



Salahaddin University- Erbil  
College of Engineering  
Department of Architecture

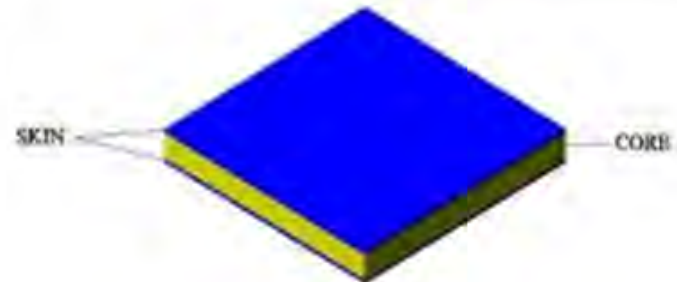
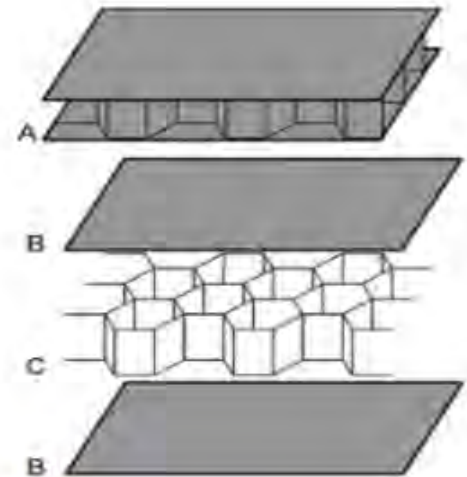
# Wall and Roof cladding in Steel Structural Building

Prepared by: Assist. Lect. Sakar Yousif

12/3/2023

# INTRODUCTION

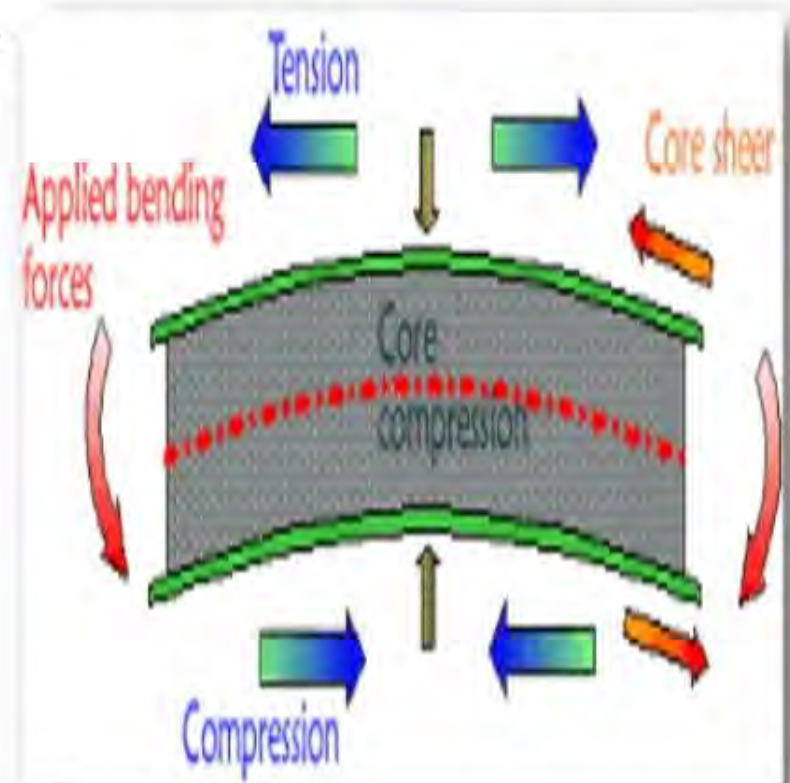
- A **sandwich structured composite** is a special class of composite material that is fabricated by attaching two thin but stiff skins to a lightweight but thick core. The core material is normally low strength material, but its higher thickness provides the sandwich composite with high bending stiffness with overall low density.



- Open and closed cell structured foam, polystyrene, balsa wood, syntactic foam and honeycomb are commonly used core materials. Glass or carbon fiber reinforced laminates are widely used as skin materials. Sheet metal is also used as skin materials in some cases. ANNUAL PRODUCTION IN WORLD- 500 million m<sup>2</sup> ,of 10 billion€ per year.

# Why a Sandwich ?

Long ago engineers realized that by adding a core to a material, the strength and stiffness could be dramatically increased with very little added weight. Cores, in comparison to the additional structural value they add, are extremely cost effective. With a sandwich, less material is required than with a solid structure.



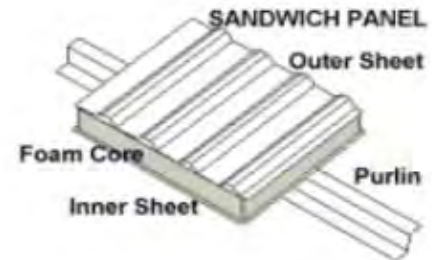
# ADVANTAGES OF SANDWICH PANELS

- Fast installation and ease of handling
- Crane assembly therefore no scaffolding required
- No thermal bridges and good thermal insulation properties
- Design flexibility with choice of colour finishes
- Panels can be installed horizontally or vertically
- Reliable robust mechanical performance
- Outstanding non combustible and acoustic performance
- Resistance to weather and aggressive environments
- Ease of installation
- Long life and very low maintenance cost
- Easy repair and replacement in case of damage



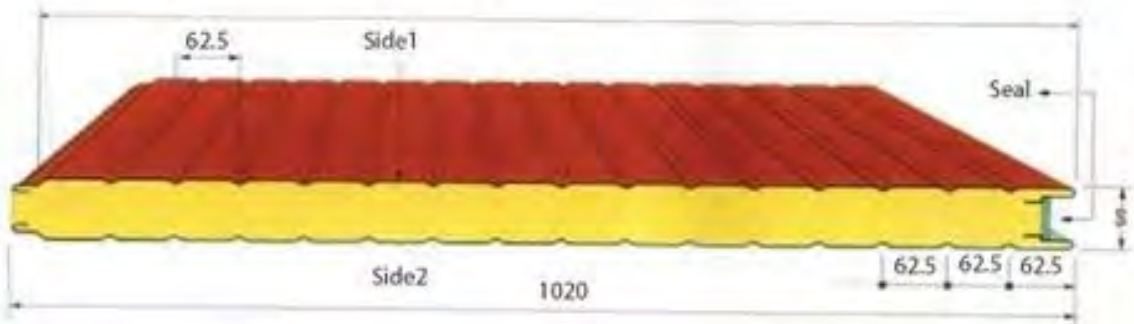
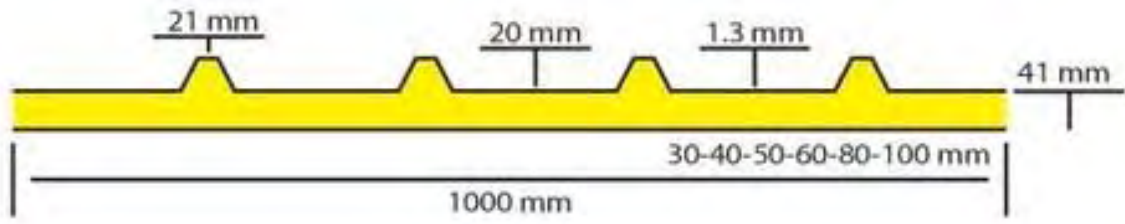
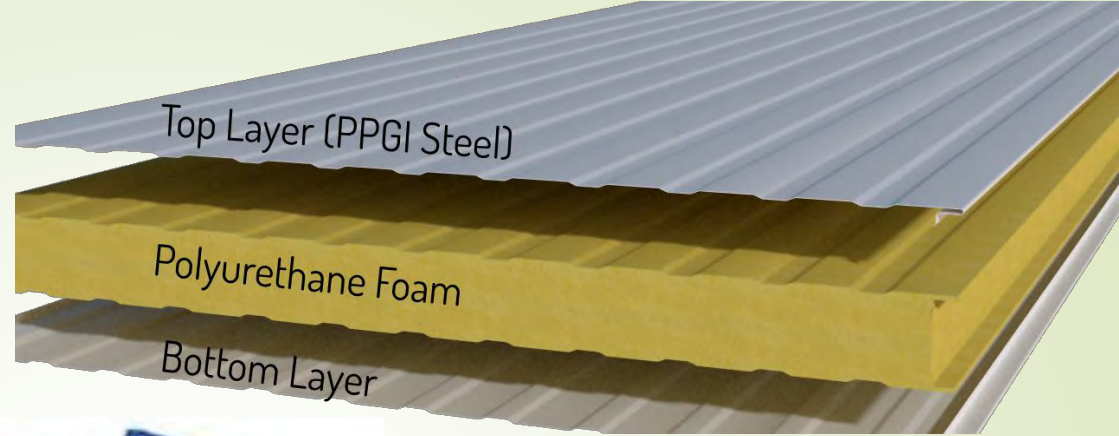
# APPLICATIONS

- ROOFING



- COLD ROOM WALLING
- PARTITION WALL
- AEROSPACE
- MOBILE HOMES
- MODULAR HOMES





# Types of sandwich panels

- **SANDWICH PUFF PANELS**

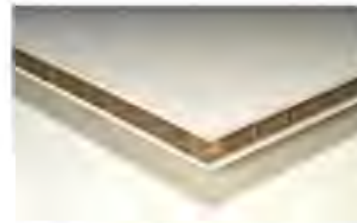
These panels consists of two facings of relatively thin metal sheet profiled of high strength enclosing a core, which is relatively thick and light with required stiffness. The facings are of aluminum or steel.

- Thicknesses -30 to 120 mm
- Width -1000 mm to 1200 mm
- Maximum Length -15 meter



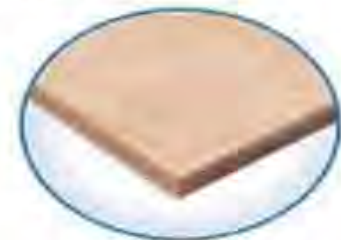
- **Sandwich panel: gypsum plasterboards and carton**

Mostly used in partitions.



- **Insulation sandwich panel in wood and PVC foam (waterproof)**

Resistant to hydrocarbons, alkalis, diluted acids, methyl alcohol, sea water, petrol and diesel fuel, and can be used with polyester, vinylester and epoxy resins. Reduce weight upto 80% compare to plywood.





- **Acoustic metal sandwich panel**

aluminum structural panel is light, resistant, incombustible, 100% recyclable and economical. Because of its flexibility, the panel can be applied in different fields: building, interiors, exhibition design and stands e.t.c.

Thickness- 4-50mm

Width- 1050-1200mm

Length- upto 5000mm



- **Rigid sandwich insulation panel in wood and polystyrene**

These are the panels which can add crystalline effect in the appearance.

Also can be used to cover walls and attics





- **EPS(Expanded polystyrene) Sandwich panel**

Composed of 2 layers of **weather proof colored steel sheet and jetted** hard forms of polyurethane between 2 layers (fireproof material). Suitable for various roofs and walls referring to the large size factory  
Thickness- 50-200mm



- **PU(Polyurethane) Sandwich panel**

Light self-weight: **10 to 14kg/sqm.** Installation is convenient and flexible without the large-size lifting devices so that the construction period is limited with the lower comprehensive costs.  
Thickness- 75-200mm



# STRUCTURAL INSULATED PANELS

The common characteristic of all SIPs are two exterior skins adhered to a rigid plastic foam core. Typical product dimensions are 300, 600, or 1,200 mm wide and 2.4, 2.7, and 3 m long, with roof SIPs up to 6 m long

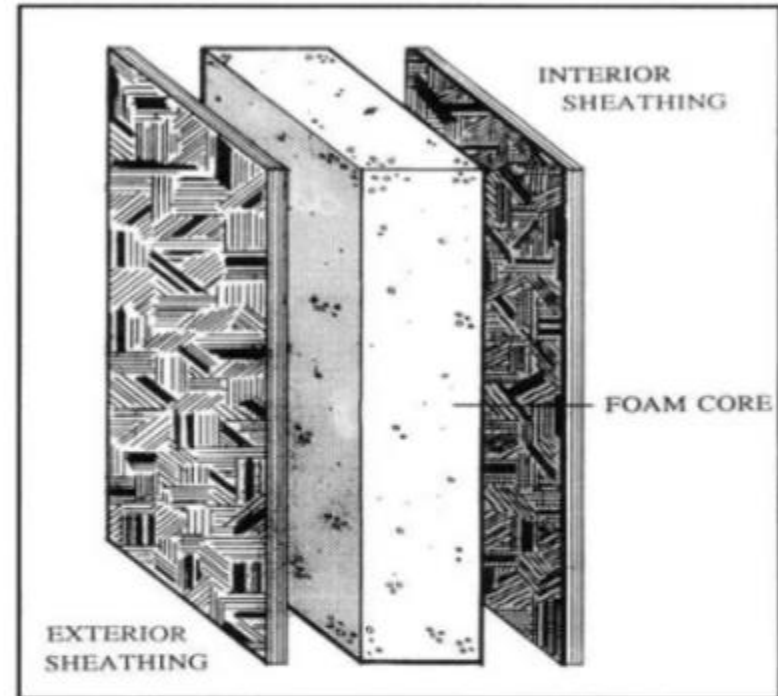


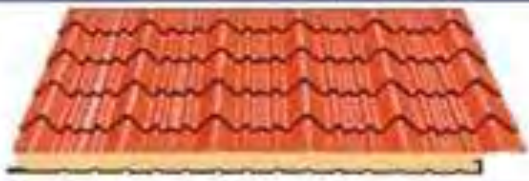

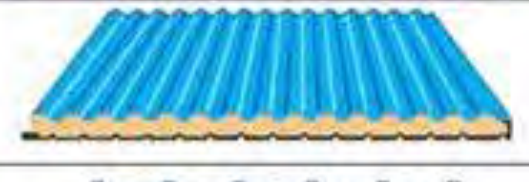
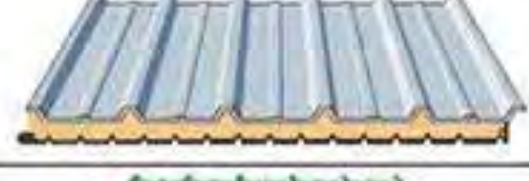


Fig. 2: SIPs have two exterior skins bound to a rigid plastic foam core

- The board can be sheet metal, plywood, cement or oriented strand board (OSB) and the foam either expanded polystyrene foam (EPS), extruded polystyrene foam (XPS) or polyurethane foam.  
EPS is the most common of the foams used material for the construction of SIP.

These are widely used in Mobile homes and Modular homes.

# Type of Insulated Cladding for Wall and Roof: Sandwich Panel

Type of insulated cladding manufactured by Prime Metal Building System

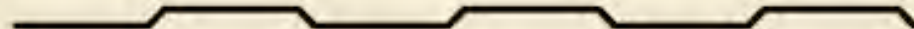
VI Profile	Drawing	Application
Tile Profile 27/195		Roof Sheets
25/252		Roof/wall sheets
Fully Corugated		Roof Sheets
35/207		Roof/wall sheets
38/200		Roof/wall sheets
45/250		Roof/wall sheets



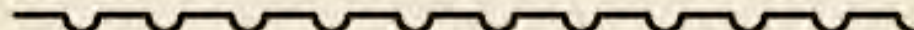
# Type of External Surfaces for Sandwich Panels



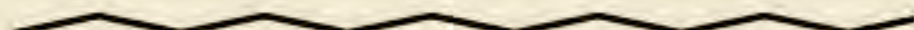
Flat



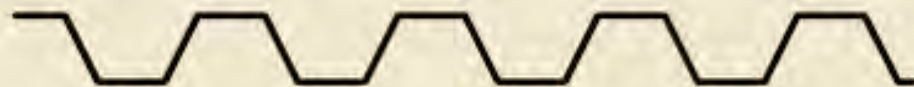
Wide profiled



Narrow profiled



Micro-profiled



Trapezoidal

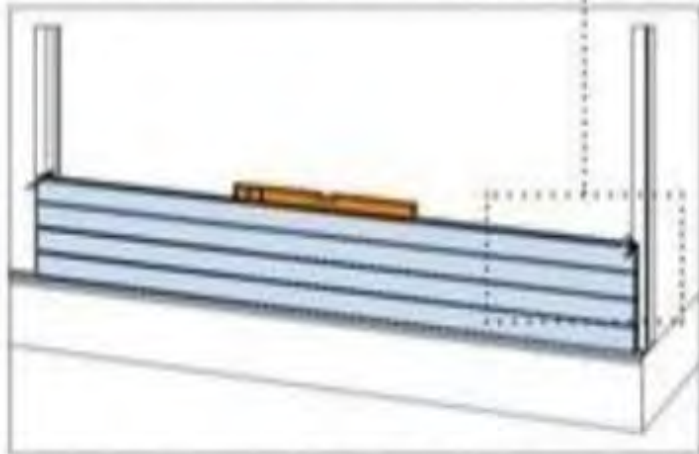


Corrugated

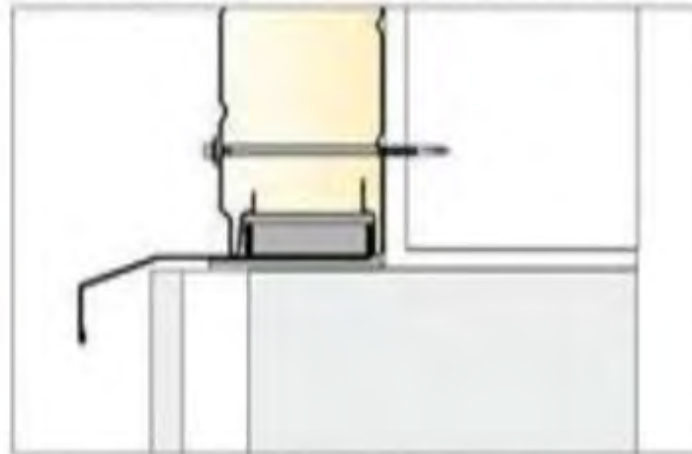
# Installation of the Wall Panels



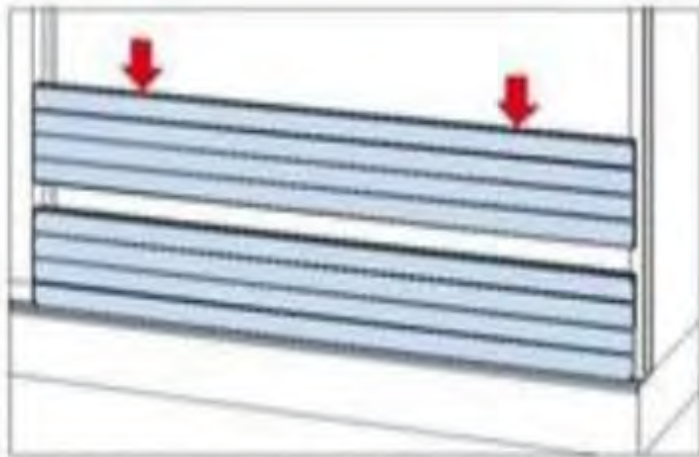
## First panel section (Monowall used in example)



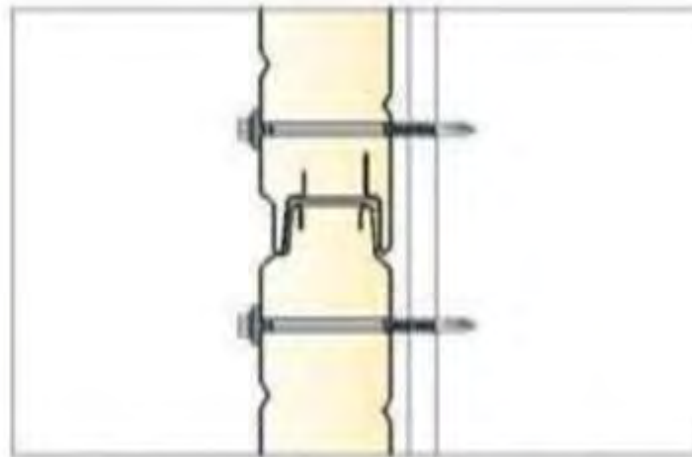
Check that the panel is horizontal by using a spirit level and fix it with a clamp.



The bottom panel is assembled over a U-shaped base runner, insulate it on the inside. Also assemble a drop flashing.



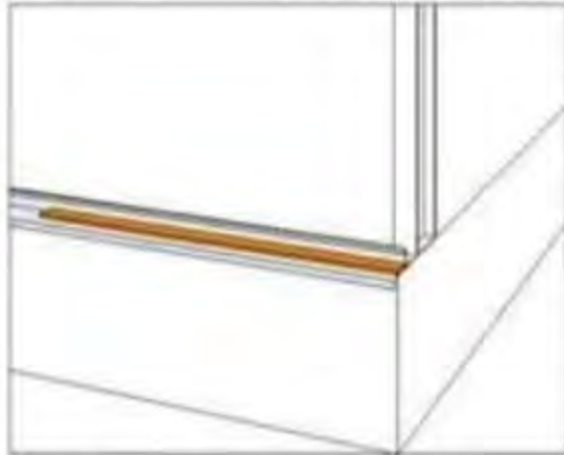
Before assembling the second panel, make sure the joints are clean.



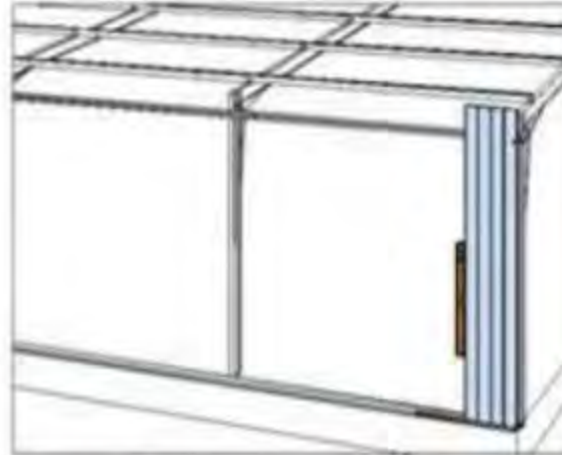
Fasten the panel with self drilling screws one screw at bottom and one at the top of the panel.



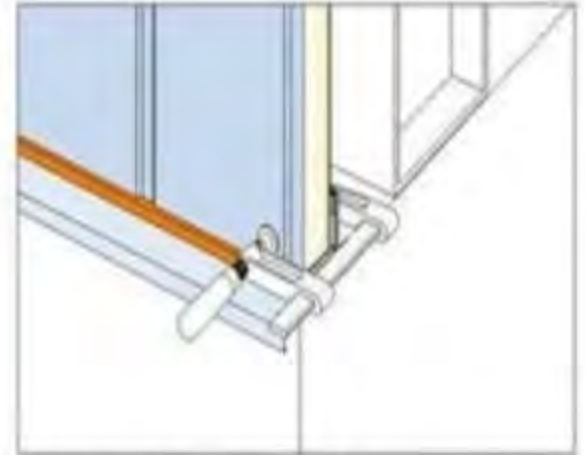
## First panel section (monowall used in example)



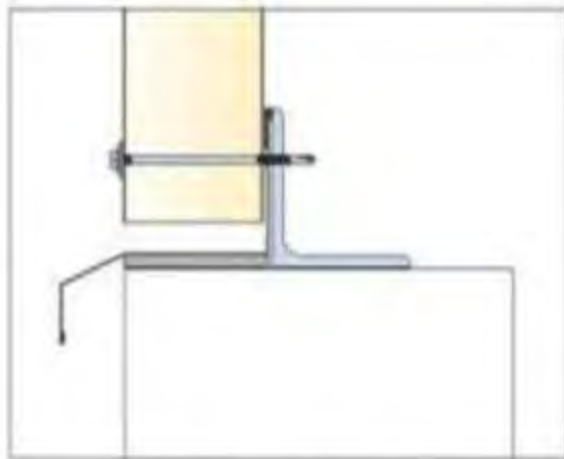
Start with placing a template for the right distance between base and plate.



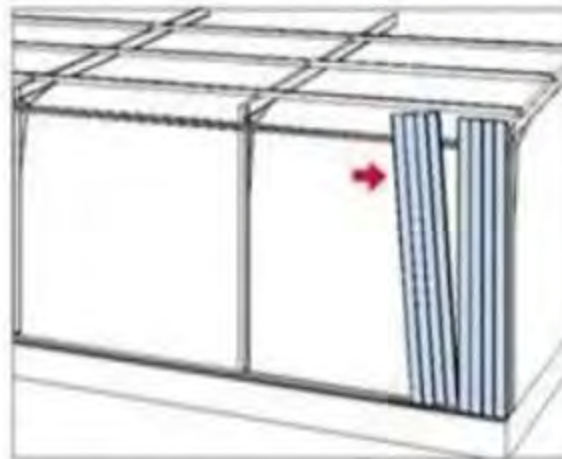
Check that the panel is vertical by using a spirit level and fix it with a clamp.



Fix the panel with a clamp before screwing.

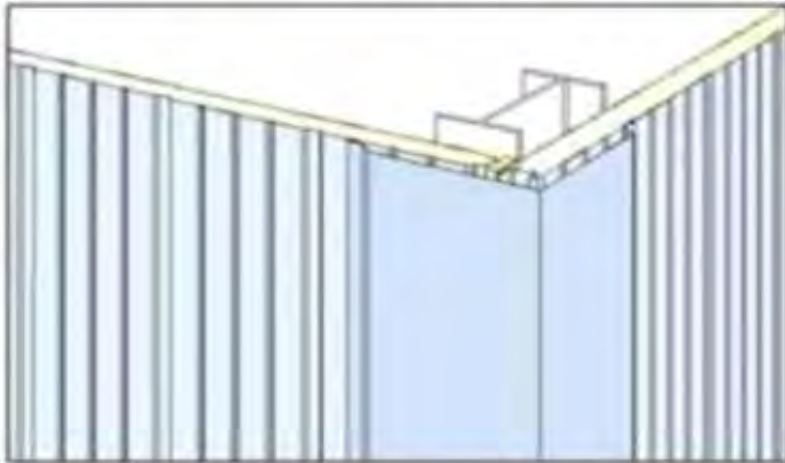


Plane drawing of the base construction.



Continue with the other panels the same way as the first one.

## Details – Flashings, openings



Cover the corners with flashings. Use screws or blind rivets.



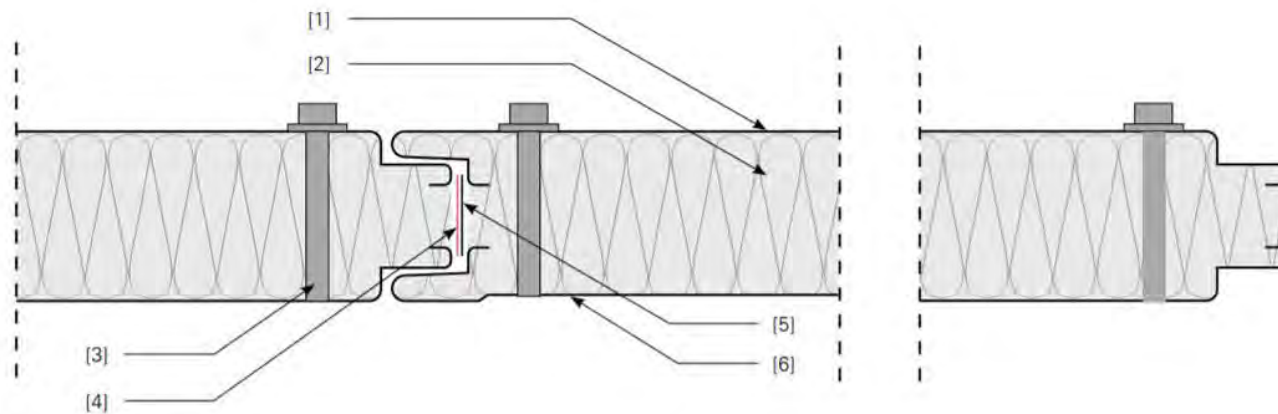
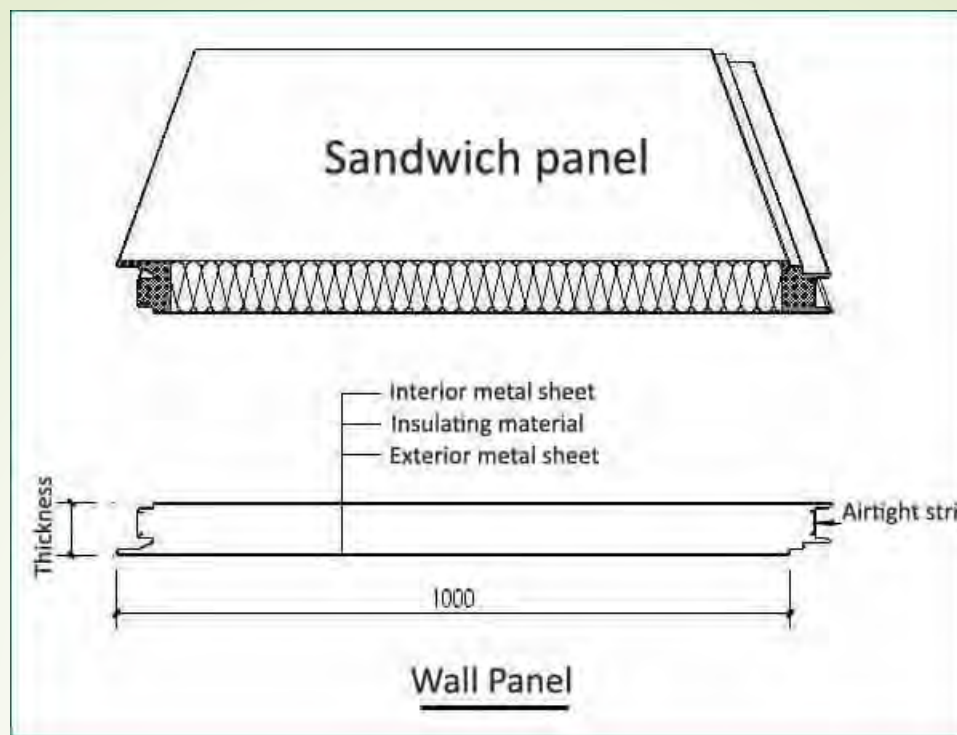
Measure the window and make the cut out in the panel accordingly.



Use a sealant before you assemble the window in the opening.

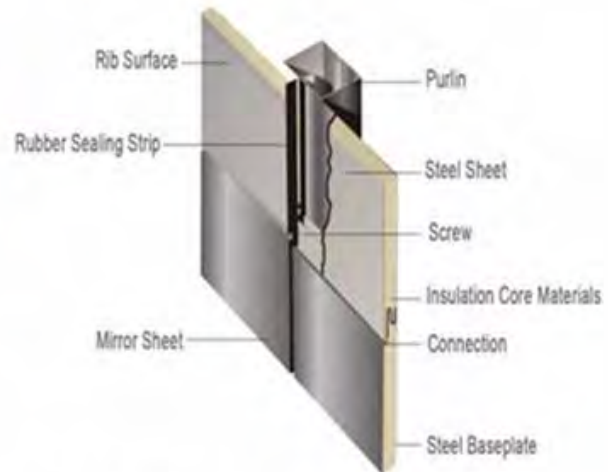
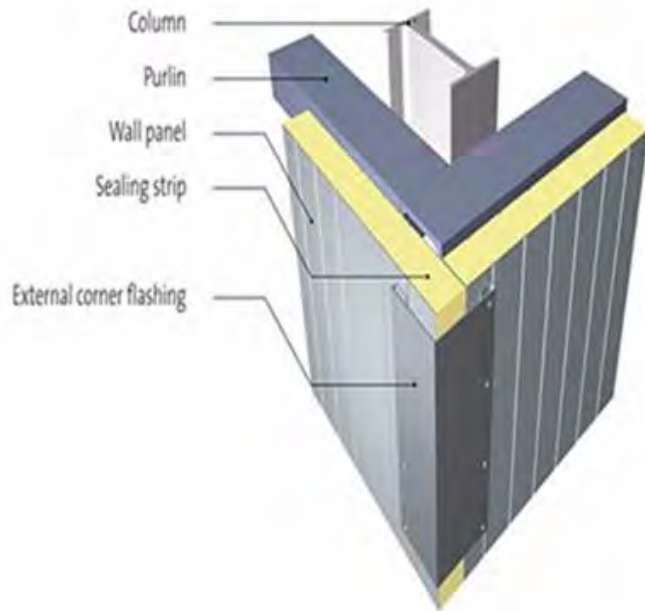
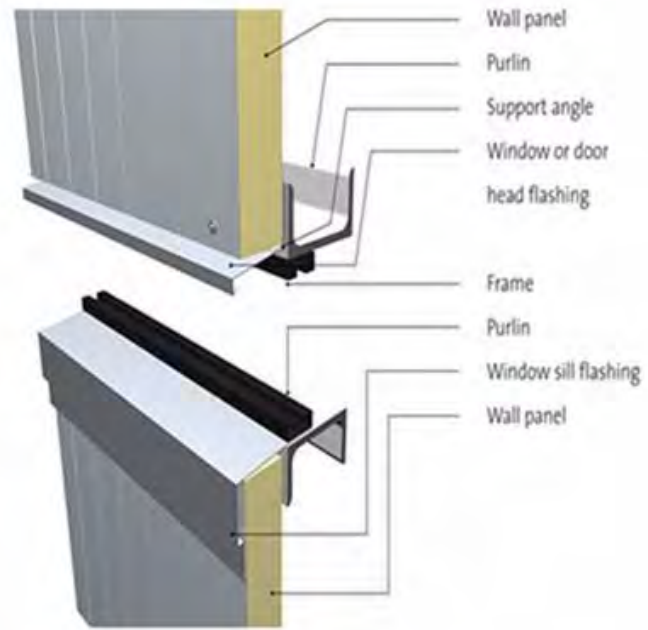
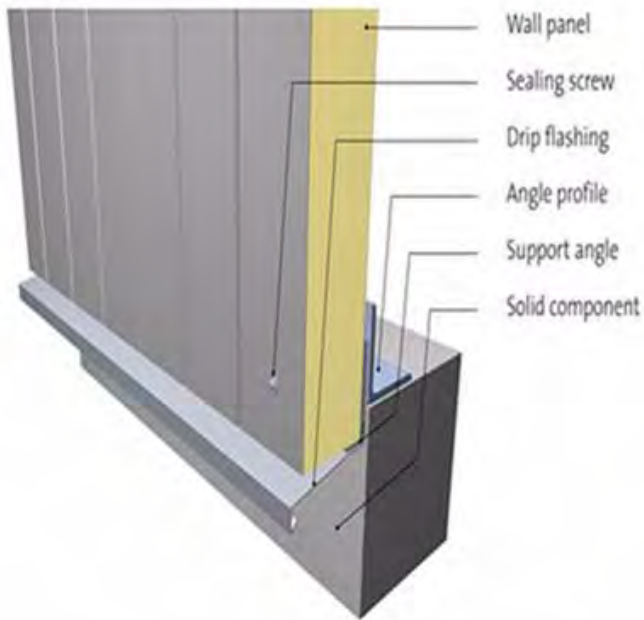


N.B view from the inside. Use wedges to hold the window in place.



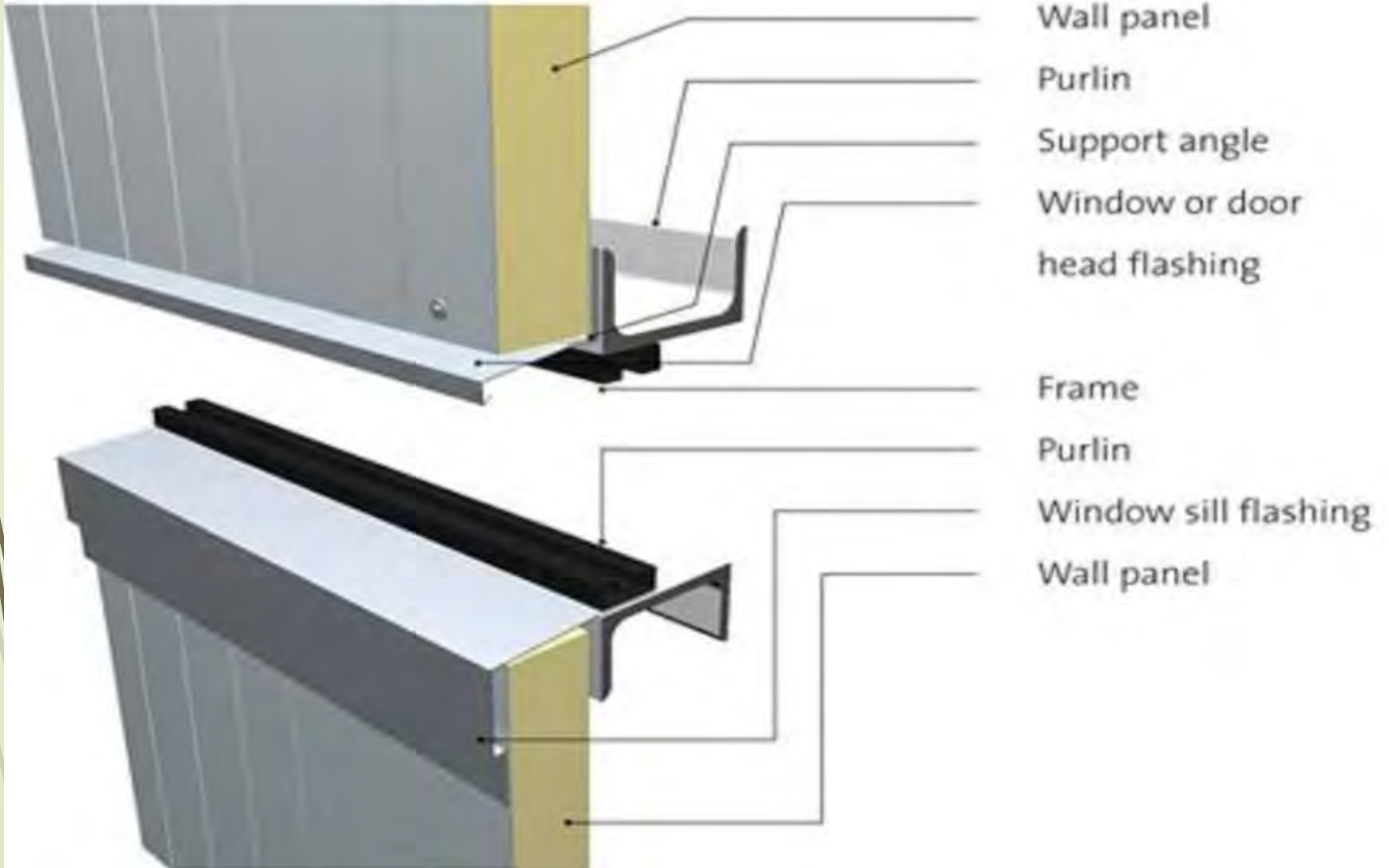
- [1] external cladding
- [2] insulation (PUR/PIR/wool)
- [3] self-drilling fastener
- [4] tape
- [5] seal
- [6] steel internal cladding



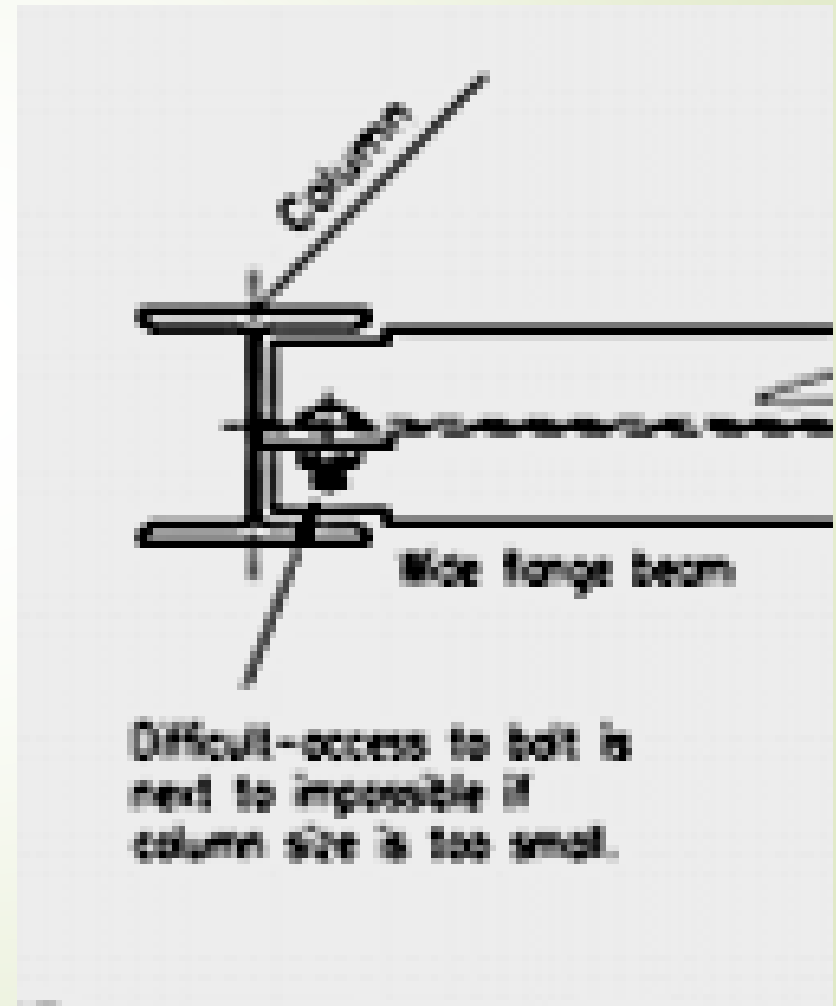
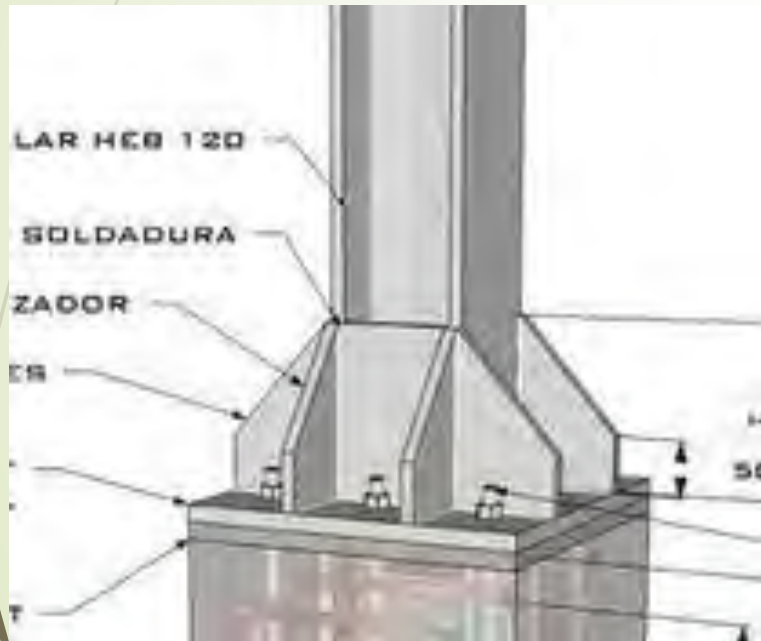


External Wall System

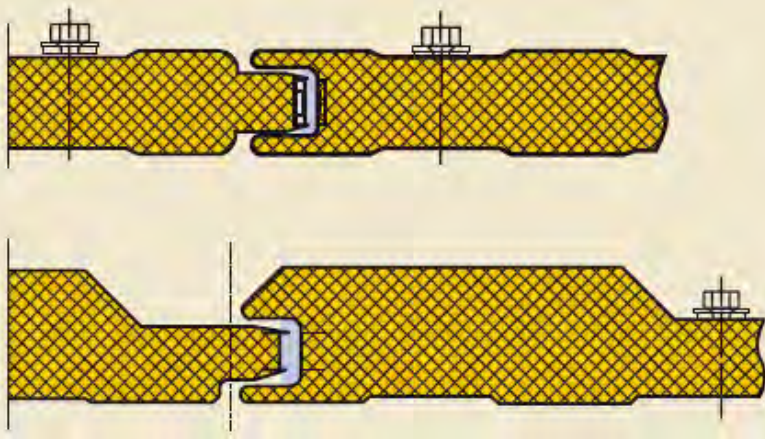
# WINDOW SILL AND HEAD DETAIL



# The connection between I Shaped column and wall Sandwich panel

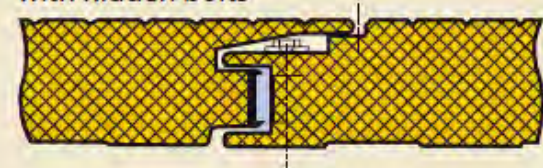


# The connection between two wall sandwich panels

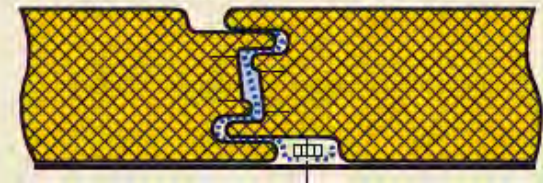


(a) Through fixings

with hidden bolts



with additional element fastener



(b) Invisible fixings



## TYPES OF INTERLOCKS



Double lock with an open fixture



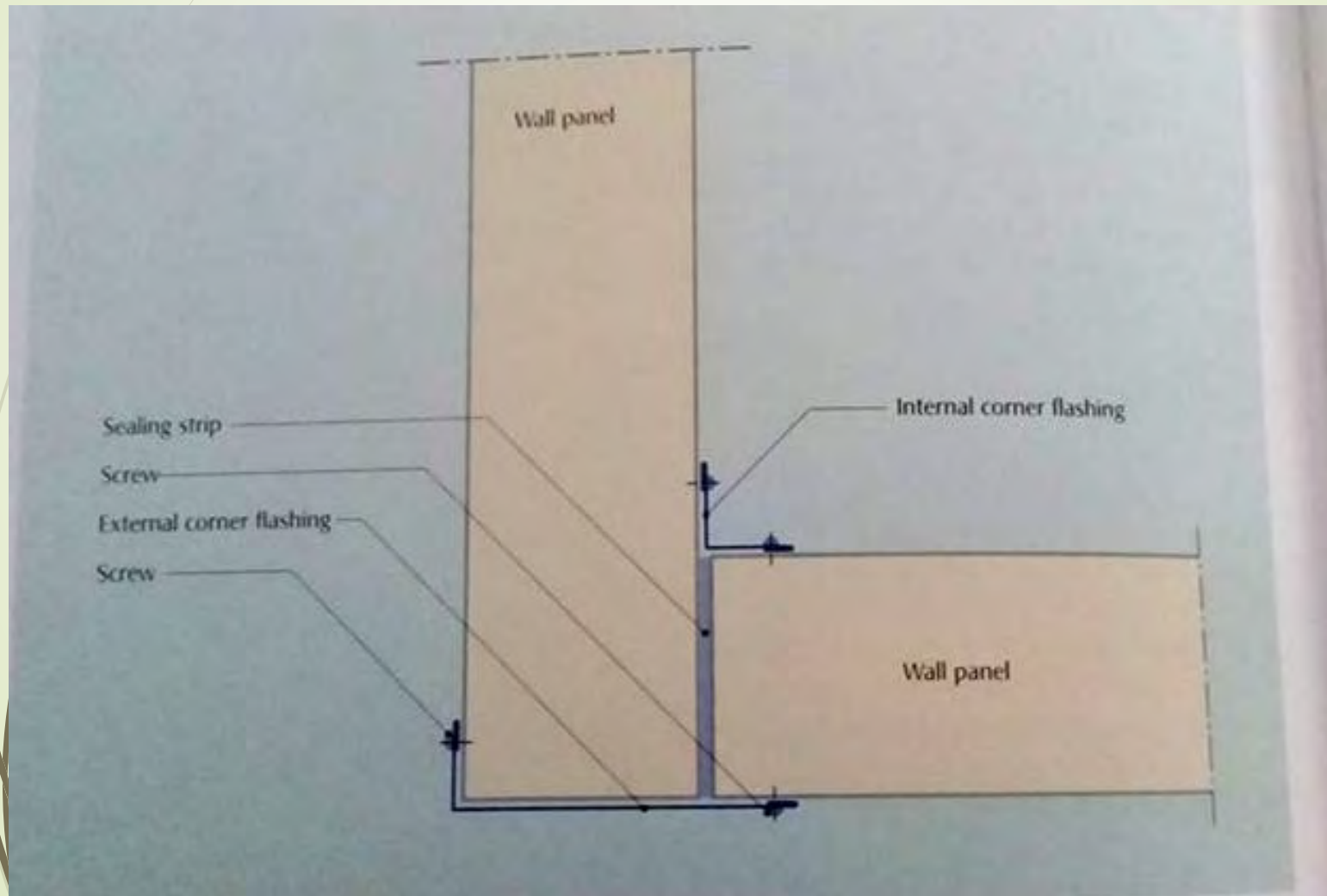
Double lock an open fixture and a groove connection



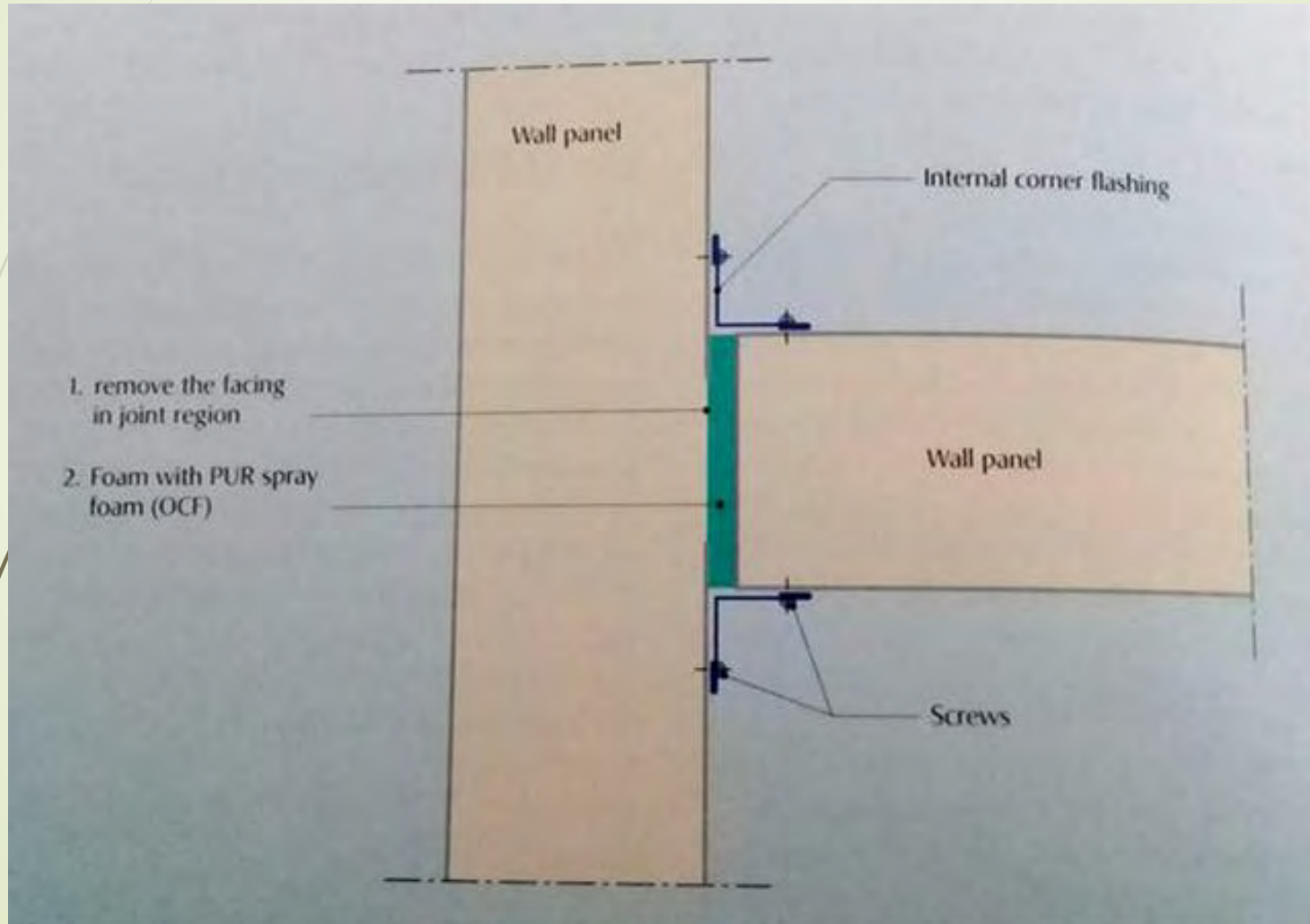
Double locking with "hidden screws" connection

Panel thickness, mm	40, 50, 60, 80, 100, 120, 150, 200, 220
Maximum length, mm	12 500
Width, mm	1 000 / 1 150 / 1 200
The thickness of outer and inner linings, mm	0,3 - 0,8

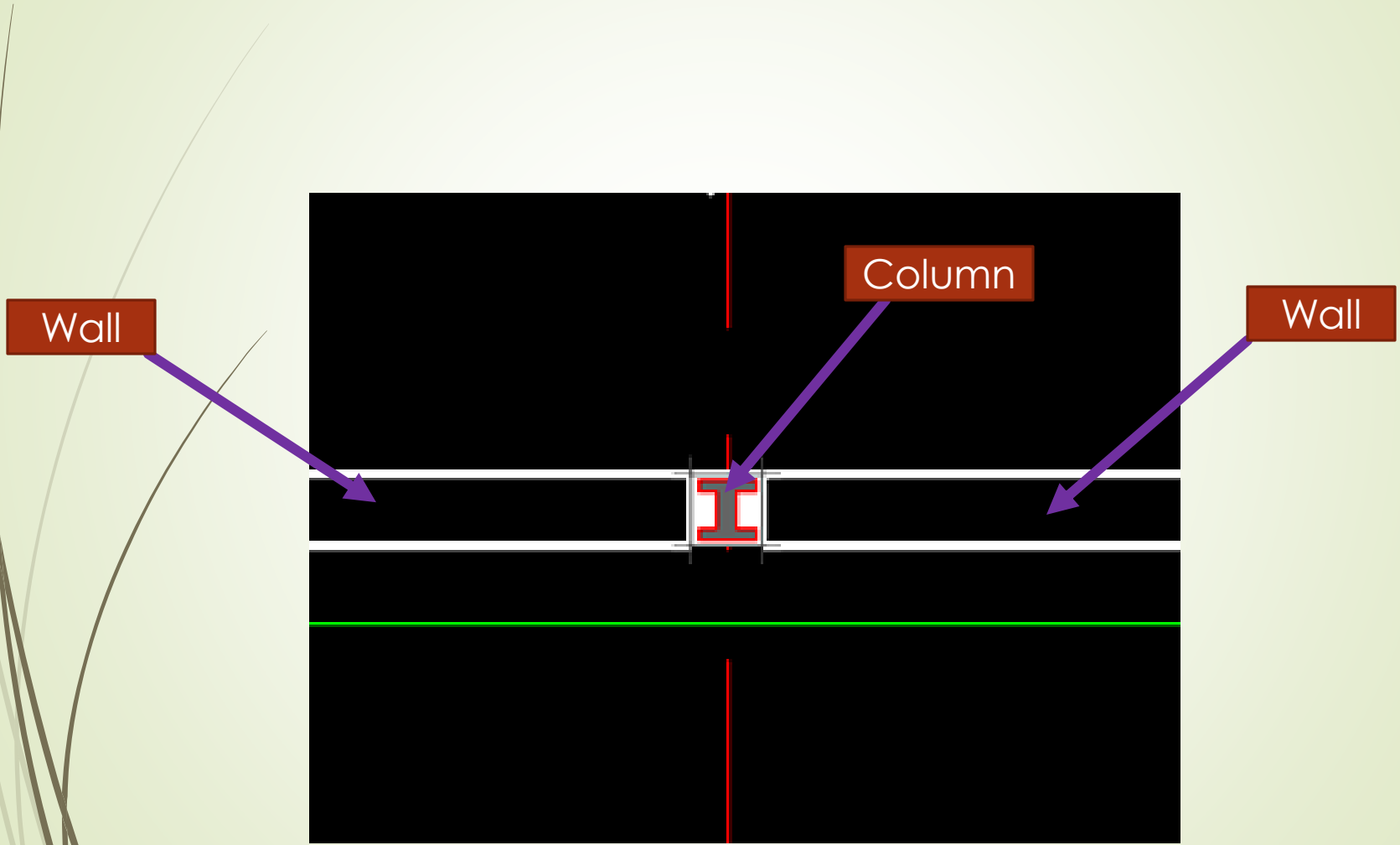
# The connection between Two sandwich Panels in the Corners



# The connection between two panels

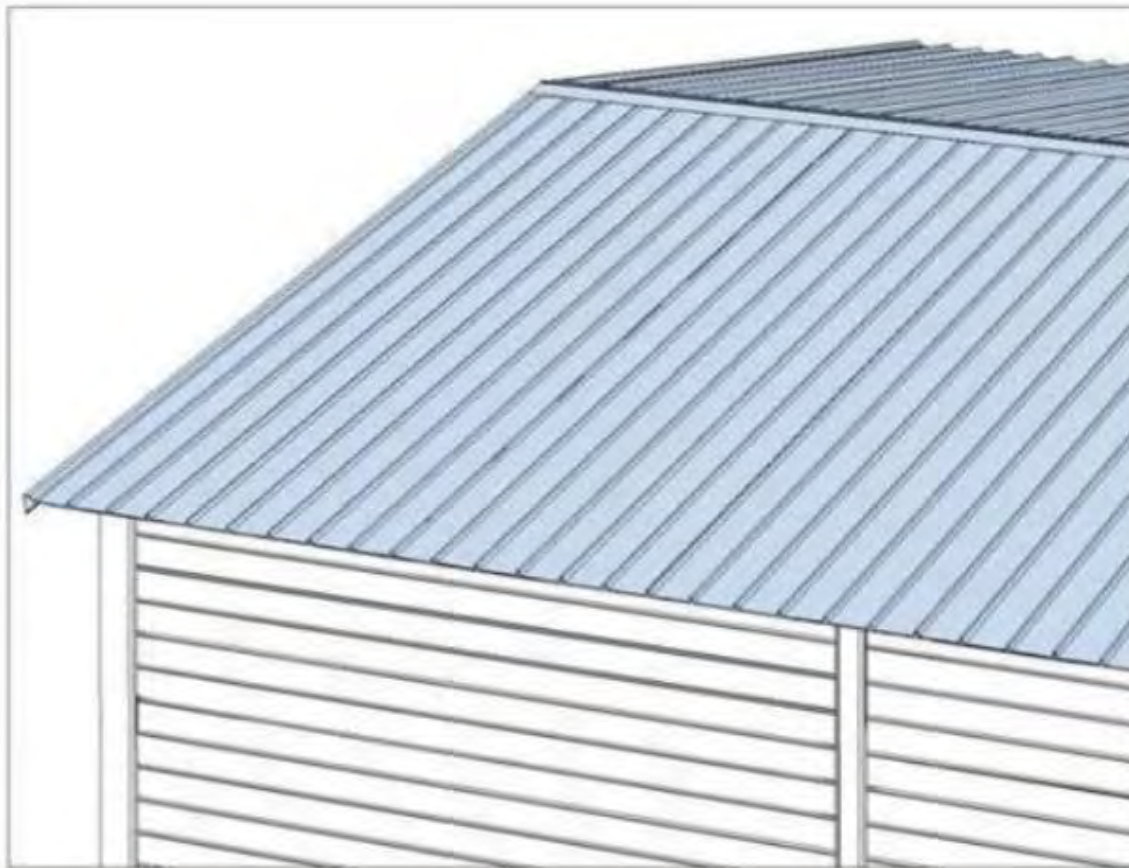


# Drawing the Walls in Dimensional plan

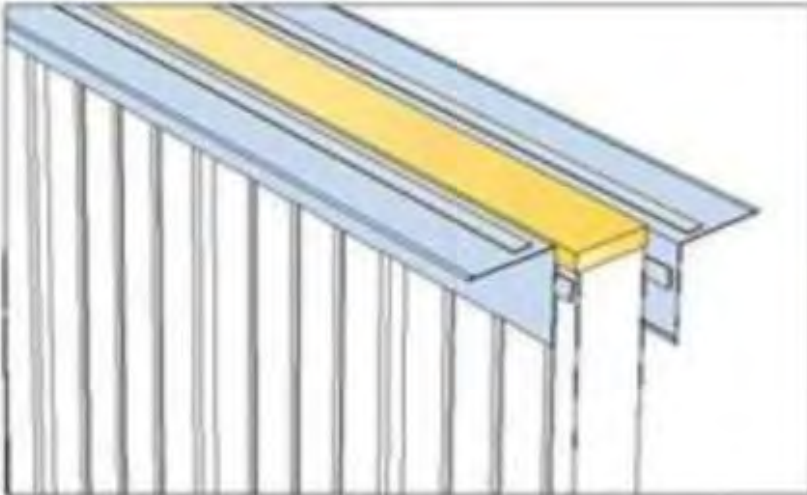




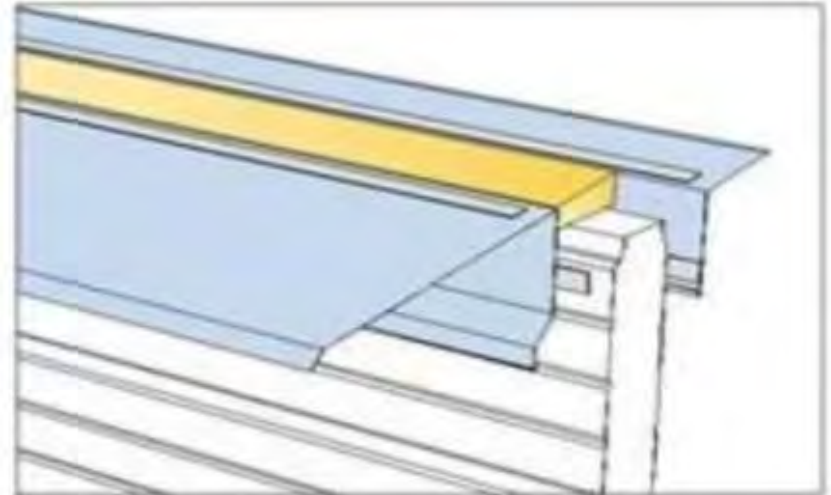
# Assembly – Roof Sandwich Panels



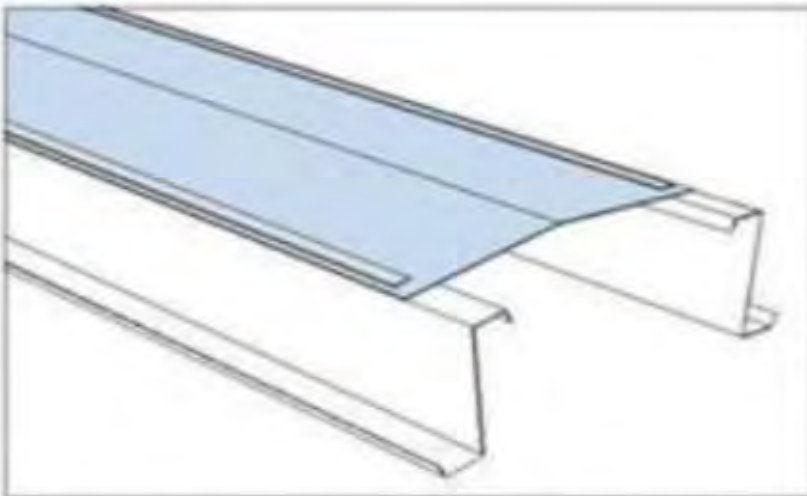
## Preparations



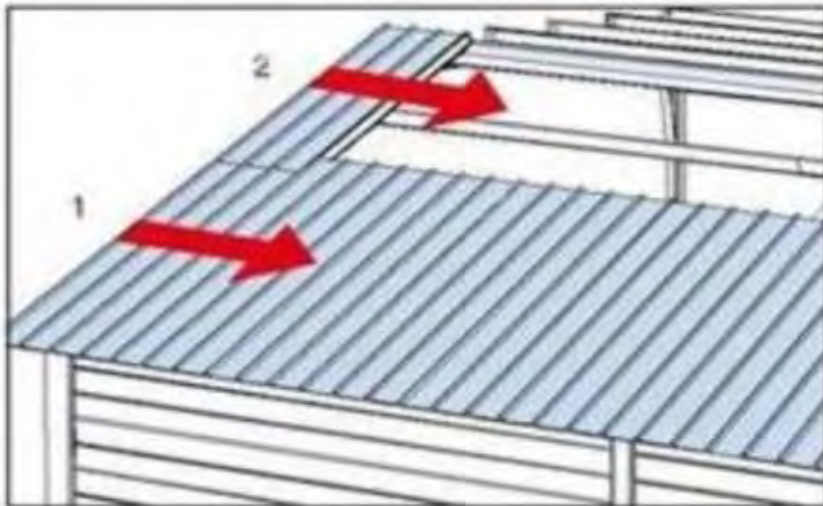
Start to fix flashings on the gable walls. Corner flashing S9 at top of the sandwich element on the outside and on the inside a still flashing long side interior S15.



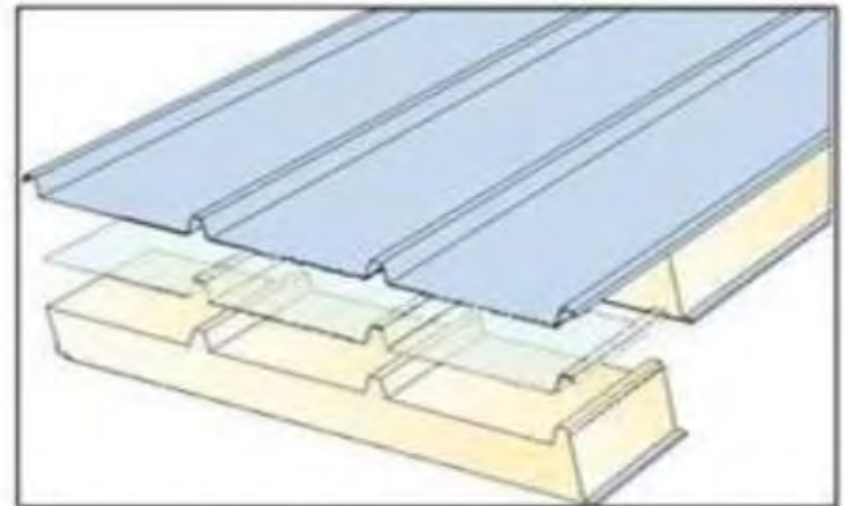
Prepare flashings on the long side walls. Flashing S5 up against the wall panel on the outside. On the inside a still flashing long side interior S13.



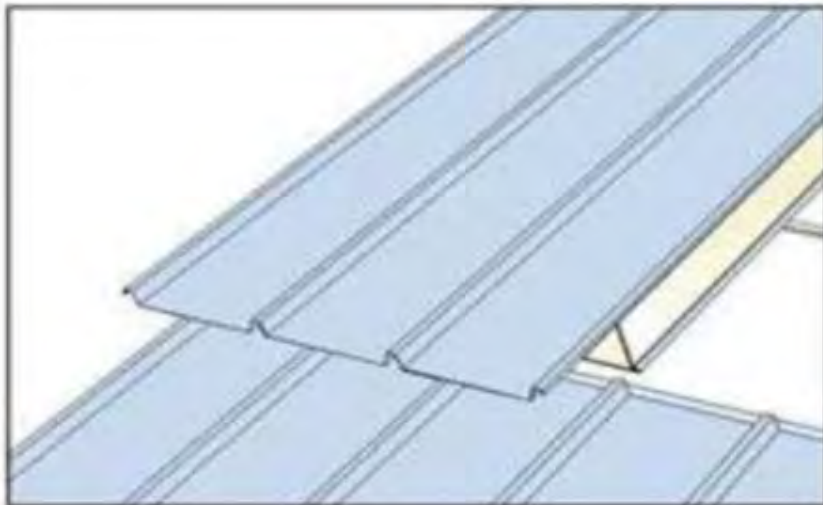
On the ridge prepare with a internal flashing S2.



Assemble the lower panel row first and continue with second row.



Cut off min 100 mm and max 300 mm of the foam from the second row panels.

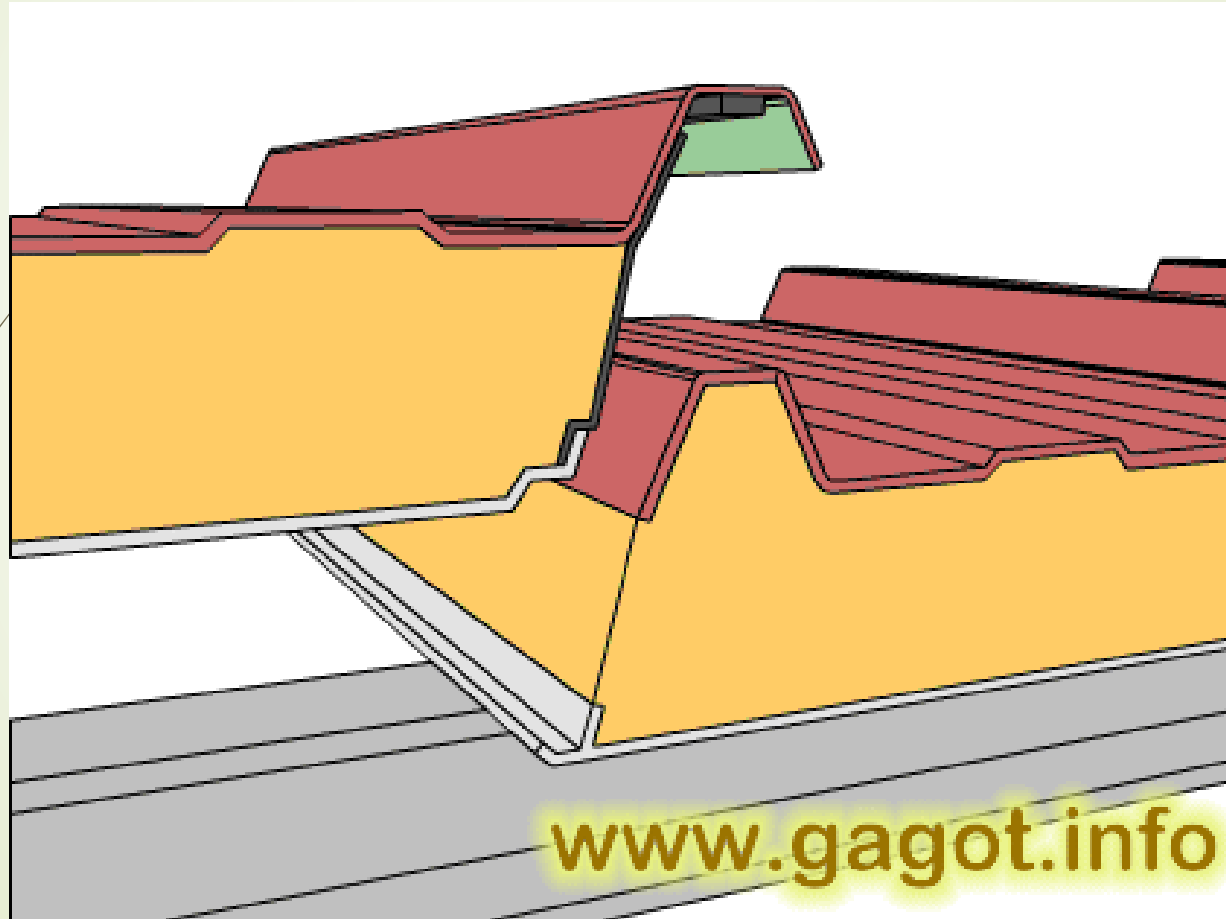


Place the panel on top of the first row panels.



Fasten with self tapping screws with cap on all

# The connection between Two Roof sandwich Panels

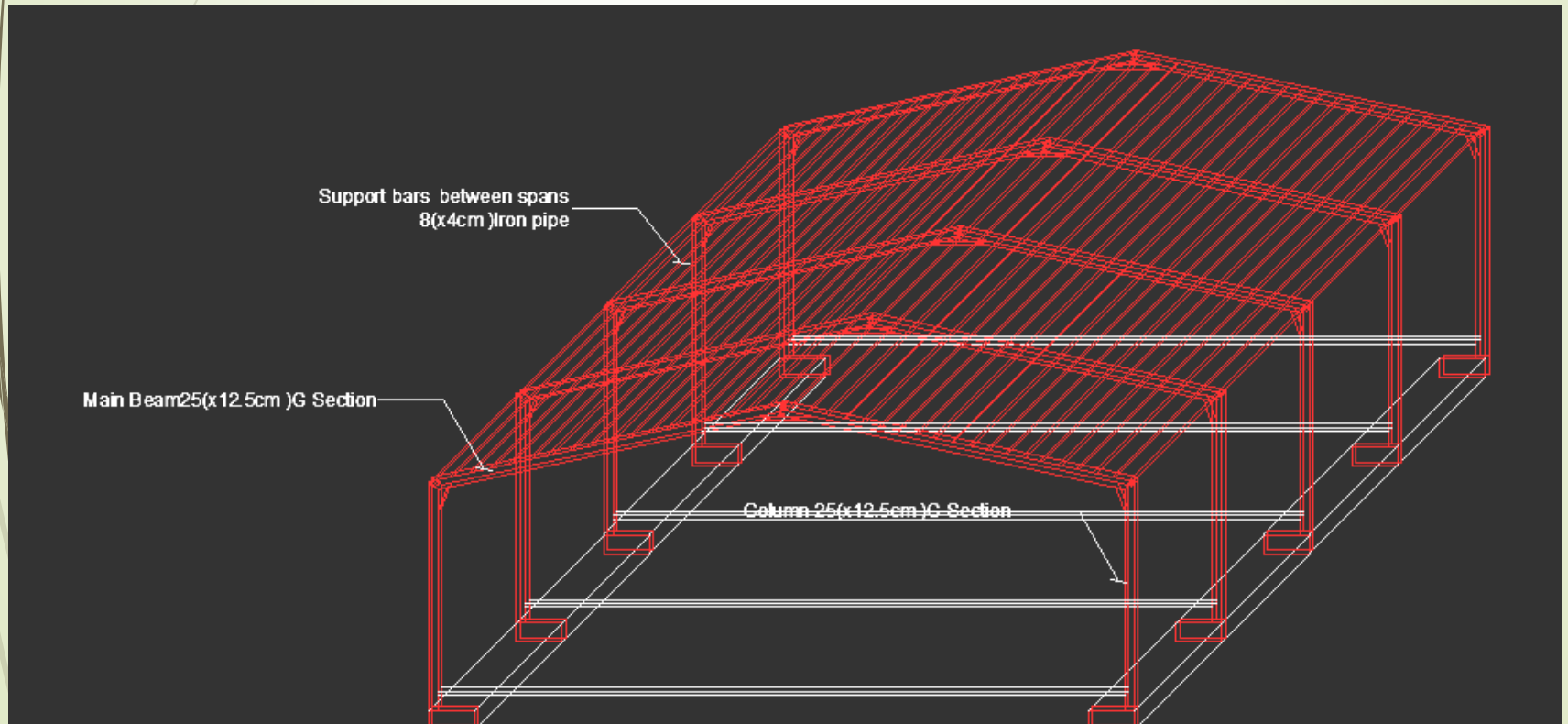




# The connection between Two Roof sandwich Panels



# Column and Beams



# The Steel Skelton



# The connection between Roof Panel and Steel Beam

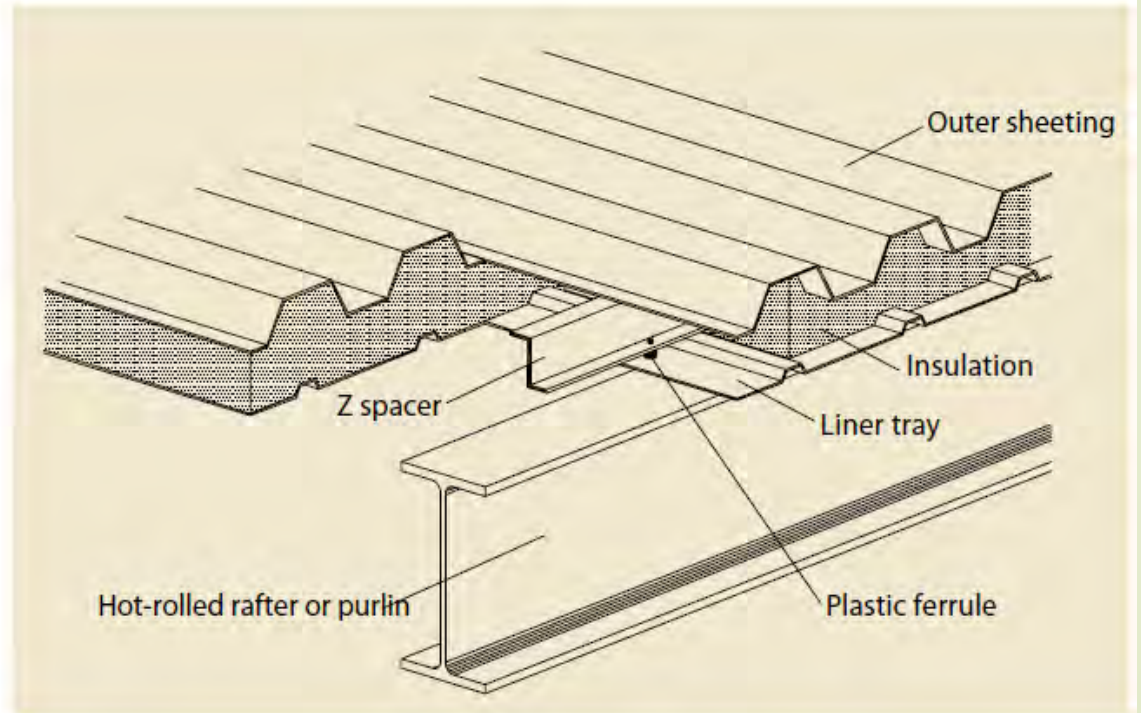


Figure 4.2 Double-skin construction using plastic ferrule and Z spacers



# The connection between Roof Panel and Steel Beam

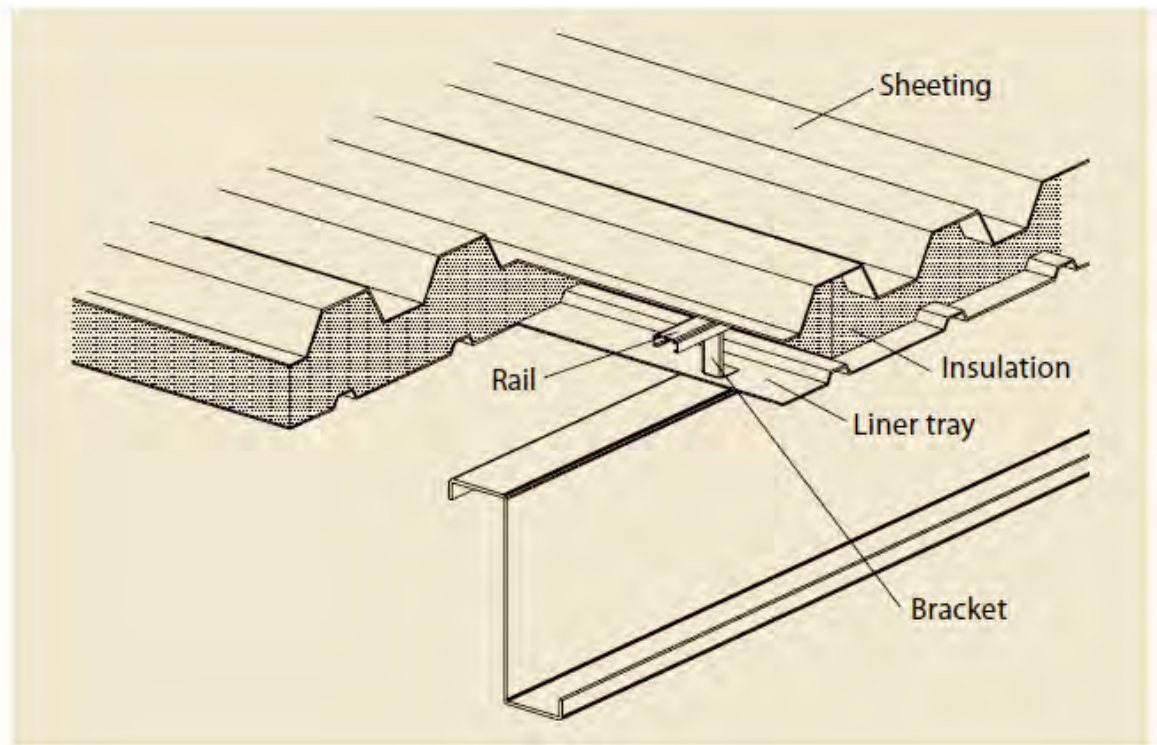


Figure 4.3 (Bottom right) Double-skin construction using 'rail and bracket' spacers

# The connection between Roof Panel and Steel Beam

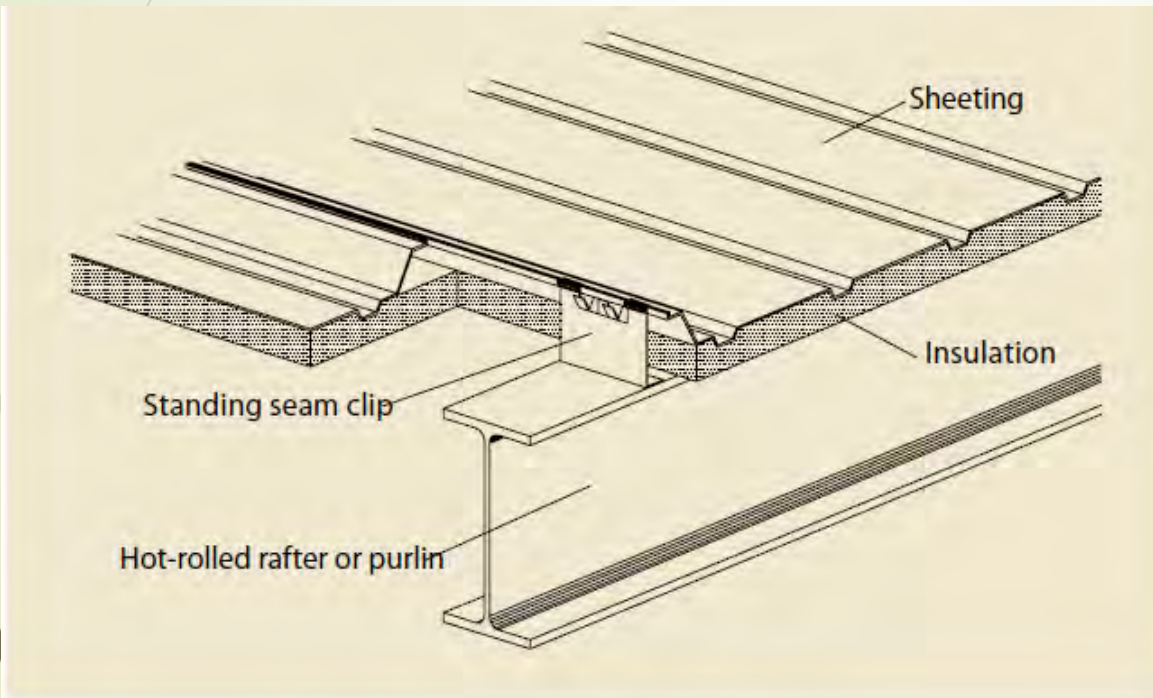


Figure 4.4 Standing seam panels with liner trays

# The connection between Roof Panel and Steel Beam

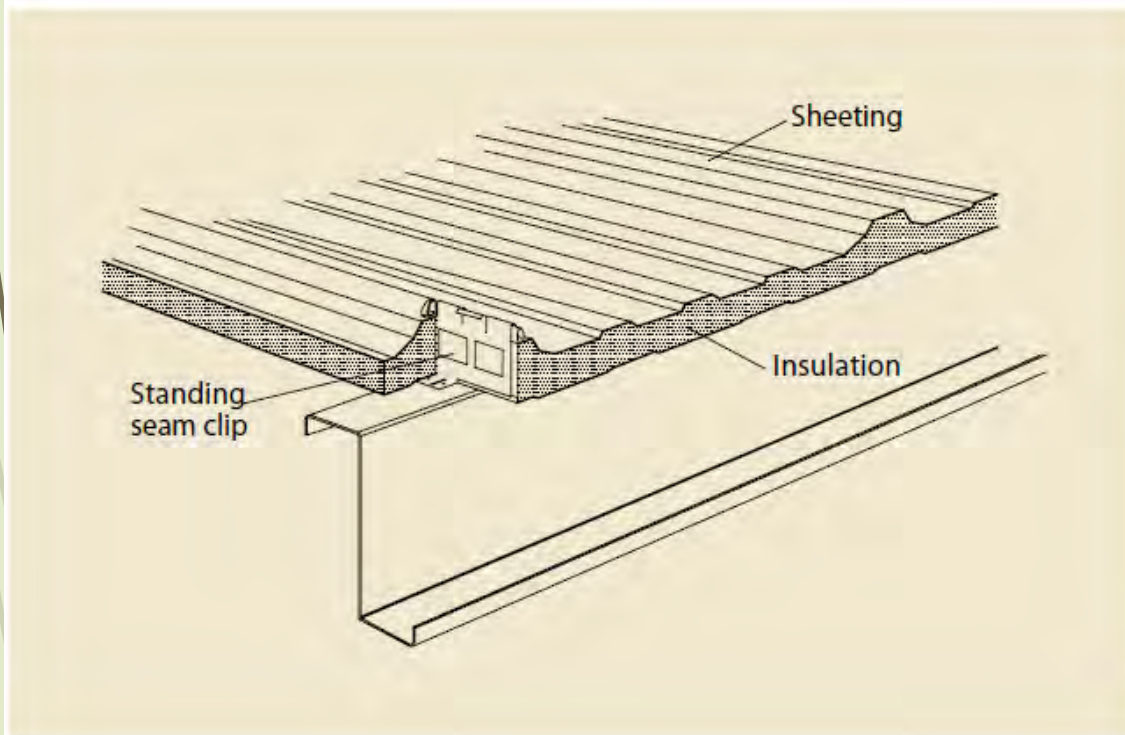
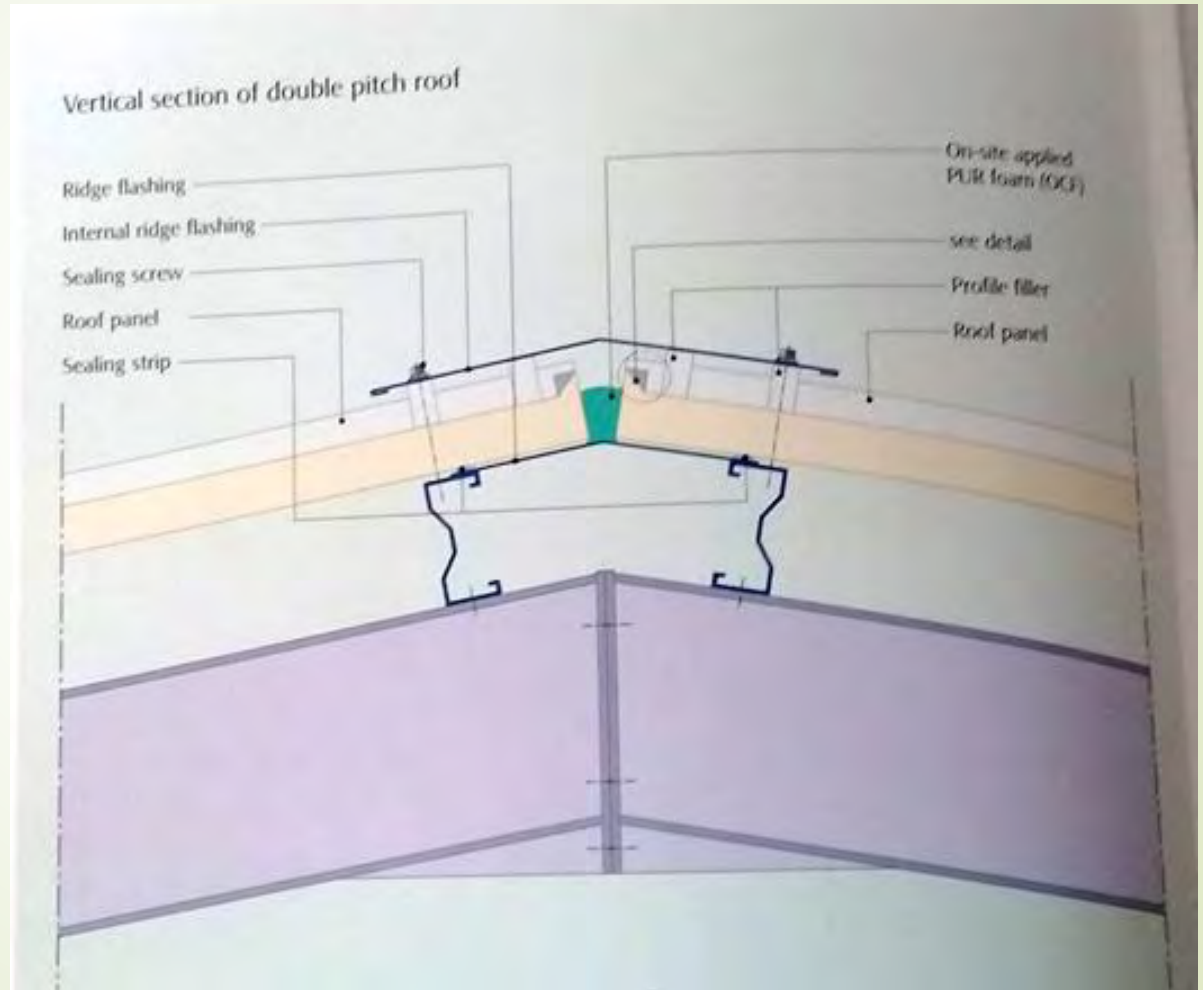
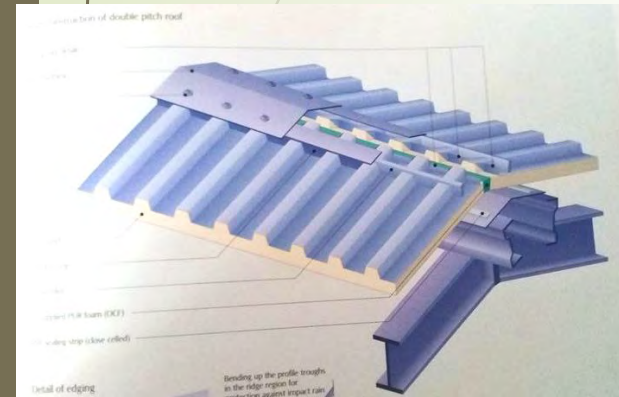


Figure 4.5 Composite or sandwich panels with clip fixings

# Pitched Roof





Gutter bracket fixed through crown with suitable self-drilling screws, recommended with saddle washers

- a) flexible PU foam strips
- b) PU foam
- c) compressed mineral fibre

Longitudinal panel joints locally sealed to metal pressing

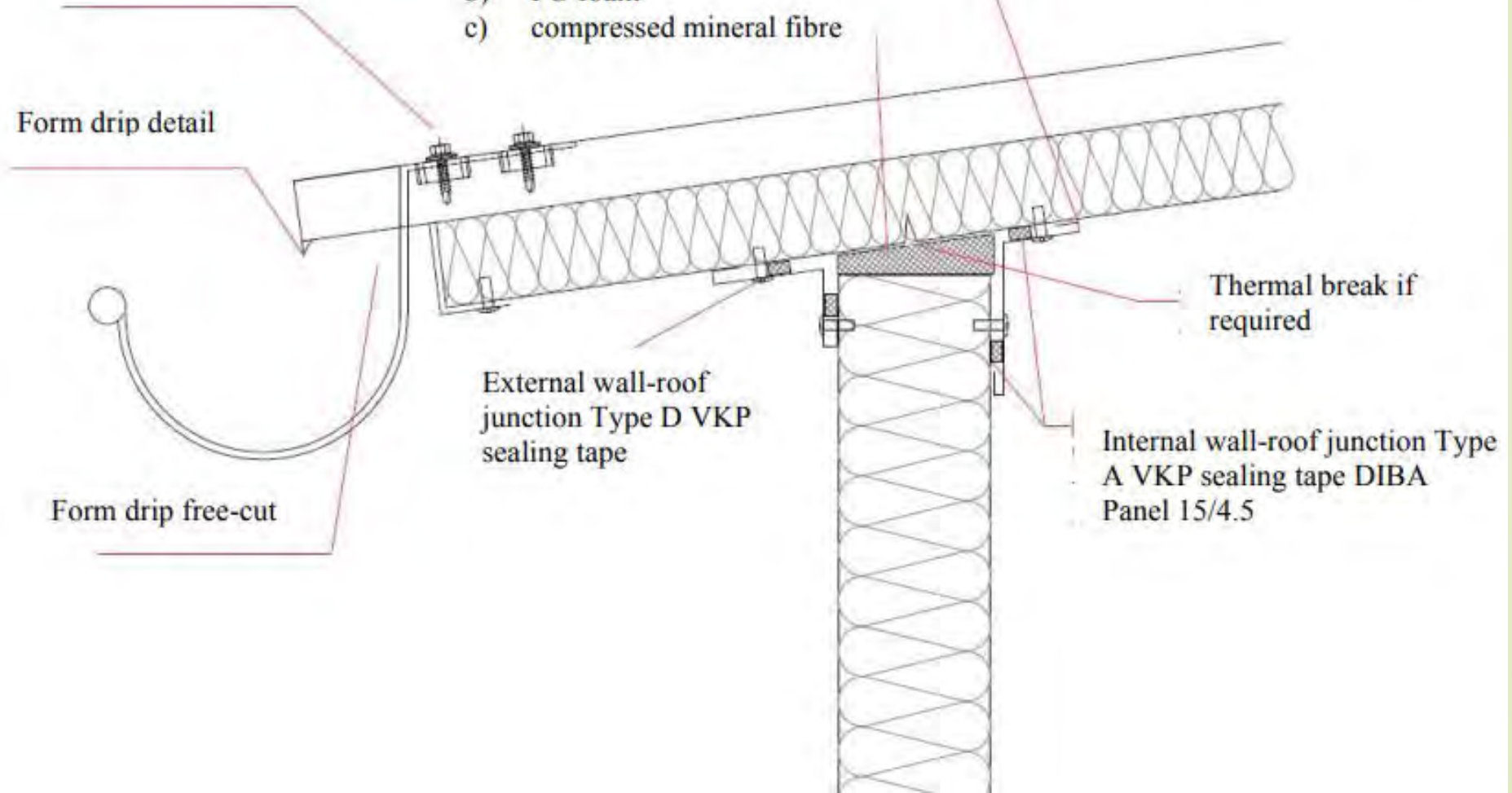
Form drip detail

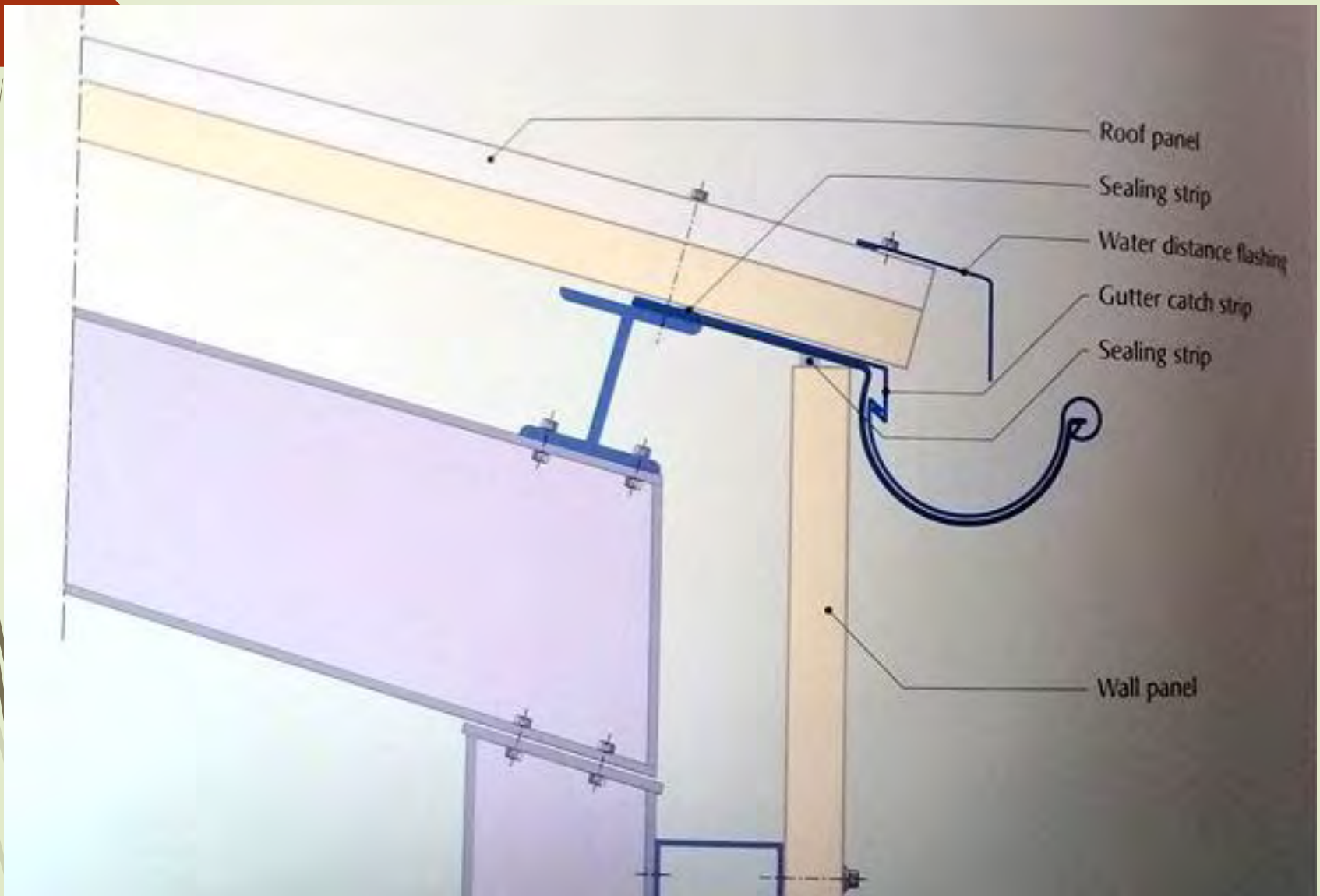
Form drip free-cut

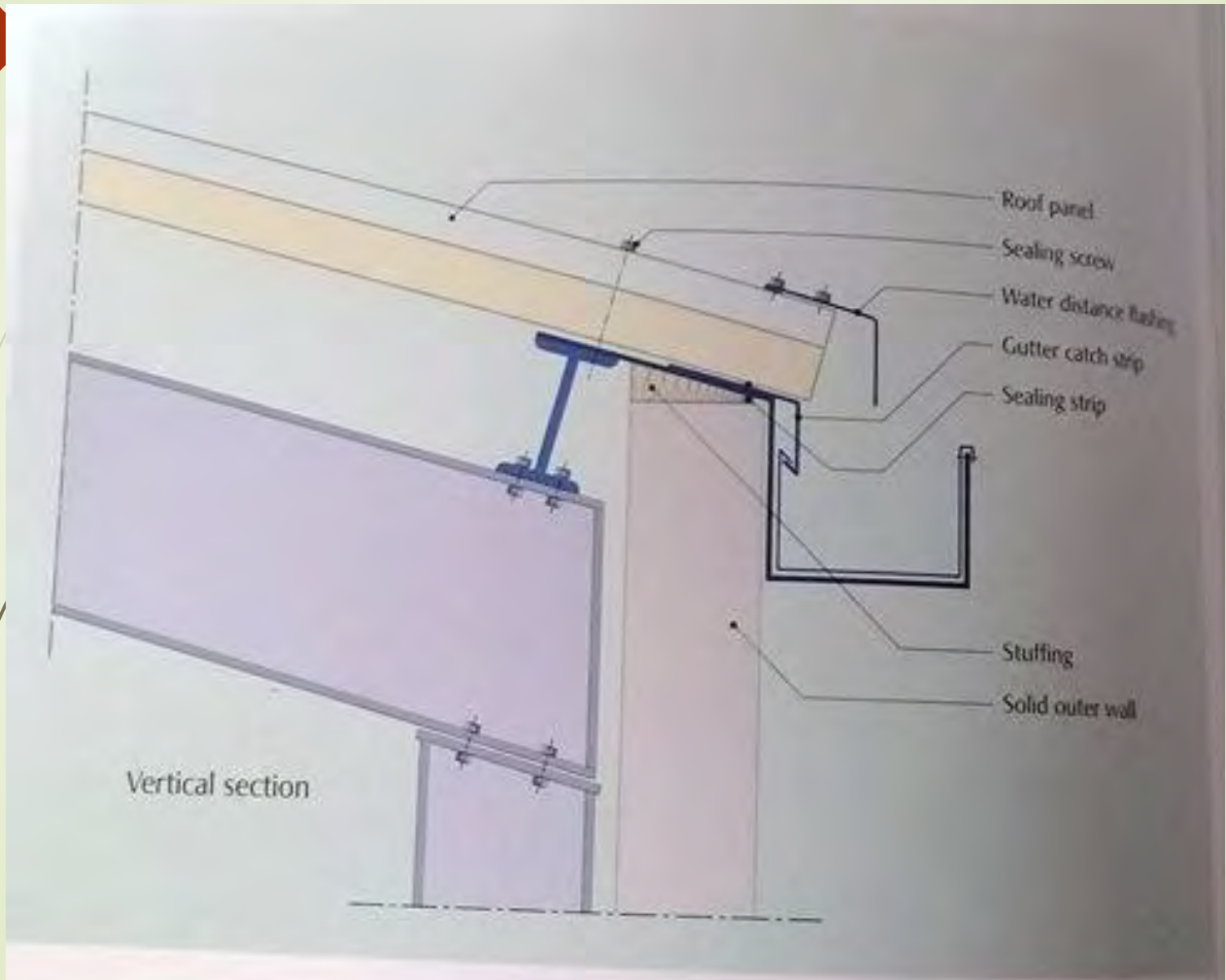
External wall-roof junction Type D VKP sealing tape

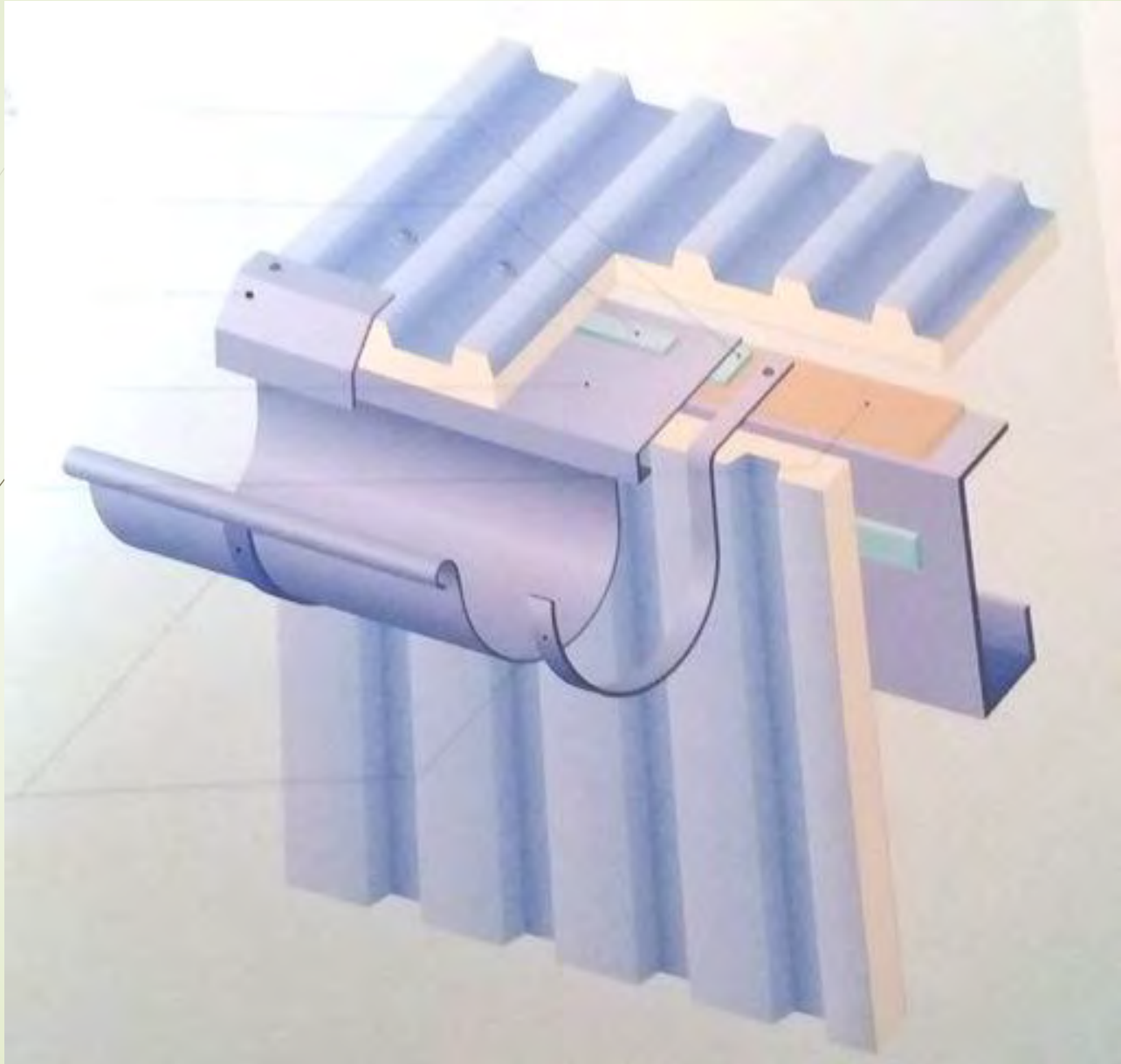
Thermal break if required

Internal wall-roof junction Type A VKP sealing tape DIBA Panel 15/4.5



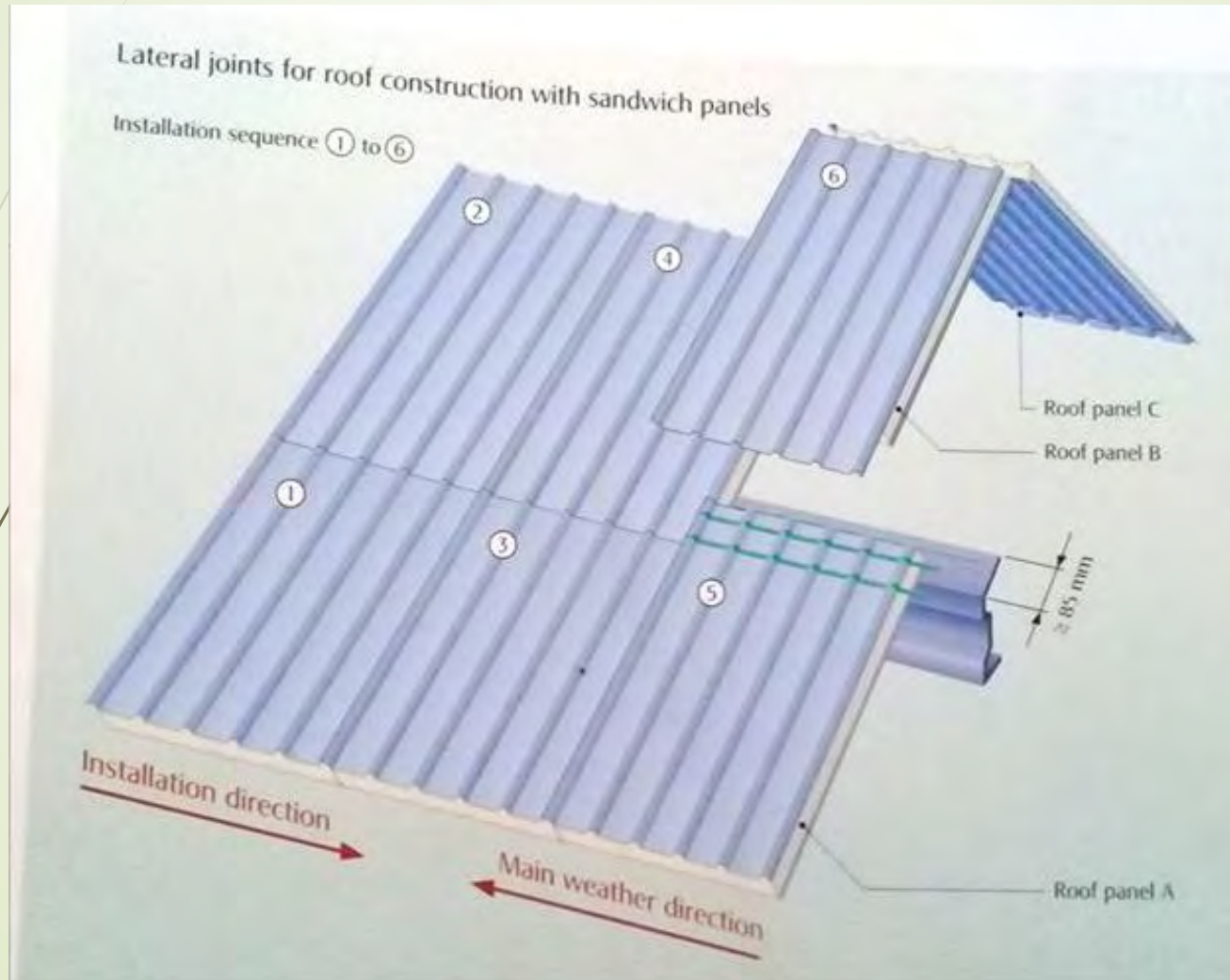








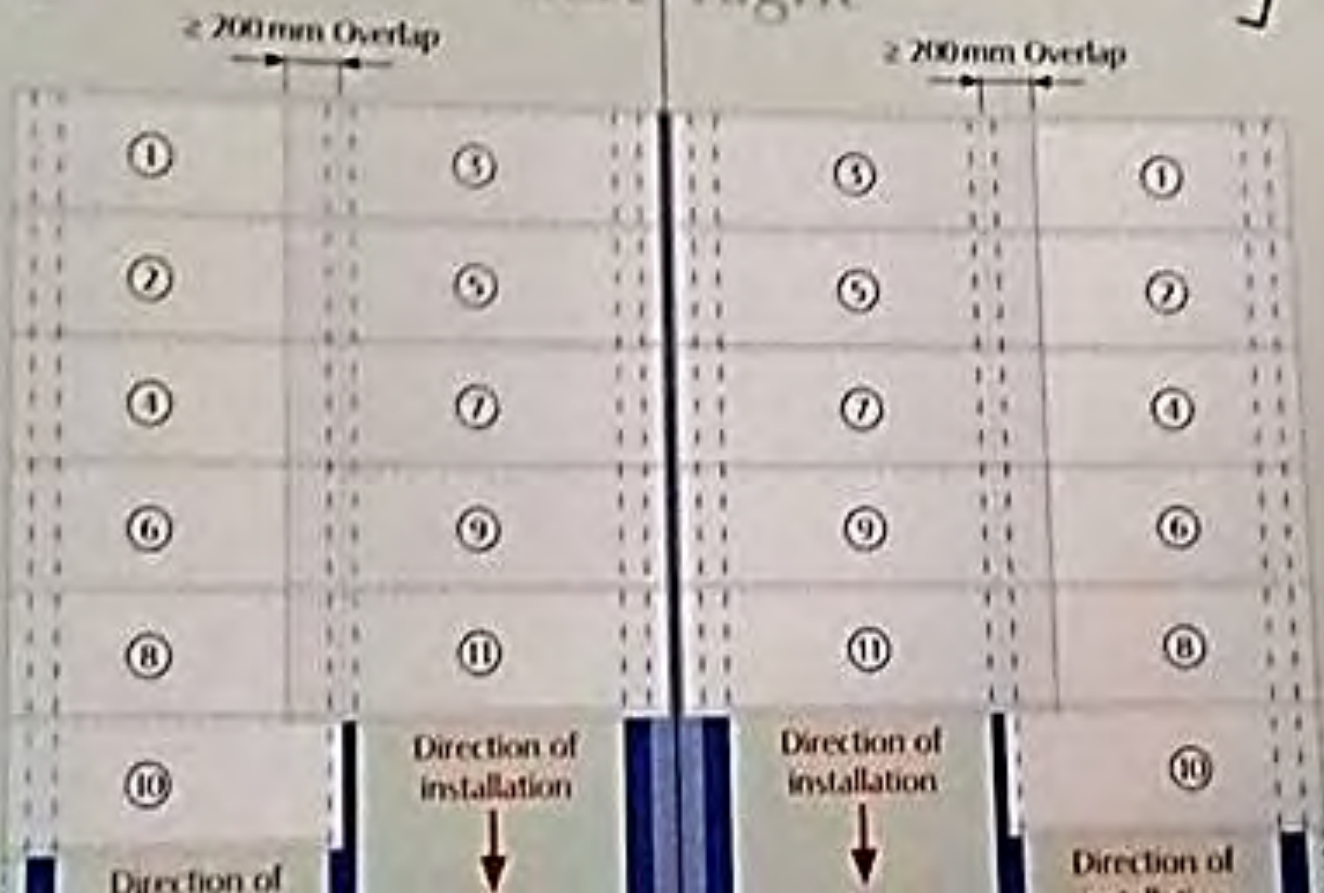
# The Direction of Roof Installation



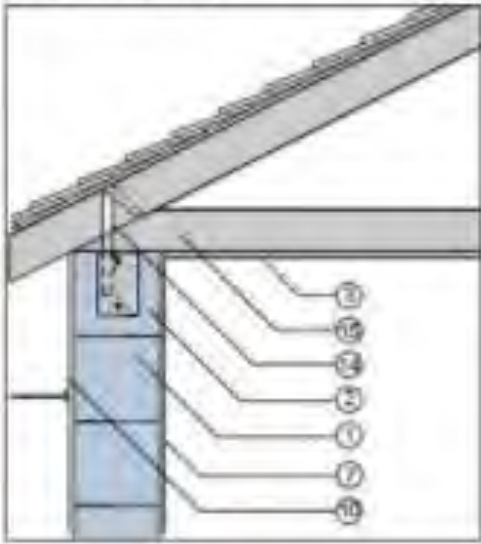
Section



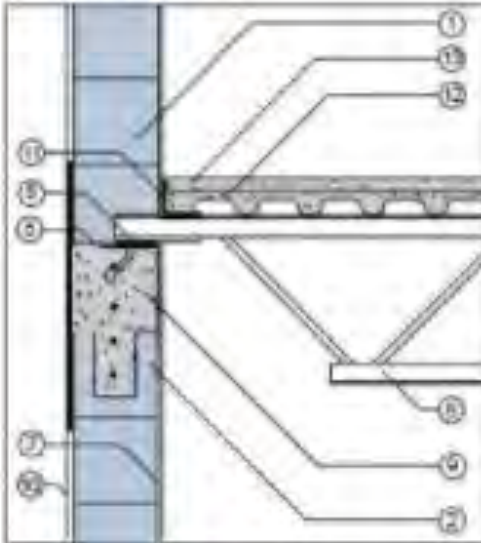
Plan



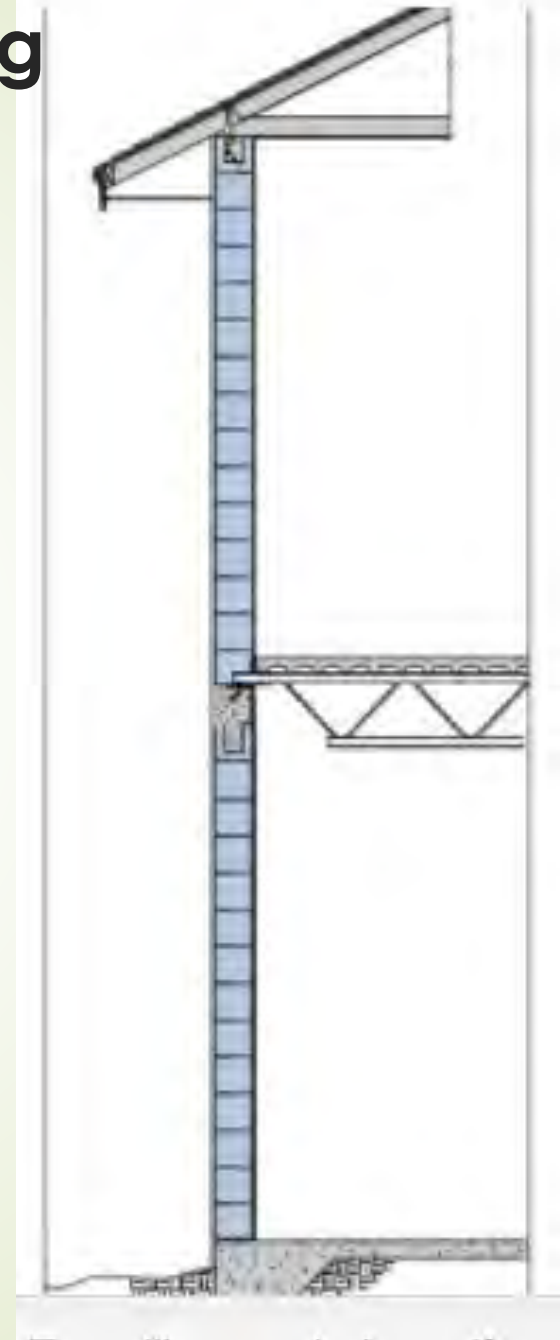
Bond Beam Detail



Joist Bearing Detail



# Two story building





# Installation of the Roof Panels





# The Internal View of a Steel Structural building



# Roof Skelton Plan

