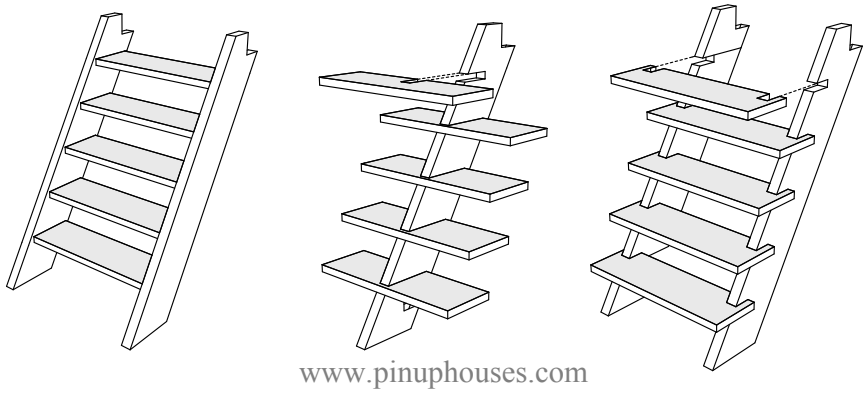


The last method is fitting the tread in a groove:

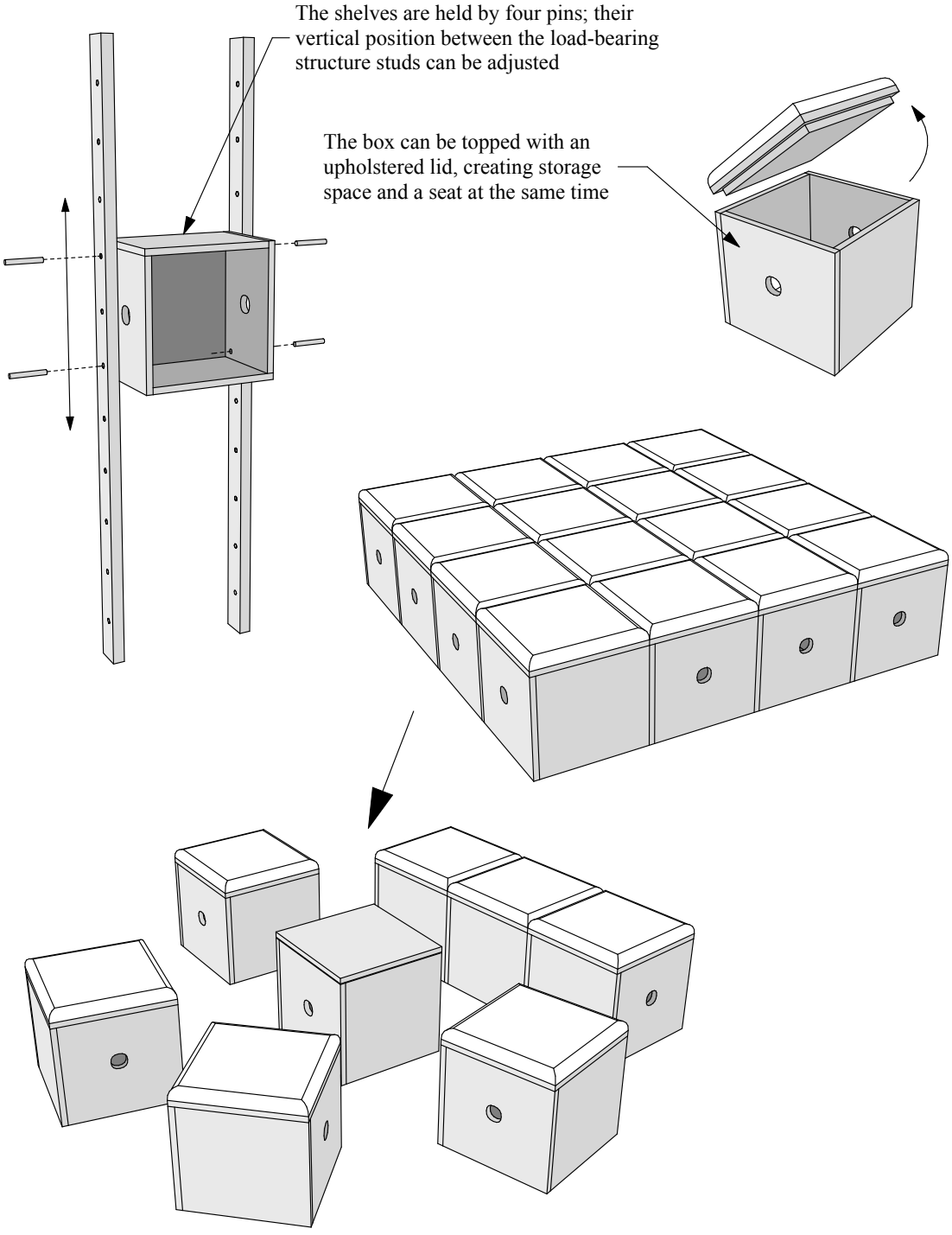


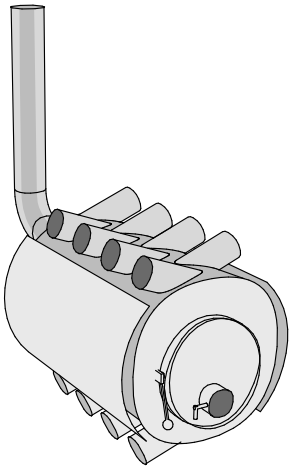
If you install your treads on battens or in the stringers, you have to decide whether the treads should be flush with the front or back edge of the stringer. Another option is using the mortise and tenon technique in the centre of treads - this is more demanding on craftsmanship.

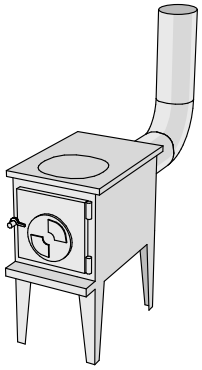
A free-standing staircase can be presented in various ways from the perspective of stringer position:

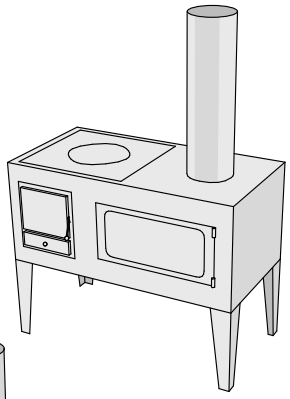


The following box system was used in the Cheryl interior. The website (pinuphouses.com) offers videos and photos from a compact interior solution. The boxes have uniform dimensions and lend themselves to a bed, sofa seating, kitchenette or wall-hung shelving.

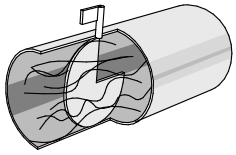




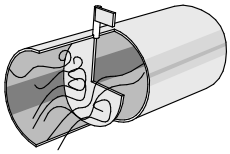




Burning regulation lever

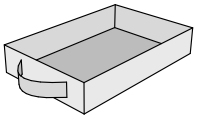


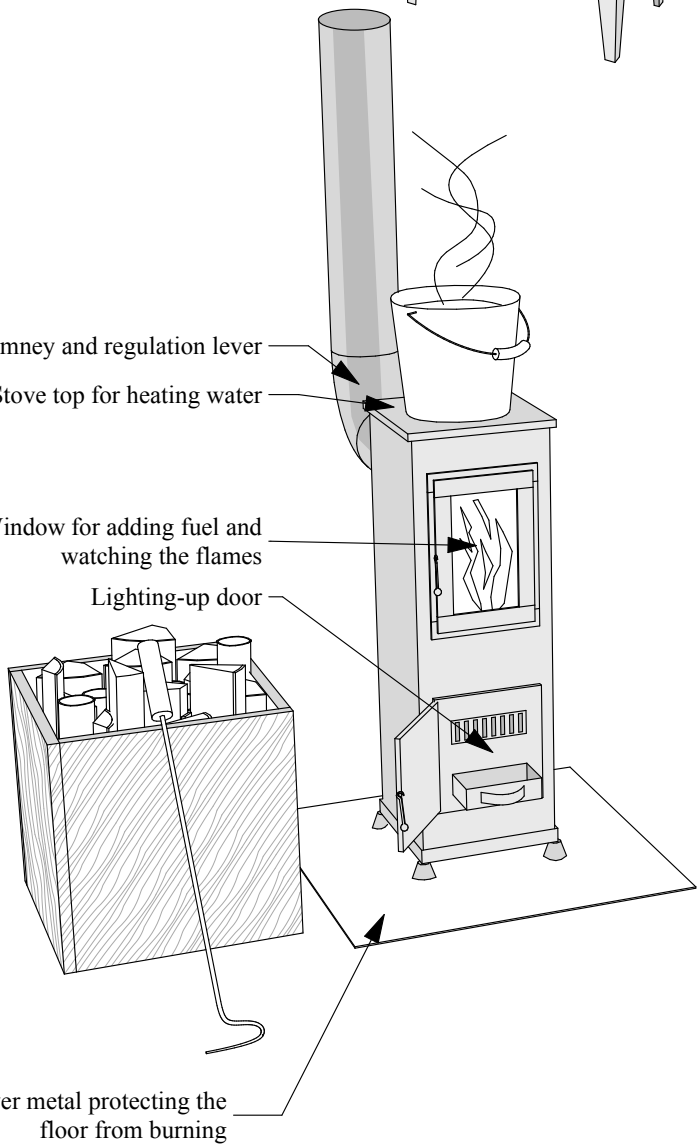
ON

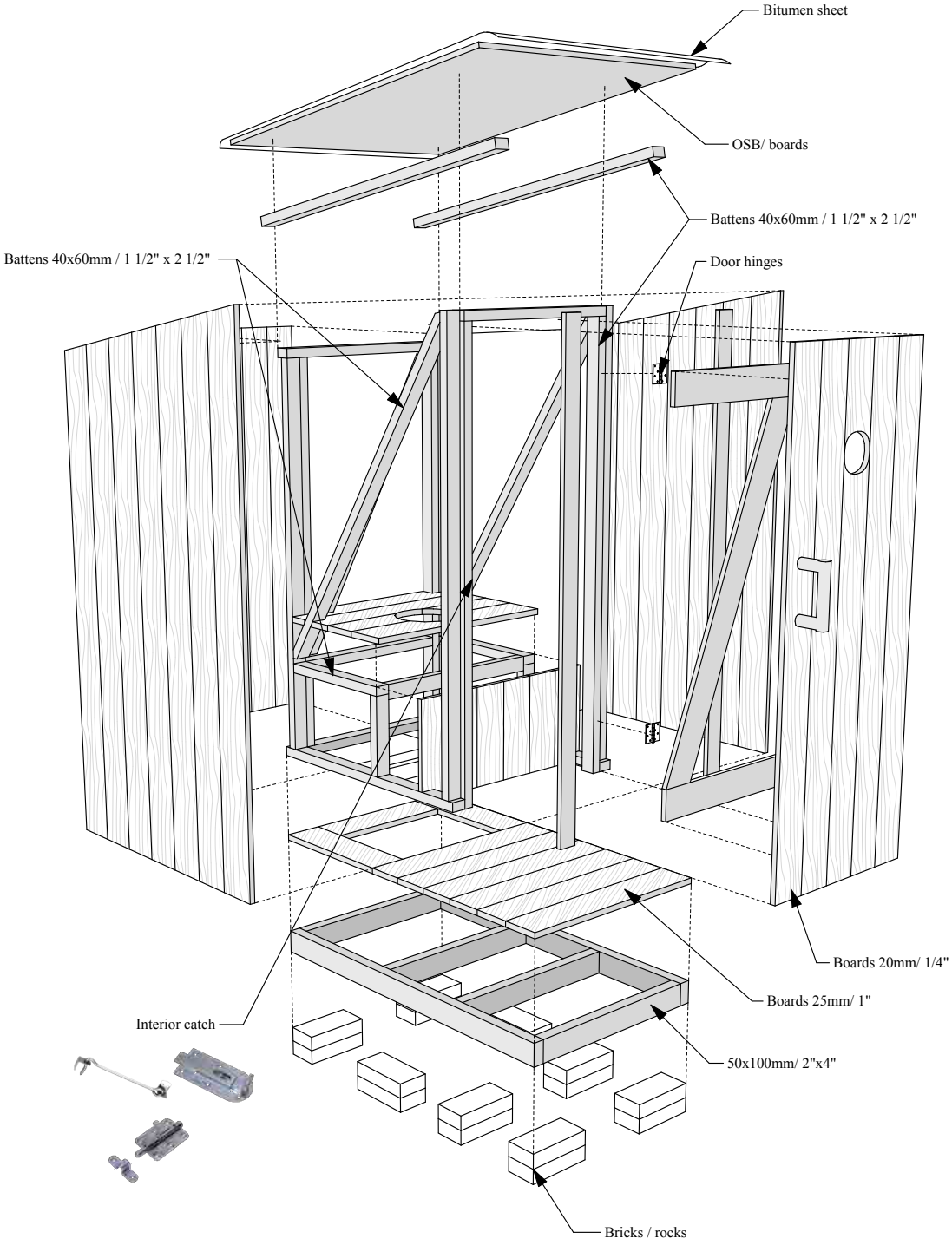


OFF

Slide-out ash tray from the bottom of the wood burner.

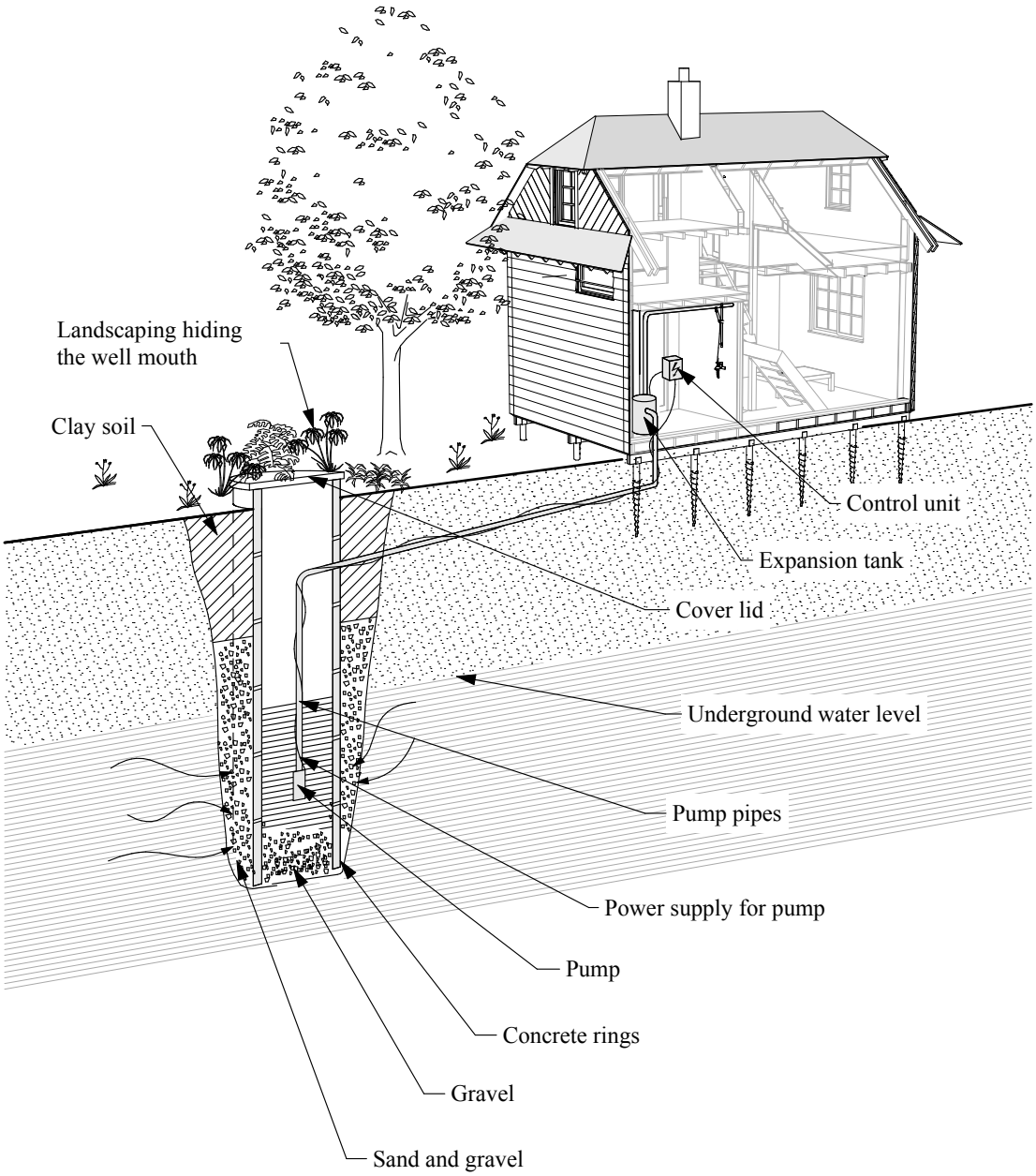





Bitumen sheet
OSB/ boards
Battens 40x60mm / 1 1/2" x 2 1/2"
Battens 40x60mm / 1 1/2" x 2 1/2"
Door hinges
Boards 20mm/ 1/4"
Boards 25mm/ 1"
Interior catch
50x100mm/ 2"x4"
Bricks / rocks

Well shaft

For locations with sufficient quantities of pure, shallow underground water, creating a well by a mining technique is a good choice. The well manages huge irregular supply and is easy to clean. It is dug either manually while the concrete rings are put in place, or mechanically by drilling with an auger. The design depth is usually 3.5 to 4 m below the underground water level. Classic wells are not really suited to weekend houses because water stagnates there most of the year if it is only used at weekends. To guarantee water supply even in hot summers, the wells must be deep enough. Moreover, other wells in the neighbourhood can drain them of water.



Most common defects

Missing roofing, or holes in roofing
- Risk of precipitation leaks
- Fungi and mould proliferation
- Degradation of internal structures

Blocked chimney vent
- Smoke contaminates the interior
- Risk of suffocation

Absence of ventilated roof, incorrect ridge structure
- Risk of water condensation inside the structure
- Fungi and mould proliferation

Rotten or missing exterior paint
- The wall structures are not protected
- Degradation accelerates
- Negative visual impression

Blocked eaves, rusty and dysfunctional gutters, holes or rust in the metalwork
- Leaks in the interior structures
- Dysfunctional rainwater management

Insufficient parameters of load-bearing structure
- Load-bearing elements deflect too much
- Expansion cracks occur
- Structures become misaligned

Warped door and window frames
- Deteriorated or zero mobility
- Poor thermal insulation properties

Insufficient thermal insulation in walls, floors and ceilings
- Huge thermal losses in the building
- Uncomfortable user environment

Insufficient weather-stripping
- Poor thermal insulation properties
- Poor sound insulation properties

Lack of vapour barriers
- Interior structures become damp
- Fungi and mould proliferation
- Subsequent loss of thermally insulating properties of the building

Insufficient hot water capacity
- Lower user comfort

Plumbing: pipe leakage, corrosion, clogged pipes, low water pressure
- Interior structures become damp
- Dysfunctional fixtures

Loose, rotten deck boards
- Health hazard (injury)
- Limited use

Insufficient wiring
- Impossible to use electrical appliances
- Electricity hazard in case of neglected electric wiring

Rotting non-impregnated parts of floor, damaged by biological pests - termites
- Risk of serious static problems
- Serious threat to the inhabitants
- Increased interior humidity
- Reduced thermal insulation properties of the building

Interior cracks
- Poor aesthetic impression

Warped floor tiles, floor boards
- Poor aesthetic impression
- Lower user comfort

Waste pit / sump lacking maintenance

Lack of kitchen and bathroom exhaust
- Interior structures in the building become damp
- Insufficient odour extraction