

# House P | Kfar Masaryk, Israel

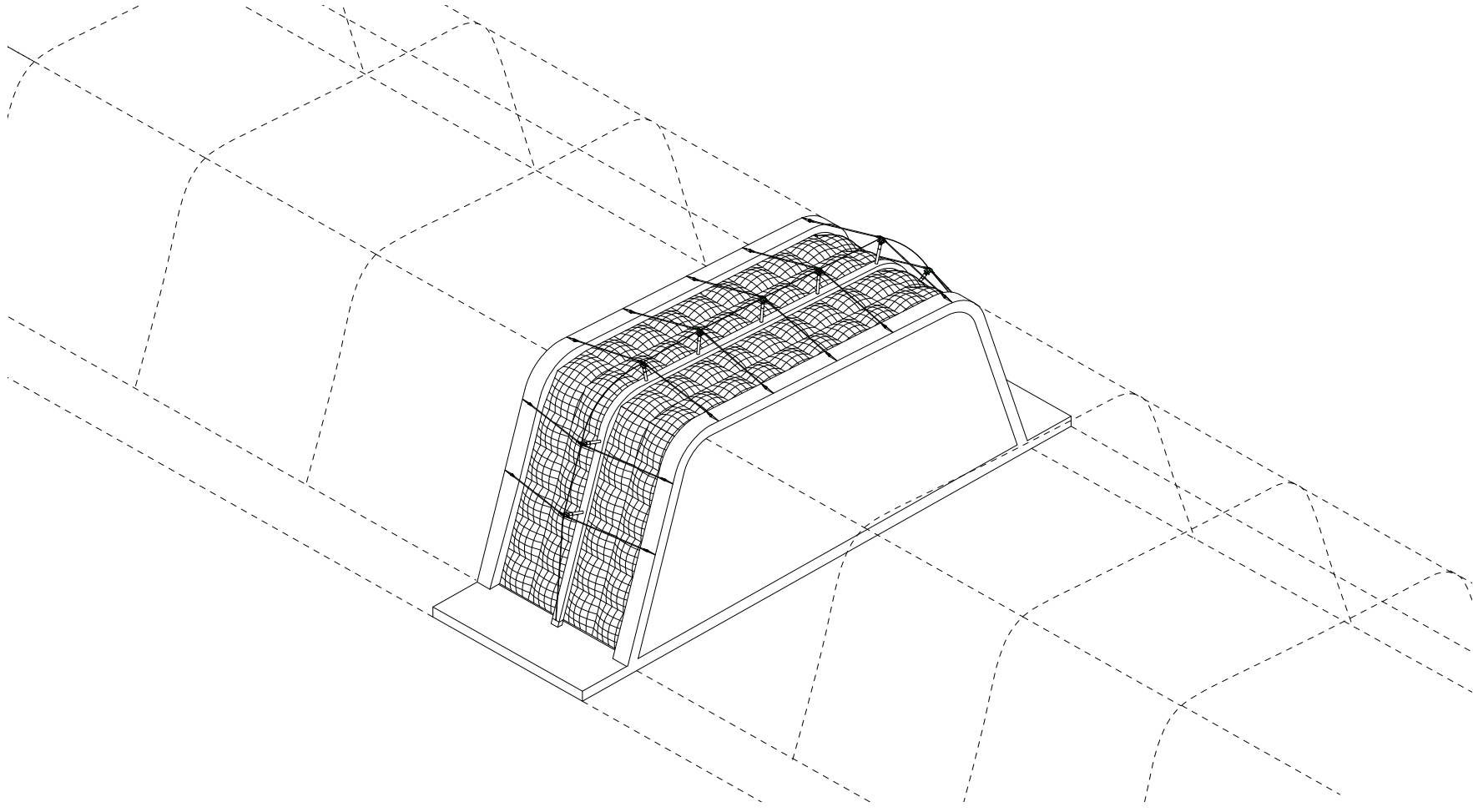
Located in the Northern region of Israel in Kfar Masaryk, House P is designed as a prototype for new families who wish to settle in the Kibbutz. The house is designed in a way, which allows repetitive duplication and even further expansion. The 5 m by 15,5 m house has a light structured polymer exterior skin as its main feature providing the house with a roof as well as a front and back exterior wall. Connecting the two concrete sidewalls, the air structure exists out of 84 ETFE (copolymer of ethylene tetrafluoroethylene) pneumatically prestressed cushions that are easy to maintain. The cushions are prefabricated in factories protected from the weather and then installed as complete units on the building site.

The air-inflated structure is constantly stabilized by an overpressure and by a return air system, which enables the system to respond to the changing weather conditions. The clamping details along the edges of the cushions are particularly important and are designed with care since they must satisfy structural requirements as well as to various constructional and building physics conditions. The seams of the cushions are welded resulting in homogenous joints and have as aim to minimize unavoidable air leaks.

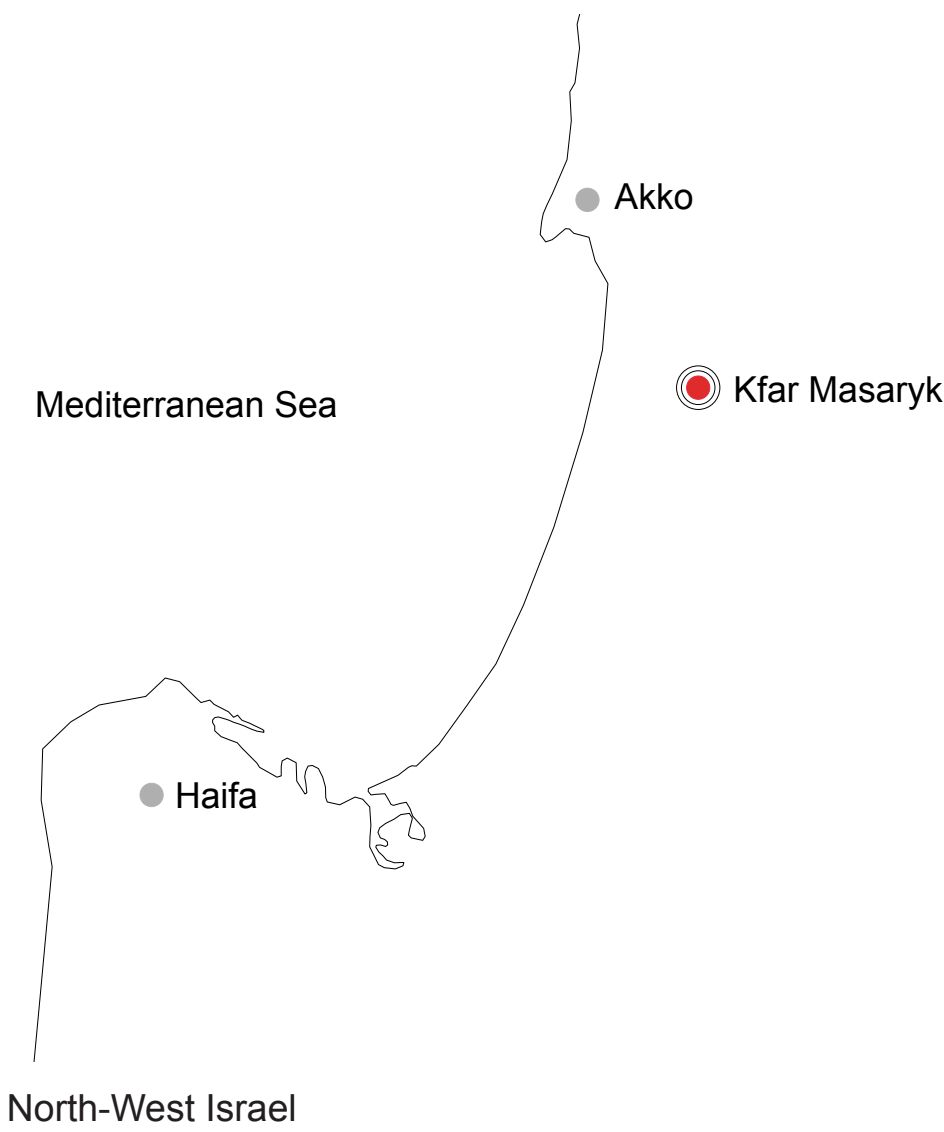
The choice to opt for a soft air-inflated shell suitable for growing children at home is made for several reasons. Firstly, the polymer skin provides House P with an excellent insulation system by using pressurized air and repels water, as the air cushions are waterproof. The repelled water is collected through a water duct and recycled.

Secondly, the various foil plies of each cushion are printed depending on their orientation to the sun, allowing optimal protection of UV sunrays.

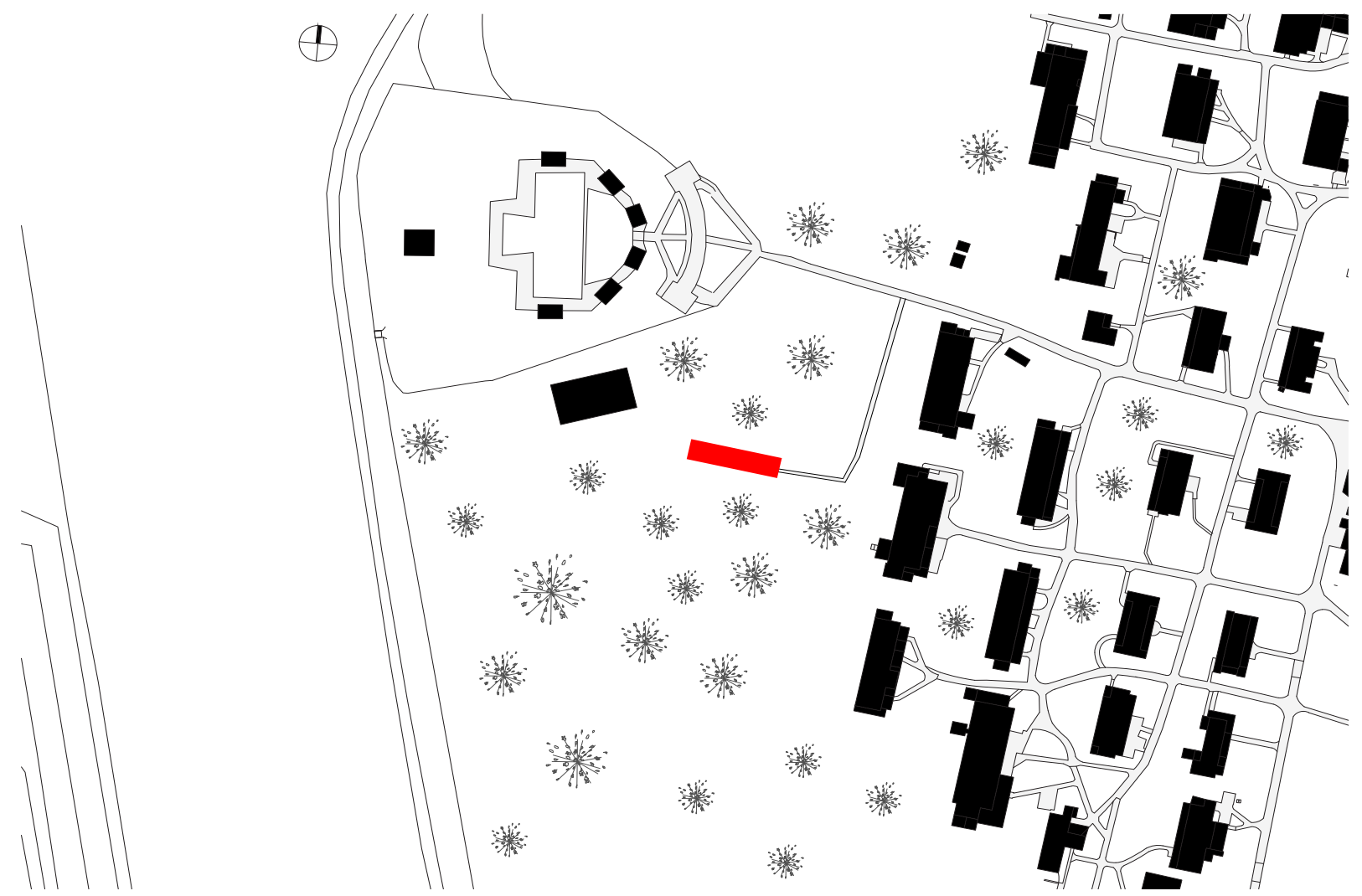
Thirdly, the overall transparency allows a maximum of daylight inside constantly blending the surrounding of the kibbutz with the interior of the house.



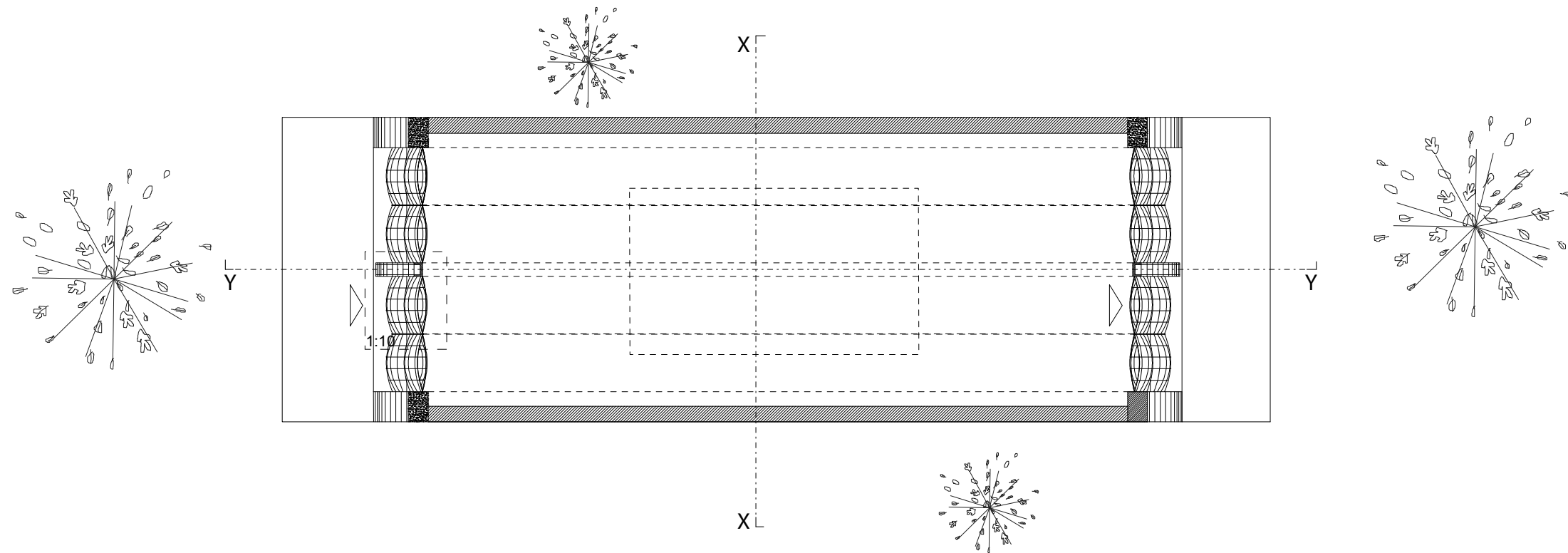
Scheme: multiplication



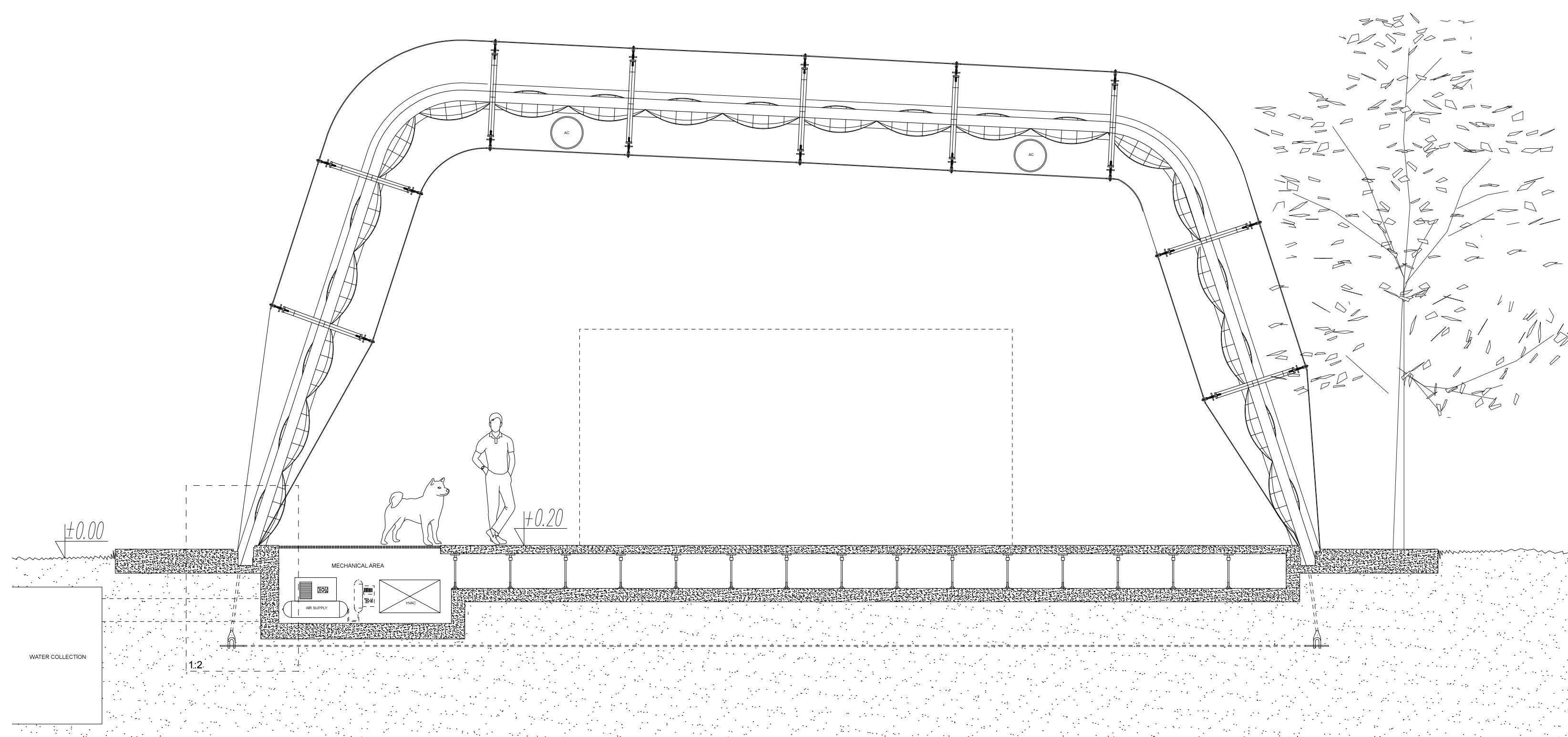
North-West Israel



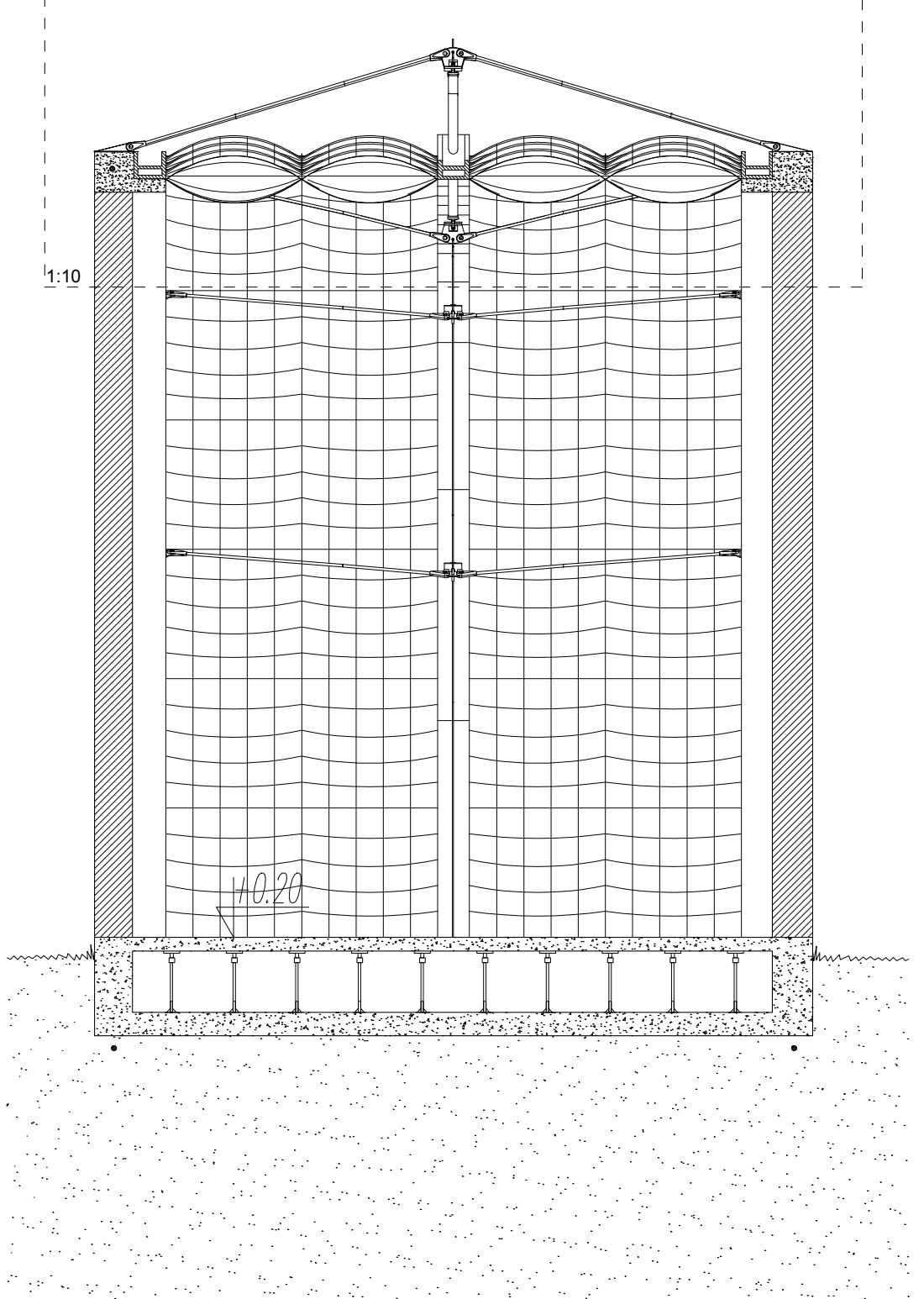
Site Plan, Kibbutz Kfar Masaryk



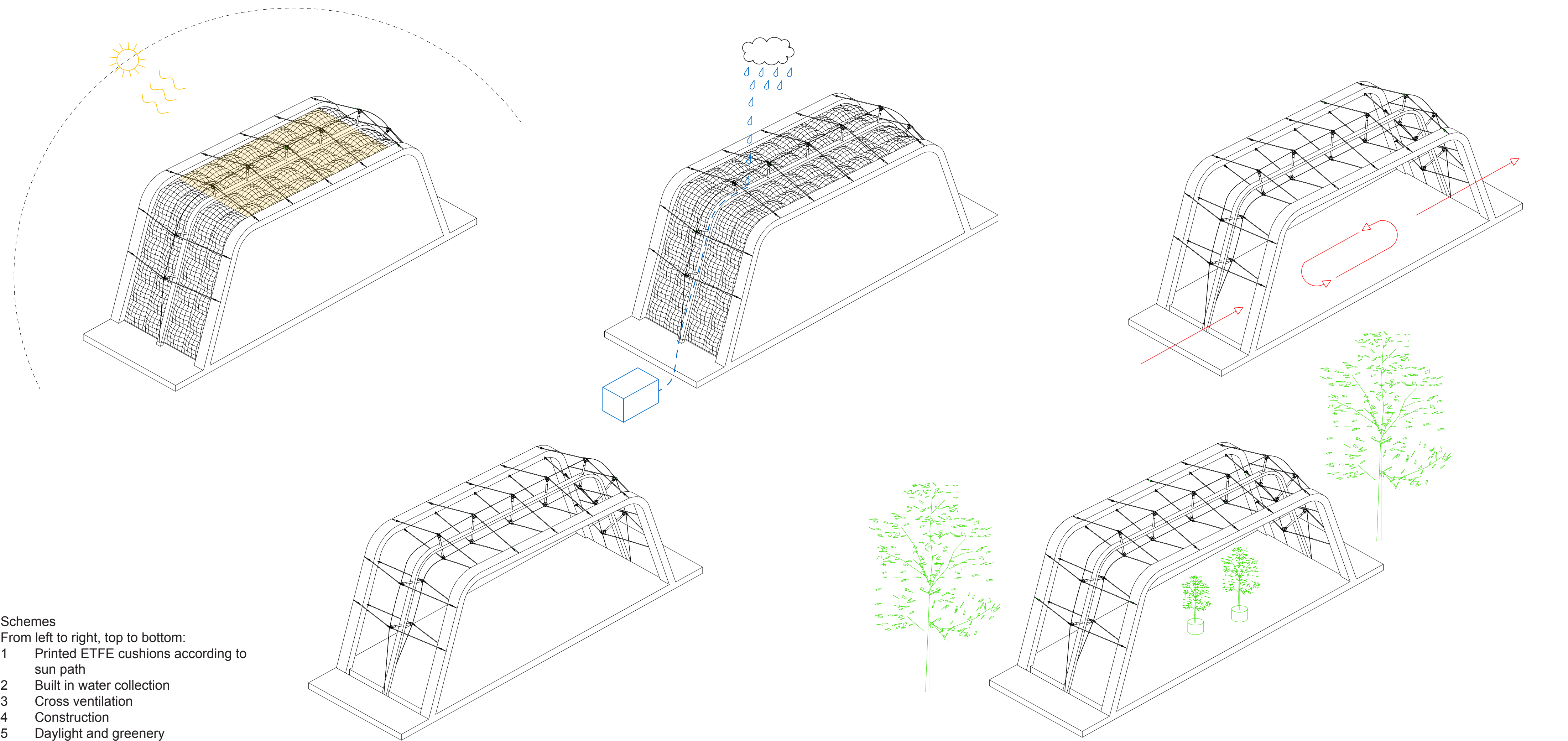
Floor plan, 1:100



Section Y-Y, 1:50



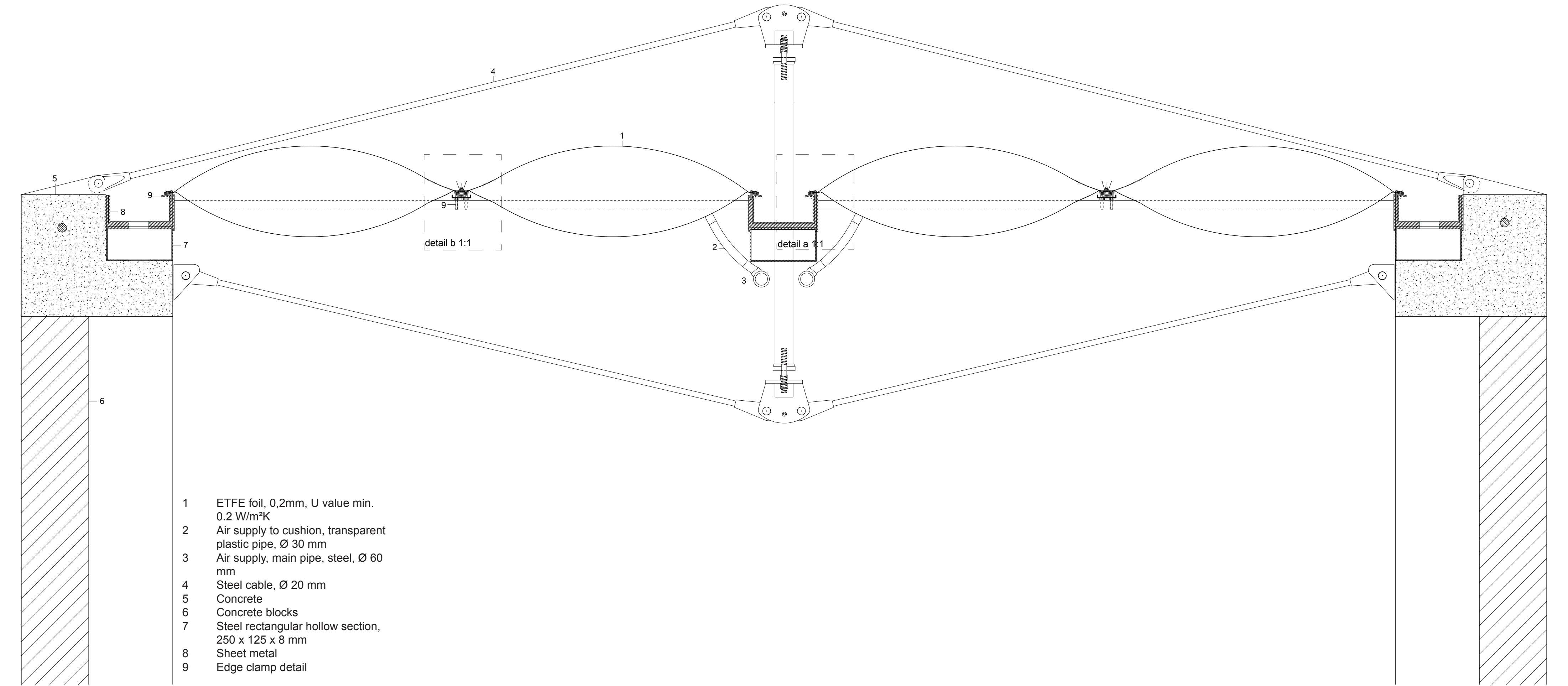
Section X-X, 1:50



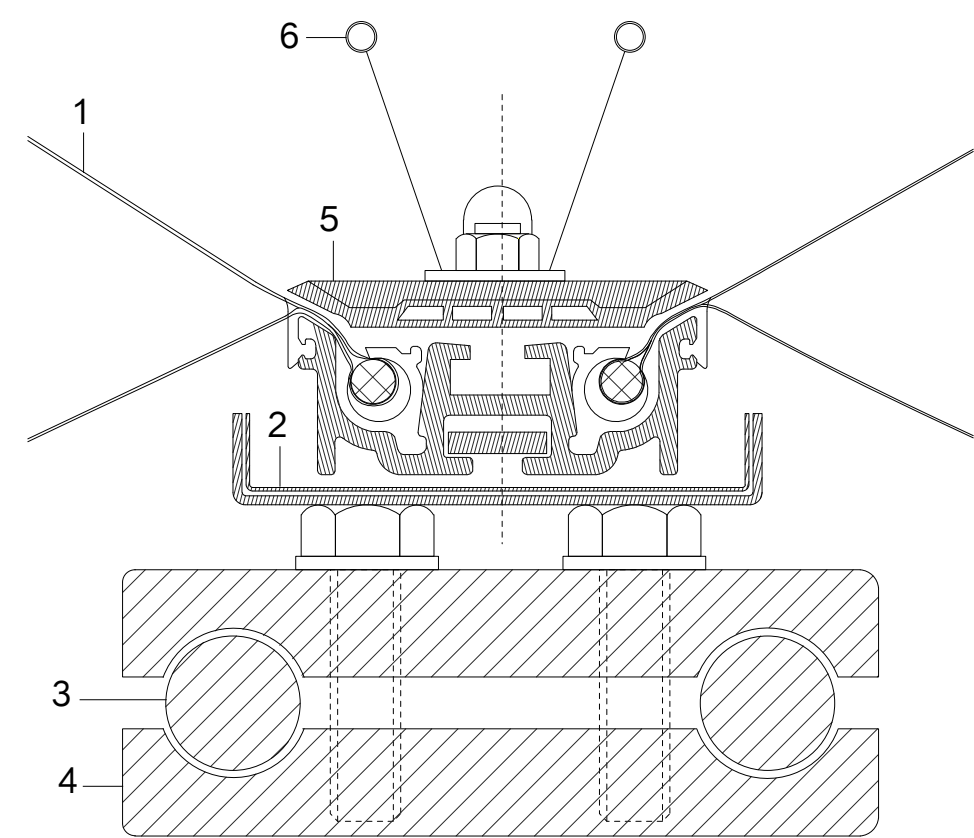
- Schemes  
From left to right, top to bottom:
- 1 Printed ETFE cushions according to sun path
  - 2 Built in water collection
  - 3 Cross ventilation
  - 4 Construction
  - 5 Daylight and greenery



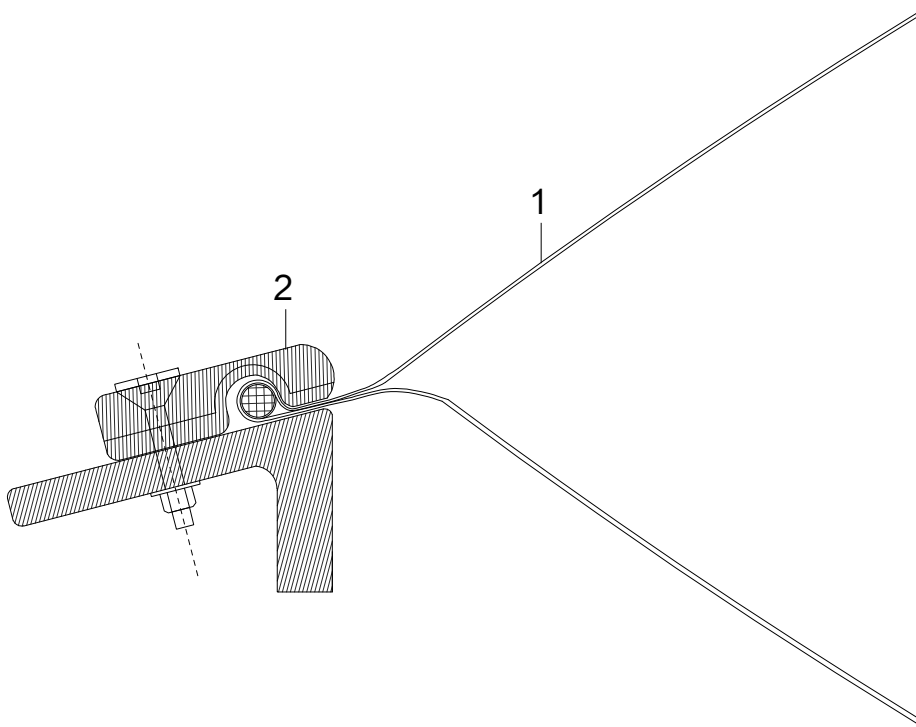
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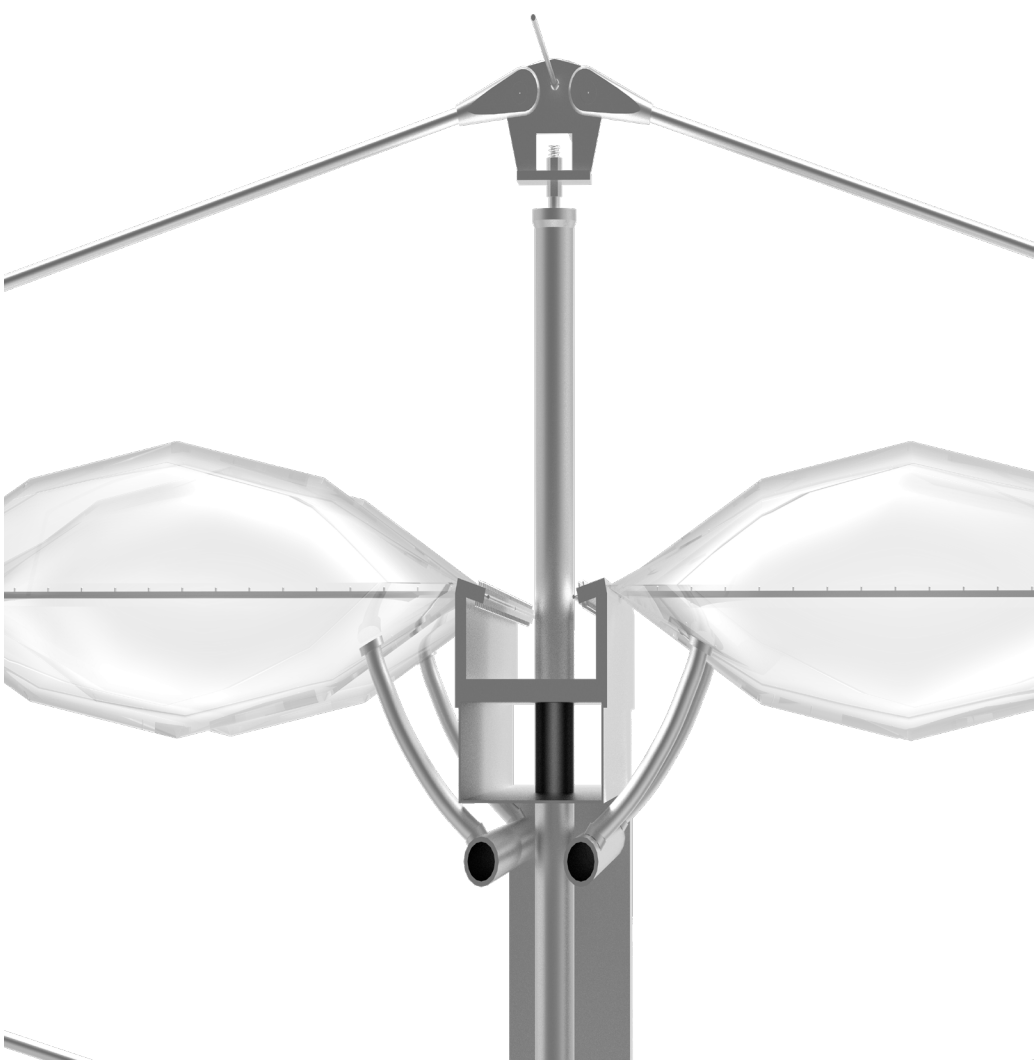
Section, roof, 1:10



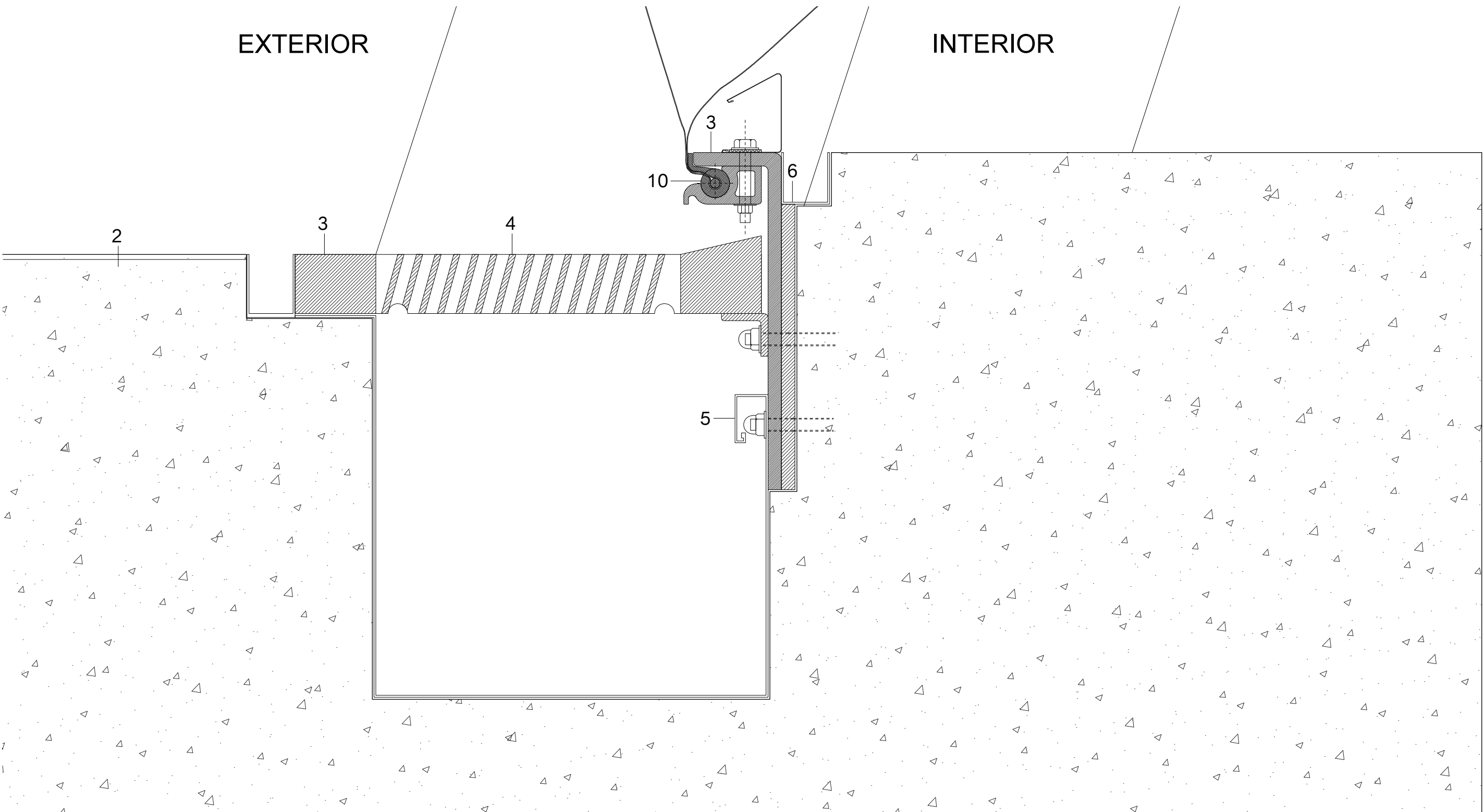
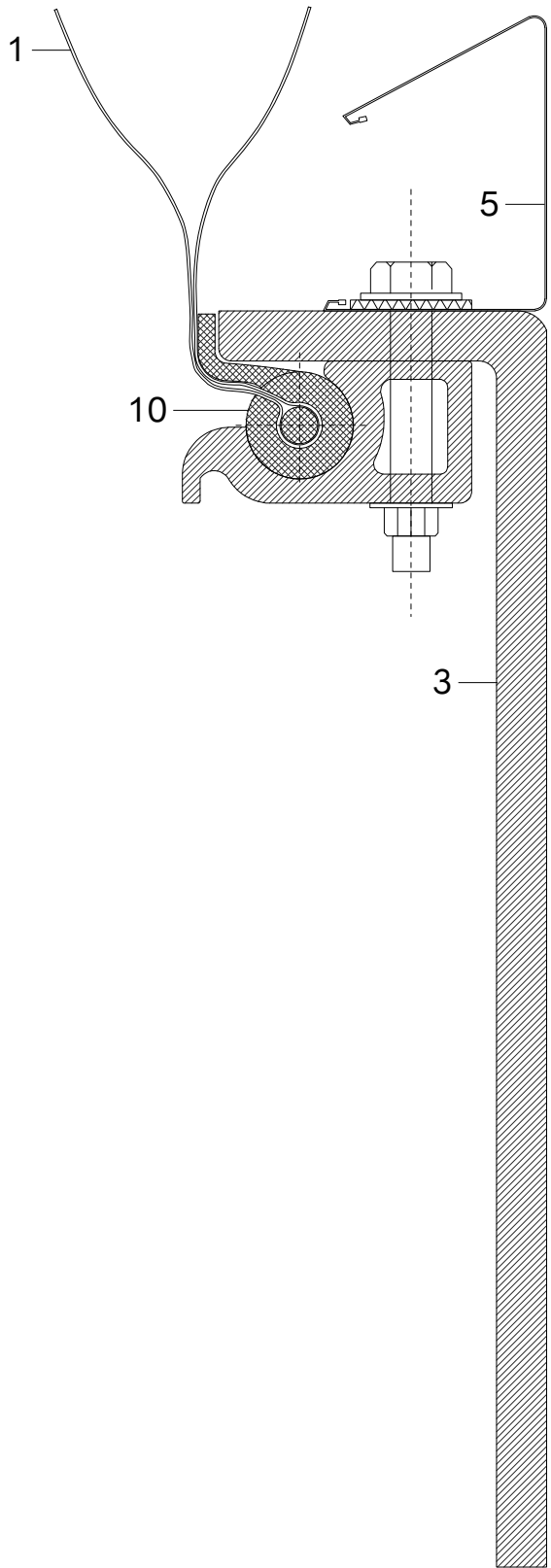
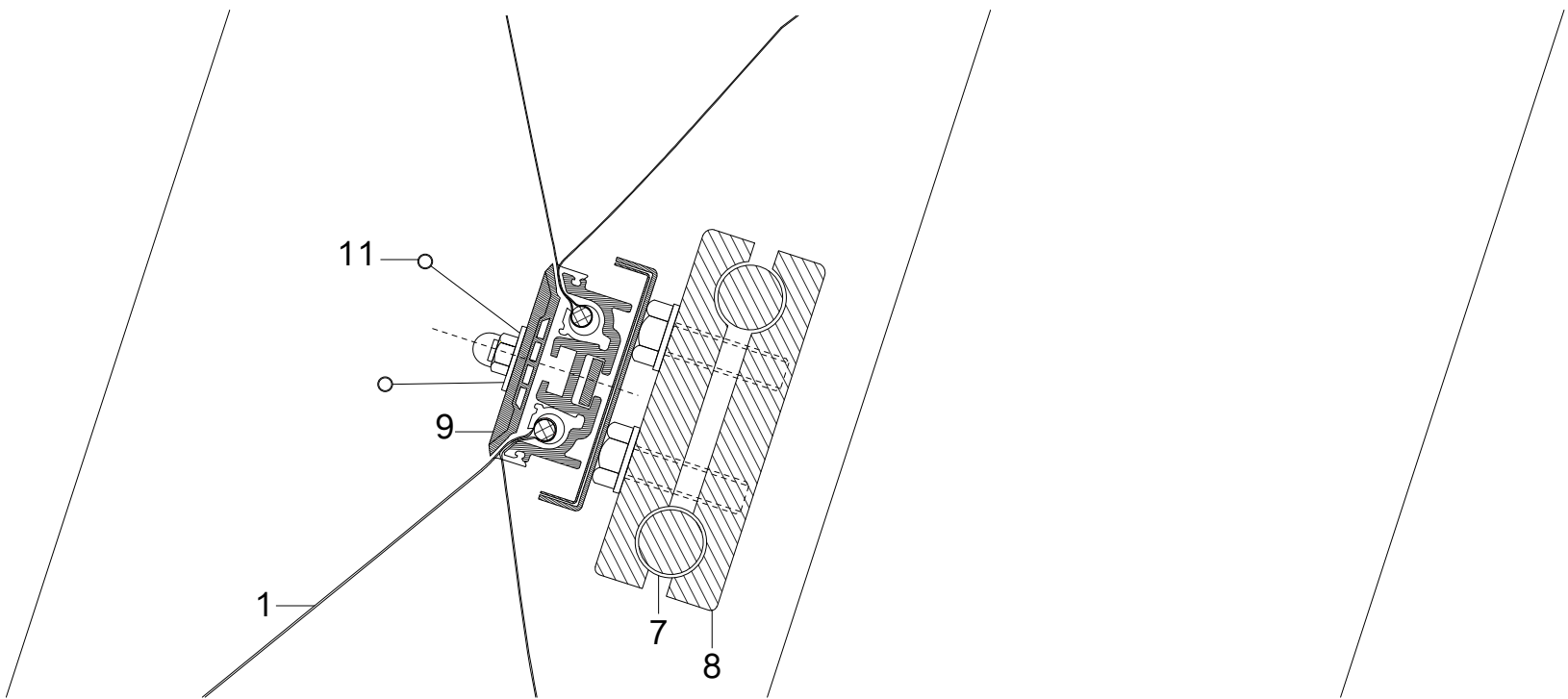
Clamp detail b, 1:1



Clamp detail a, 1:1



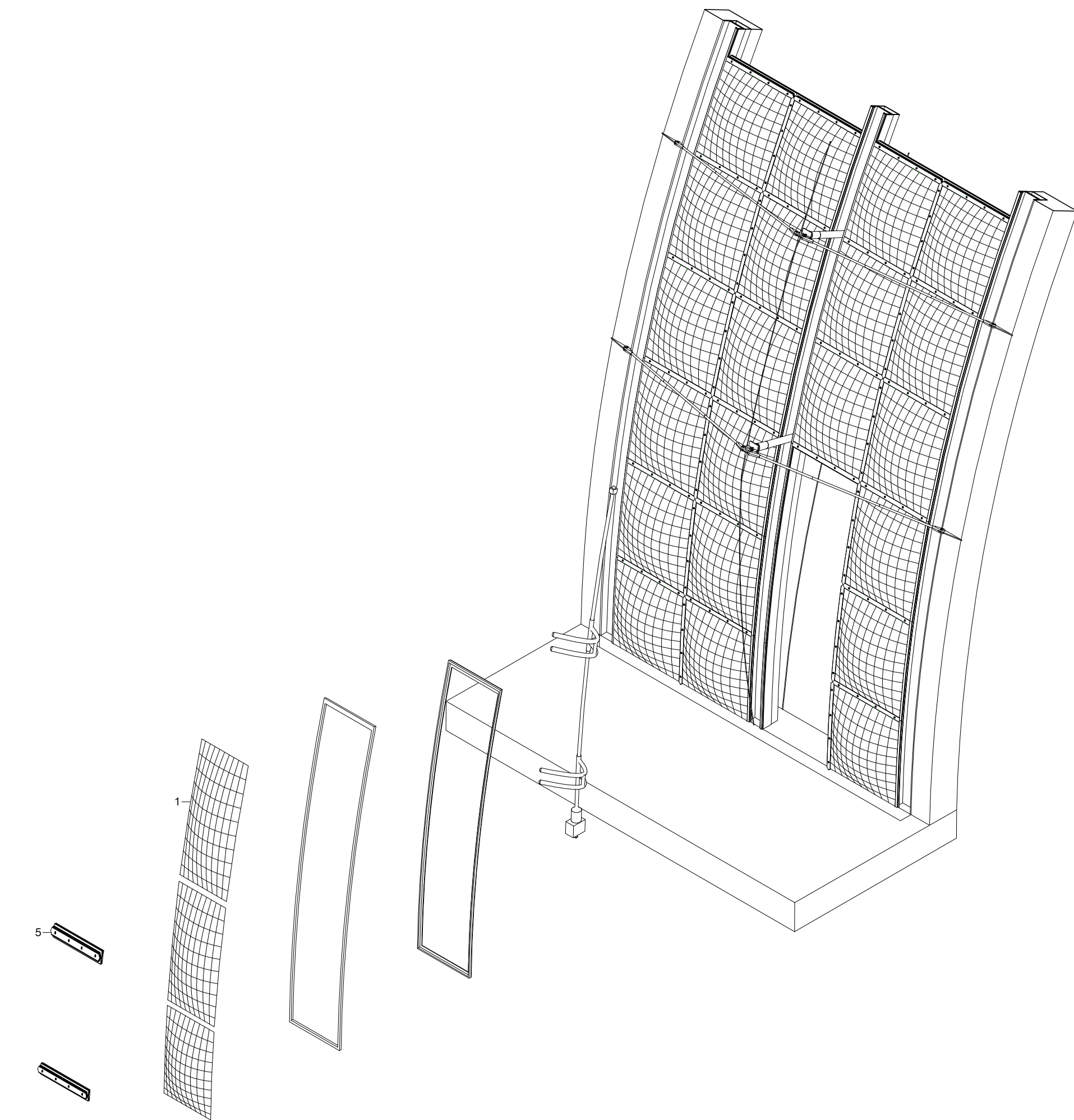
Roof detail, 3D-rendering



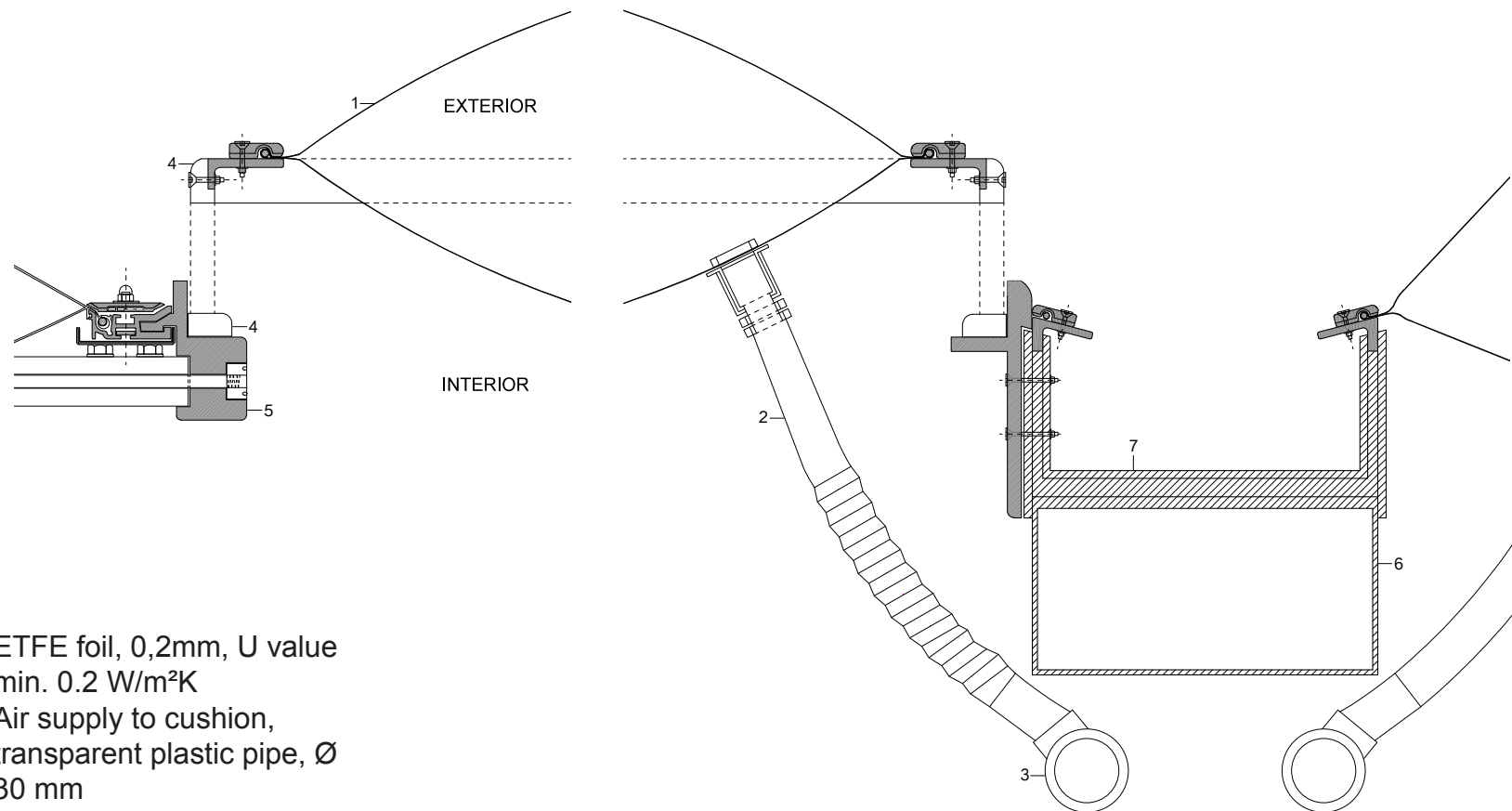
Section, contact wall to floor, 1:2



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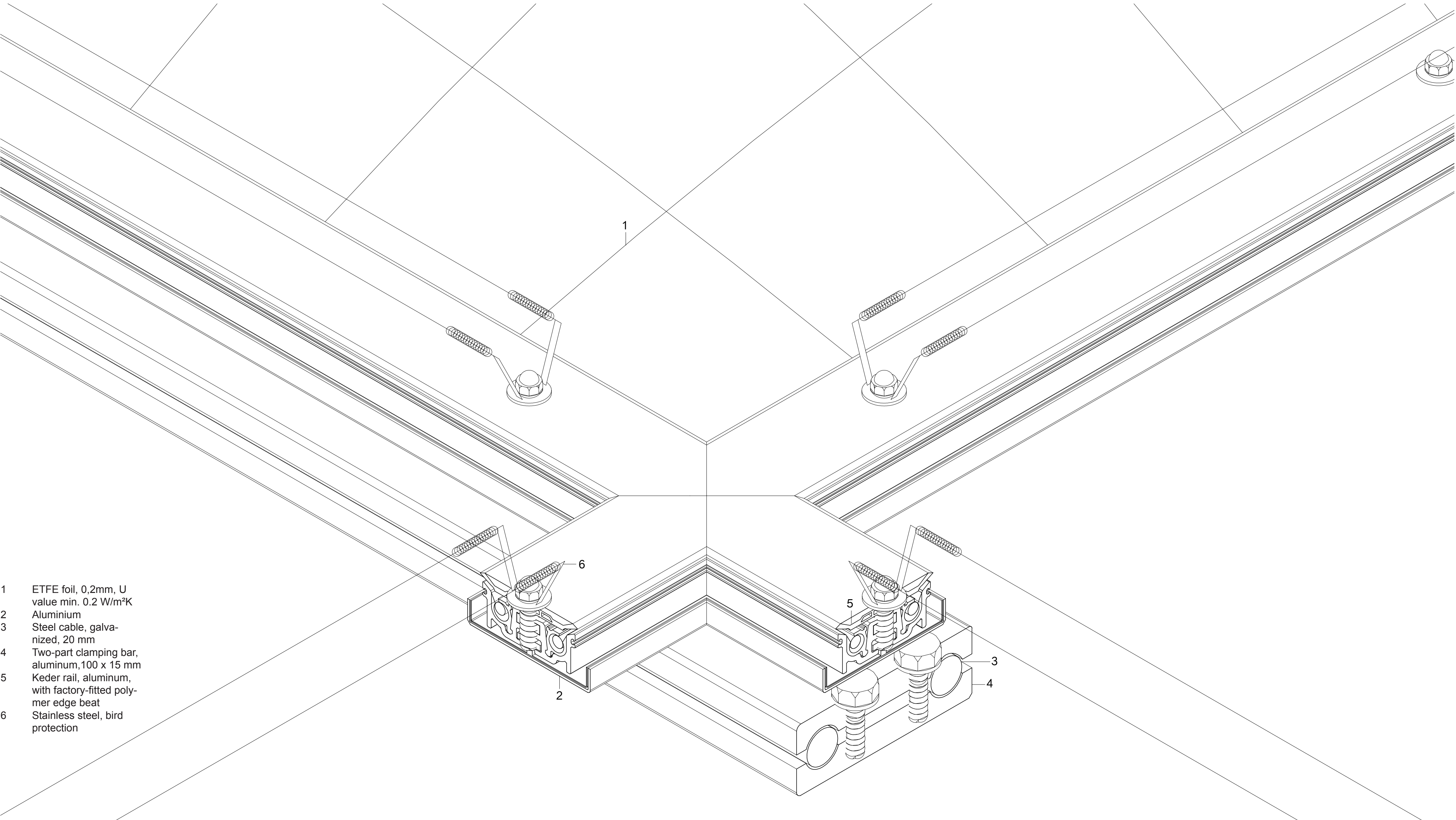
Isometric view, door, 1:50



- 1 ETFE foil, 0,2mm, U value min. 0.2 W/m²K
- 2 Air supply to cushion, transparent plastic pipe, Ø 30 mm
- 3 Air supply, main pipe, steel, Ø 60 mm
- 4 Rubber
- 5 Aluminum
- 6 Steel rectangular hollow section, 250 x 125 x 8 mm
- 7 Sheet metal

Detail, door opening, plan, 1:5

Wall, 3D-rendering

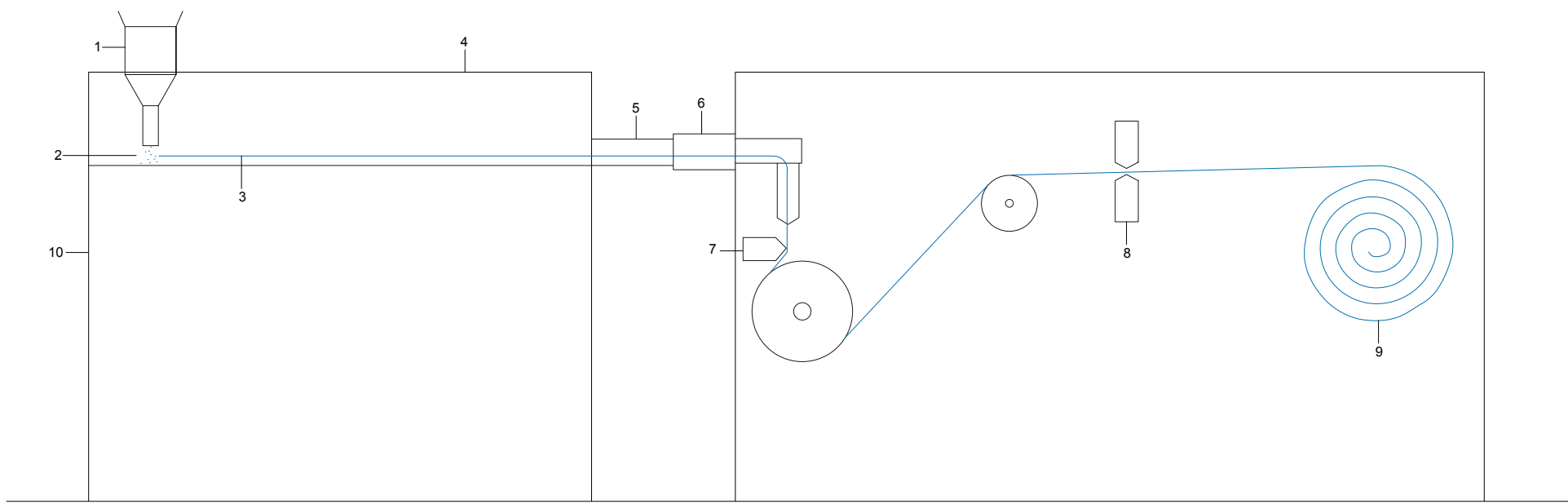


- 1 ETFE foil, 0,2mm, U value min. 0.2 W/m²K
- 2 Aluminium
- 3 Steel cable, galvanized, 20 mm
- 4 Two-part clamping bar, aluminum, 100 x 15 mm
- 5 Keder rail, aluminum, with factory-fitted polymer edge beat
- 6 Stainless steel, bird protection

Isometric view, contact 4 cushions and edge clamps, 1:1

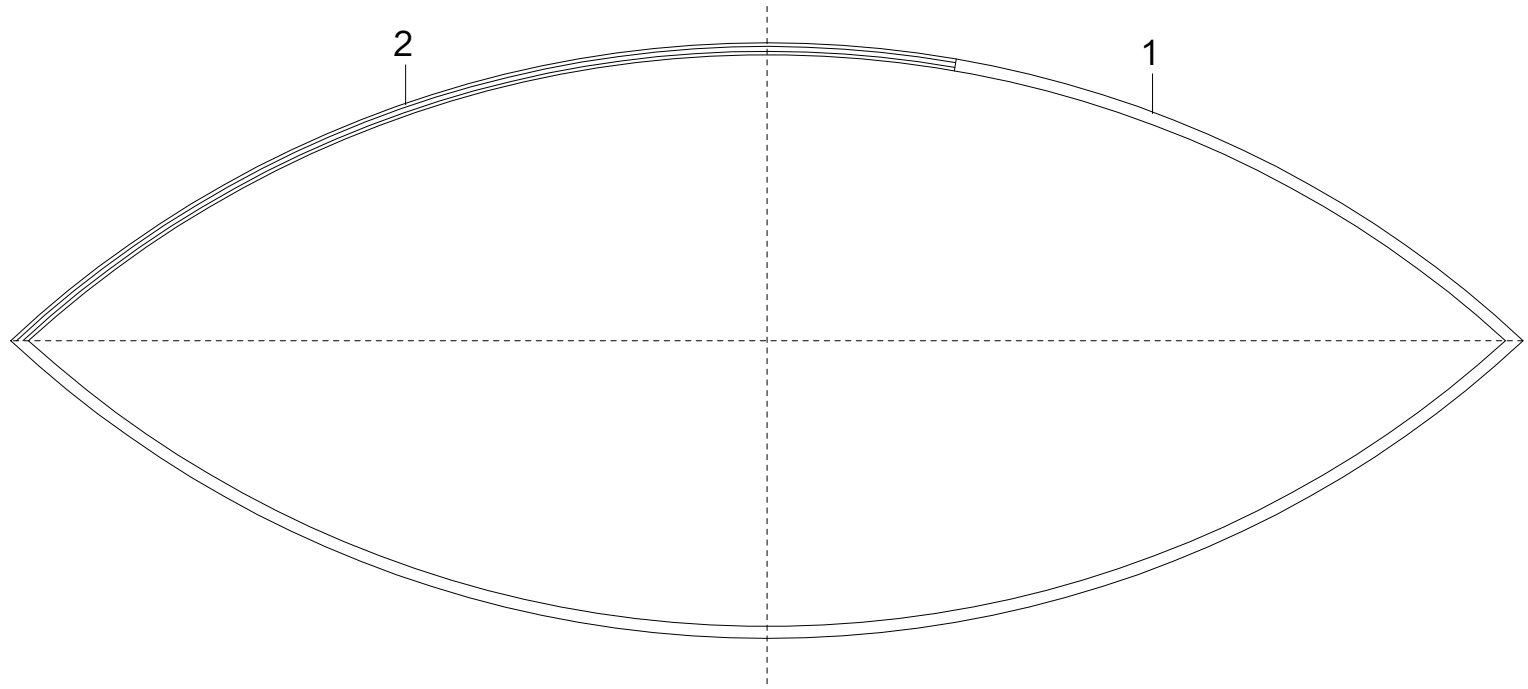


# Polymer foil | Material study



Foil extrusion  
a Extrusion of flat foil  
b Extrusion of tubular foil (blown foil)

- |   |                       |    |                   |
|---|-----------------------|----|-------------------|
| 1 | Metering              | 9  | Reel of foil      |
| 2 | Granulate             | 10 | Extruder          |
| 3 | Melting               | 11 | Air               |
| 4 | Filter                | 12 | Wide-slot-die     |
| 5 | Smoothing             | 13 | Air-ring          |
| 6 | Cooling               | 14 | Nip rolls         |
| 7 | Forming               | 15 | Cutting to length |
| 8 | Thickness measurement |    |                   |



House P cushion diagram, 1:5

- |   |  |
|---|--|
| 1 | ETFE foil, transparent, 0,2mm, U value min. 0.2 W/m²K                            |
| 2 | ETFE foil, transparent, top and underside printed with 65% dotted silver pattern |

## ETFE FOIL

### Typical applications

Density [g/cm³]

Standard thickness [µm]

Tensile strength [N/mm²]

Elastic modulus [N/mm²]

Formability

Long-term stability

Melting point

Service temperature range [°C]

Reaction to fire

Sensitivity to soiling

Light transmittance [%]

Remarks

Variations available

copolymer of ethylene tetrafluoroethylene

architecture

1,75

12-300

approx. 40

800-1000 N

high

very good UV resistance

260-270 oC

-200 bis + 150

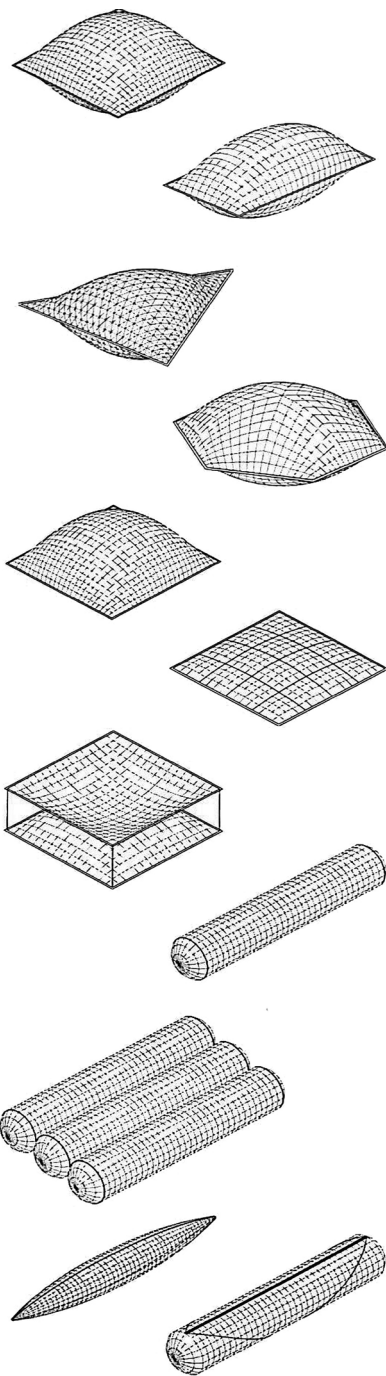
not readily flammable

very low

>90

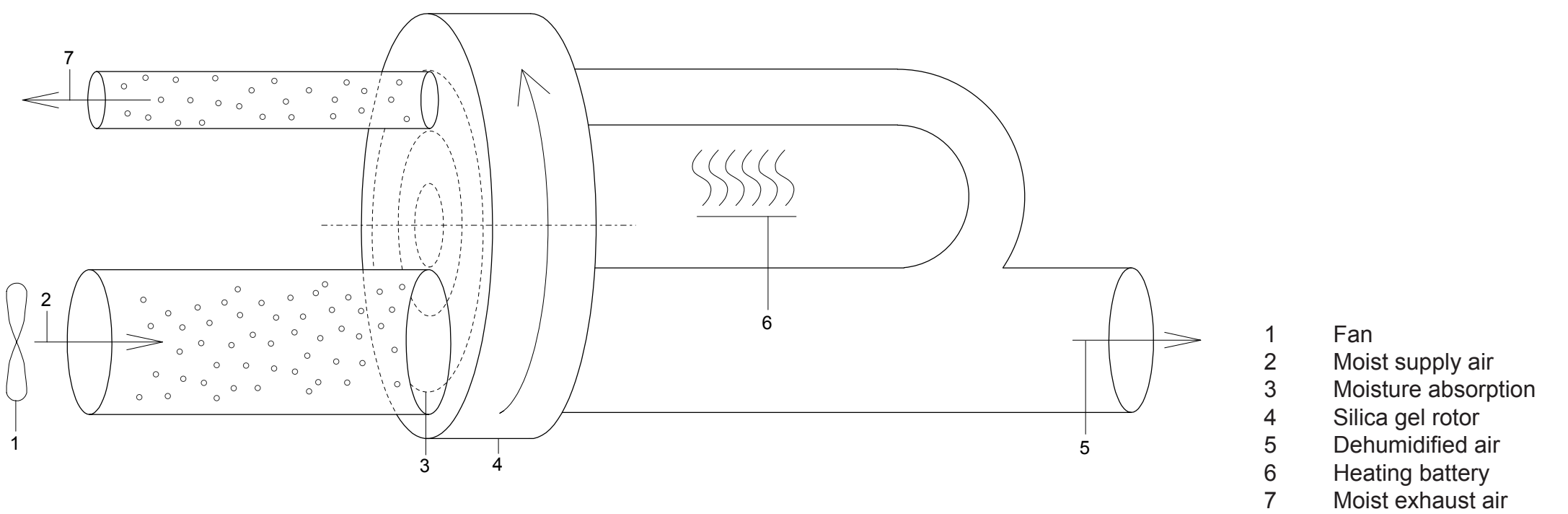
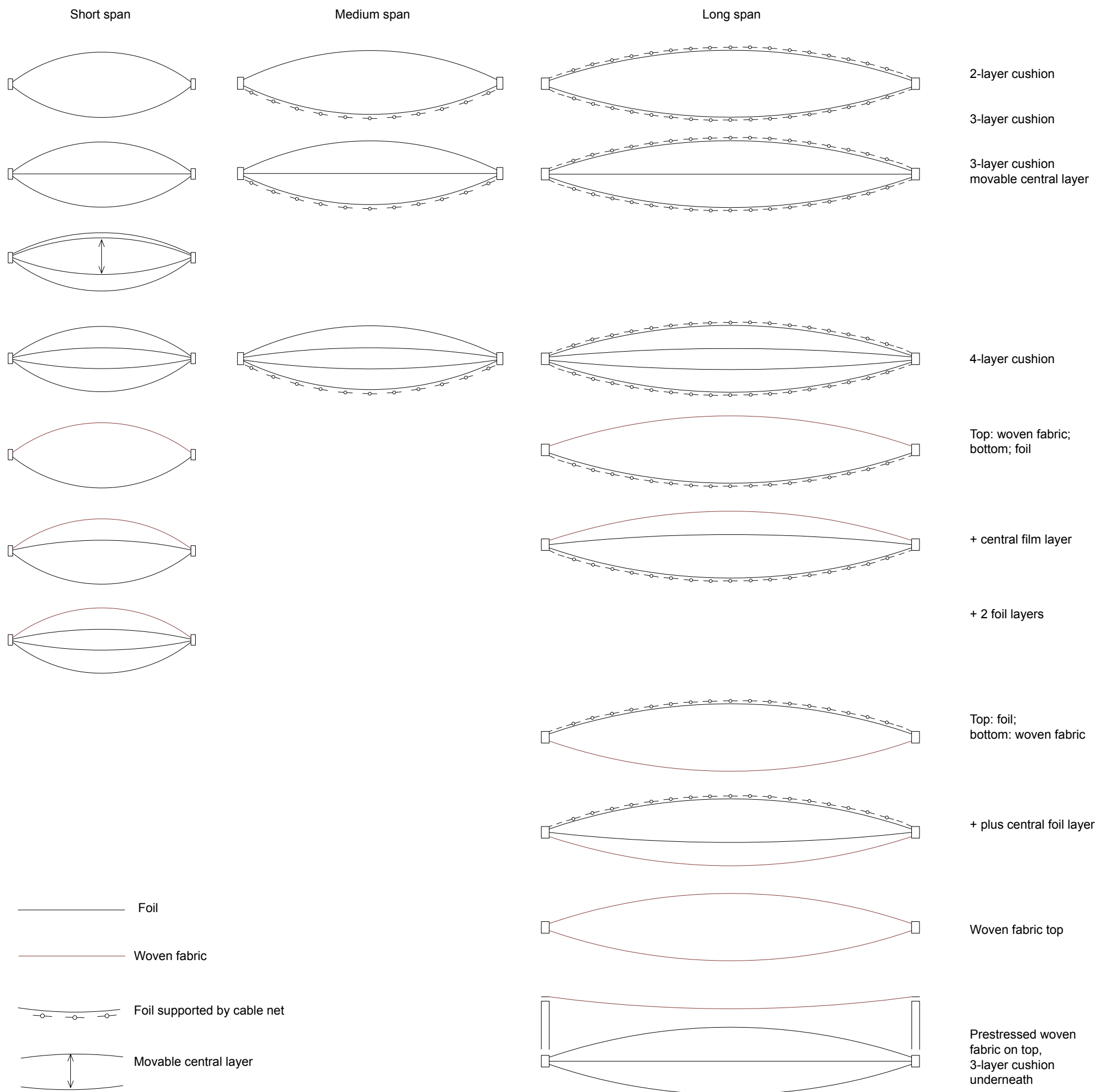
milky at flexed edges

transparent, dyed white, various colours, printing possible

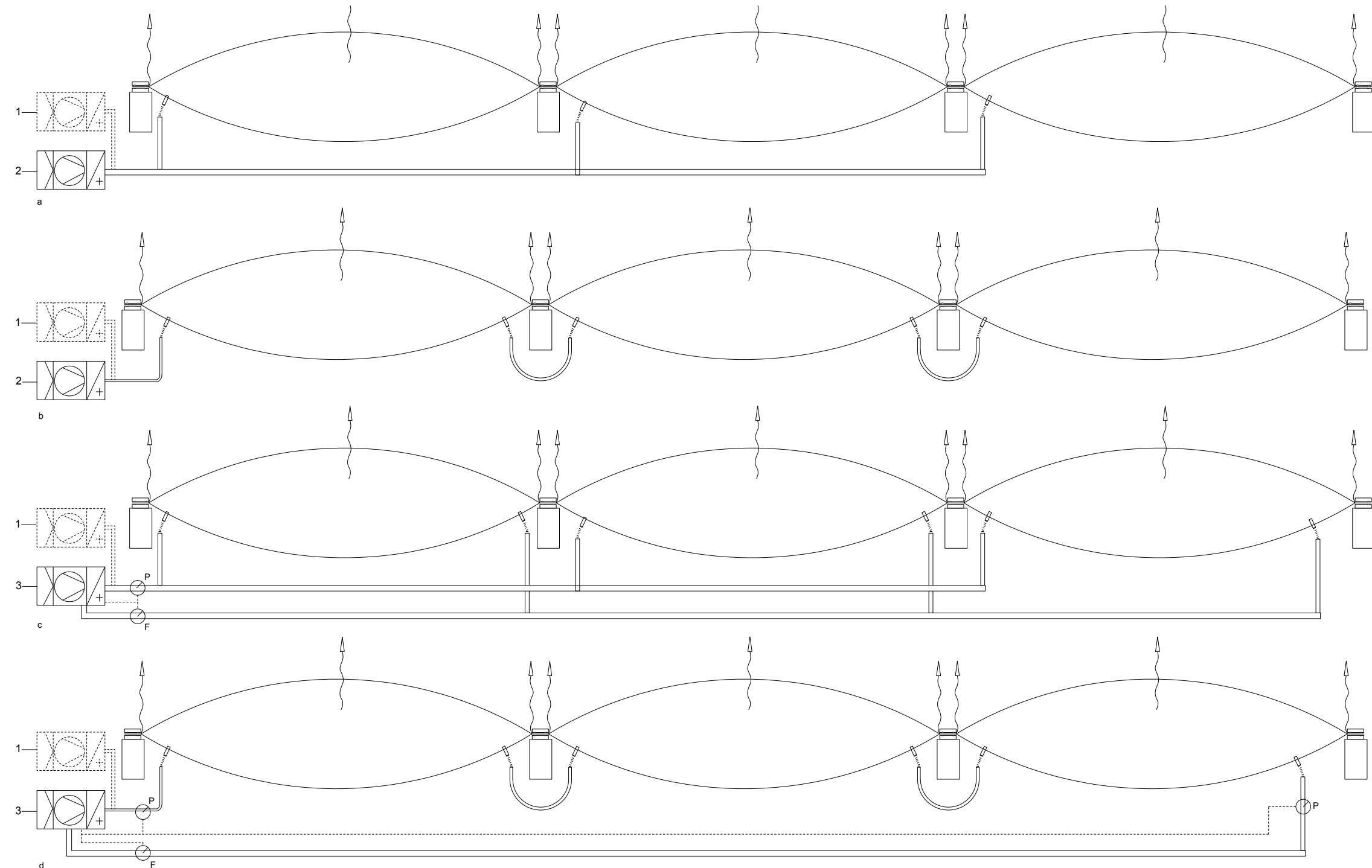


- |   |   |
|---|---|
| a | square cushion  |
| b | rectangular cushion   |
| c | triangular cushion  |
| d | hexagonal cushion   |
| e | air-supported building                                      |
| f | air-supported surface with reinforcing cables               |
| g | negative pressure cushion tube                              |
| h | addition of tubes   |
| i | tensairity beam with stiff top and bottom chords            |
| j | tensairity beam with stiff top chord and cable bottom chord |
| k |   |

Pneumatically prestressed surfaces, from top to bottom

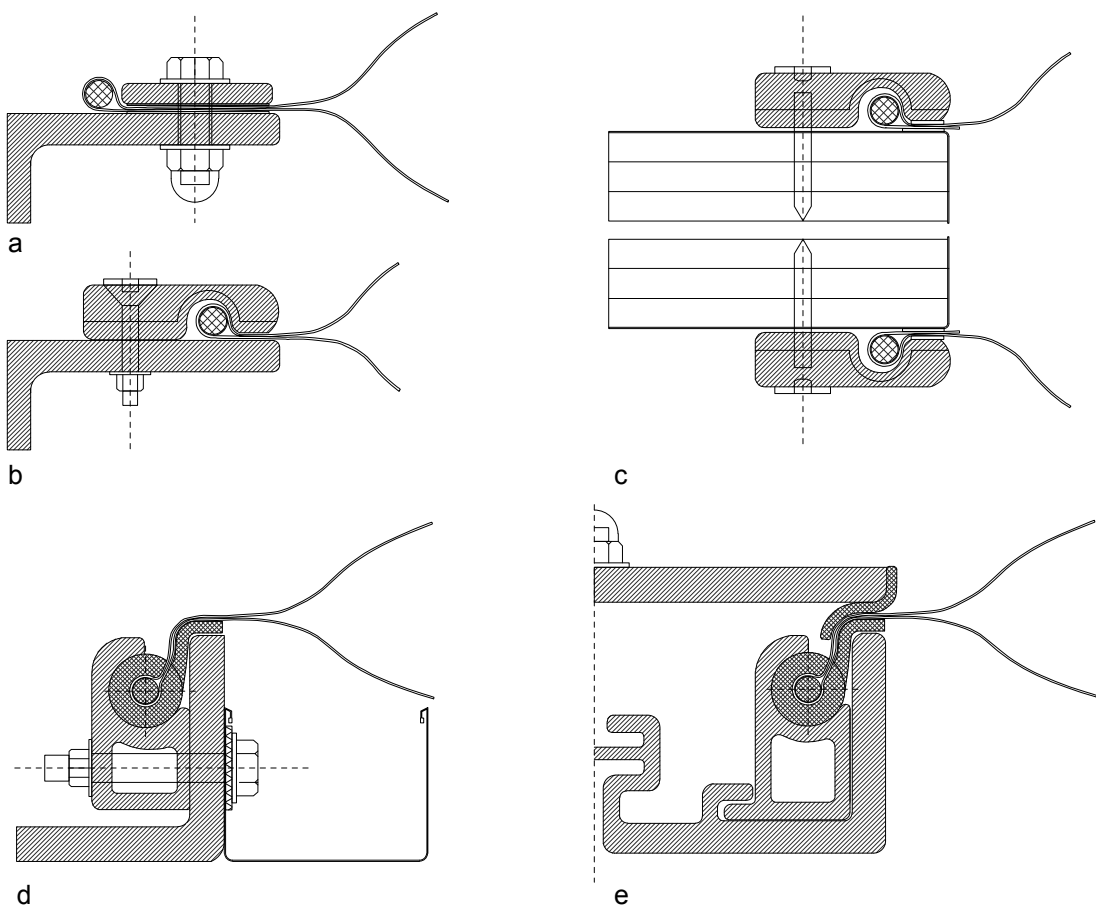


Inflation unit with absorption dehumidifier, diagram



Air supply systems with parallel (a), series (b), return air + parallel (c), return air + series (d) connections

- |   |                                |
|---|--------------------------------|
| 1 | Backup supply                  |
| 2 | Primary air supply             |
| 3 | Filter                         |
|   | Inflation unit                 |
|   | Dehumidifier                   |
|   | Return air system with sensors |
|   | P = sensor for air pressure    |
|   | F = sensor for humidity        |



Edge clamp details, 1:1

- |   |  |
|---|--|
| a | with flat bat  |
| b | with extruded aluminium section  |
| c | with extruded aluminium section above and below timber member for better thermal insulation along the edge |
| d | with condensation channel and factory-fitted polymer edge beat   |
| e | with factory-fitted polymer edge beat and clamping bar as erection aid                                     |

Connection of air supply to cushion, House P, 1:2

REF : Construction Manual For Polymers + Membranes: Materials, Semi-finished Products, Form-finding, Design  
Jan Knippers - Birkhauser - 2011

Colouring, printing and coating of ETFE foils

ETFE cushions; Allianz Arena, Munich, Germany, 2005, Herzog & de Meuron