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IDEA | DESIGN | PLAN | REALISATION | COMPLETION

## AQUAPANEL®

AQUAPANEL® is a technologically advanced building system. Because it's a system, it involves clear step-by-step process from design idea to project completion. AQUAPANEL® cement board panels, accessories and services work in unison – you can be certain that your project will all come together as planned.

 [www.Knauf-AQUAPANEL.com](http://www.Knauf-AQUAPANEL.com)

Knauf AQUAPANEL® Exterior Wall

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Knauf AQUAPANEL® Exterior Wall

04/2011

## Build exterior walls faster using drylining methods

Knauf AQUAPANEL® Exterior Wall

Be certain,  
choose AQUAPANEL®

AQUAPANEL®



## Become a façade specialist with the Knauf AQUAPANEL® Exterior Wall

The Knauf AQUAPANEL® Exterior Wall is an advanced performance exterior wall system which is built using drywall techniques. It enables dryliners to extend areas of expertise to include the façade.

The Knauf AQUAPANEL® Exterior Wall is fast and easy to build. Each standard construction type includes AQUAPANEL® Cement Board Outdoor panels and accessories for exterior finishing, Knauf profiles, Knauf Insulation materials, and Knauf Gypsum Boards, joint compounds and interior finishing options.

Knauf can provide everything you need to create an exterior drywall construction. There is no need to waste time and effort sourcing different components from different manufacturers.

This installation guide explains how to apply the Knauf AQUAPANEL® Exterior Wall and how to treat interior and exterior surfaces for finishing. It includes step-by-step installation details based on a single stud system between floors.

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# Product range

Exterior side

## Lining

### AQUAPANEL® Cement Board Outdoor



AQUAPANEL® Cement Board Outdoor is the ideal exterior render substrate. It can be used for many different surface finishings such as paint or brick slips. The product is made of Portland cement and aggregate core, with coated glass fibre mesh embedded in back and front surfaces. Ends are square cut and both edges are reinforced and finished smoothly (the EasyEdge®).

**Width:** 900 mm  
**Length:** 1200/2400/  
1250/2500 mm  
**Thickness:** 12.5 mm  
**Weight:** approx. 16 kg/m<sup>2</sup>  
**Number of boards:**  
50 pieces per pallet  
(900 x 1200); (900 x 1250)  
25 pieces per pallet  
(900 x 2400); (900 x 2500)  
**Net weight per pallet:**  
min. 864/max. 900 kg

**Width:** 1200 mm  
**Length:** 900/2000/2400 /  
2500/2800/3000 mm  
**Thickness:** 12.5 mm  
**Weight:** approx. 16 kg/m<sup>2</sup>  
**Number of boards:**  
50 pieces per pallet  
(1200 x 900)  
30 pieces per pallet  
(1200 x 2000); (1200 x 2400);  
(1200 x 2500); (1200 x 2800);  
(1200 x 3000)  
**Net weight per pallet:**  
min. 864/max. 1728 kg

## Joint treatment

### AQUAPANEL® Joint Filler – grey



AQUAPANEL® Joint Filler – grey is a cement-bound filling material for filling joints and embedding AQUAPANEL® Tape (10 cm) on AQUAPANEL® Cement Board Outdoor and AQUAPANEL® Cement Board Outdoor Climateshield. It is also used to embed AQUAPANEL® Exterior Reinforcing Tape

(33 cm) when the wall is to be painted.

**Packaging:**  
20 kg/bag  
48 bags/pallet

### AQUAPANEL® Tyvek® StuccoWrap™ (water barrier)



AQUAPANEL® Tyvek® StuccoWrap™ is a special climatic membrane made of very fine fibres with a coarse crêpe structure. This climatic membrane is a water barrier from the outside to the inside and allows vapour diffusion from the inside to the outside.

Due to its structure, AQUAPANEL® Tyvek® StuccoWrap™ is optimally suited to the requirements of AQUAPANEL® Cement Board Outdoor in water-managed (directly-applied) systems. It is installed as a water-carrying layer directly behind the board layer.

**Width:** 1.5 m  
**Length:** 75 m  
m<sup>2</sup>/roll: 112.5 m<sup>2</sup>

**Packaging:**  
16 rolls/pallet

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### **AQUAPANEL® Tape (10 cm)**



AQUAPANEL® Tape (10 cm) is a glass fibre tape with an alkali-resistant coating. It is used to reinforce exterior joints for render finish, glued brick slips, or other applications. It is embedded in the AQUAPANEL® Joint Filler – grey.

**Width:** 10 cm

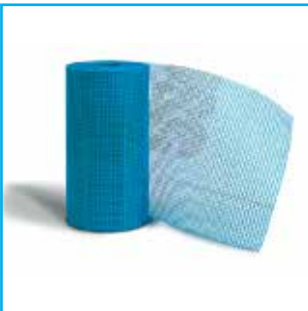
**Length:** 50 m

**Packaging:**

12 rolls/carton

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### **AQUAPANEL® Exterior Reinforcing Tape**



AQUAPANEL® Exterior Reinforcing Tape is used for joint and corner reinforcement and for reinforcement of openings on AQUAPANEL® Cement Board Outdoor when a paint finish is to be applied.

**Width:** 33 cm

**Length:** 50 m

**Packaging:**

12 rolls/carton

# Product range

Exterior side

## Fastening

### AQUAPANEL® Maxi Screws



AQUAPANEL® Maxi Screws have been specially developed for fixing AQUAPANEL® Cement Board Outdoor and AQUAPANEL® Cement Board Outdoor Climateshield onto frameworks. Both needle point and drill point are available plus countersinks. Screws have a special corrosion-proof coating which gives a guaranteed

720 hours corrosion resistance in a salt spray test.

**Packaging:**

SN 39: 500 pieces/carton  
 SN 25: 1000 pieces/carton  
 SN 55: 250 pieces/carton  
 SB 39: 250 pieces/carton  
 SB 25: 250 pieces/carton

Collated screws available on request.

	Metal framework					Timber framework	
	Metal thickness 0.6 – 0.7 mm			Metal thickness 0.8 – 2.0 mm		Single layer	Double layer
	Single layer	Double layer	Triple layer	Single layer	Double layer		
AQUAPANEL® Maxi Screw SN 25	✓						
AQUAPANEL® Maxi Screw SN 39	✓	✓				✓	
AQUAPANEL® Maxi Screw SN 55			✓				✓
AQUAPANEL® Maxi Screw SB 25				✓			
AQUAPANEL® Maxi Screw SB 39				✓	✓		
AQUAPANEL® Rustproofed Screw SN 40						✓	

## Finishing and priming

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### **AQUAPANEL® Exterior Basecoat**



A Portland cement bound, synthetic resin-enhanced basecoat. AQUAPANEL® Exterior Basecoat serves as complete basecoat on AQUAPANEL® Cement Board Outdoor for rendered or painted surfaces. Minimum layer thickness 5-7 mm. Curing time: 1 day/mm material thickness.

**Packaging:**  
25 kg/bag  
40 bags/pallet

### **AQUAPANEL® Reinforcing Mesh**



AQUAPANEL® Exterior Mesh a wide-meshed, alkaline-resistant glass fabric mesh designed for complete cover reinforcement of AQUAPANEL® Exterior Basecoat and AQUAPANEL® Exterior Basecoat – white in the exterior area.

**Weight:** 160 g/m<sup>2</sup>  
**Width:** 100 cm  
**Length:** 50 m

**Packaging:**  
30 pieces/pallet

# Product range

Interior side

## Lining with gypsum board

### Gypsum Board



The ideal standard interior lining for the Knauf AQUAPANEL® Exterior Wall. It offers an economic building solution and is ideal for all types of living spaces without additional requirements.

**Width:** 1250 mm  
**Length:** 2000/2500/  
2600/2750/3000 mm  
**Thickness:** 12.5 mm  
**Weight:** 9.2 kg/m<sup>2</sup>  
**Number of boards:** 50  
**Net weight per pallet:**  
min. 1150/max. 1725 kg

### Vidiwall Gypsum Fibre Board



The ideal interior lining of the Knauf AQUAPANEL® Exterior Wall where higher mechanical surface resistance is required. (Performance is comparable to Diamant Hard Gypsum Board, however, board is not impregnated.)

**Width:** 1250 mm  
**Length:** 2000/2540/  
2570/3000 mm  
**Thickness:** 12.5 mm  
**Weight:** 14.8 kg/m<sup>2</sup>  
**Number of boards:** 40  
**Net weight per pallet:**  
min. 1480/max. 2220 kg

### Impregnated Gypsum Board



The ideal interior lining of the Knauf AQUAPANEL® Exterior Wall for damp rooms in living areas where there is occasional exposure to water spray. Boards remain impervious to moisture and create an even surface for untiled areas. They are ideal for painting or for further surface finishing (with appropriate sealing for gaps, edges and surfaces).

**Width:** 1250 mm  
**Length:** 2000/2500/  
2600/3000 mm  
**Thickness:** 12.5 mm  
**Weight:** 10.2 kg/m<sup>2</sup>  
**Number of boards:** 50  
**Net weight per pallet:**  
min. 1275/max. 1912.5 kg

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## Fireboard



The ideal interior lining of the Knauf AQUAPANEL® Exterior Wall where high fire protection requirements are critical. This special board with glass fleece coating is used for fire-rated linings. In general, the planking thickness is lower compared with standard carton-coated Gypsum Board. An impregnated version

is available: Impregnated Fireboard.

**Width:** 1250 mm

**Length:** 2000 mm

**Thickness:** 12.5 mm

**Weight:** 10.7 kg/m<sup>2</sup>

**Number of boards:** 50

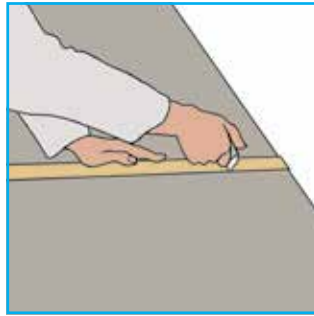
**Net weight per pallet:**  
min. 1337.5 kg

# Processing/handling

## Formatting/cut-outs

### Boards

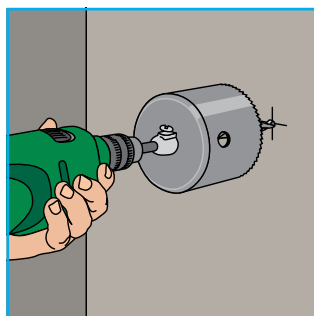
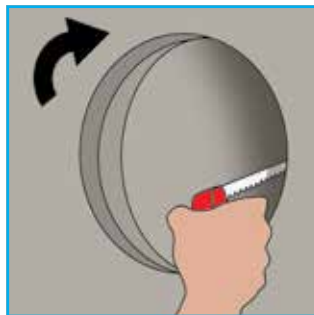
Mark the desired shape or opening on the board with pencil and ruler. Use a knife to score the board on one side along the line so that the mesh or thick paper is cut. Snap the scored edge and cut the mesh/paper on the rear side.



For sharp-edged cuts, for example, exterior edges, use a hand-held circular saw with a dust extractor or a pendulum jigsaw. Use of a carbide or diamond-tipped saw blade is recommended.

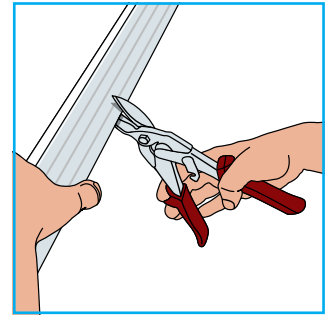


To make cut-outs for wiring and pipes, use a jigsaw or keyhole saw. The diameter of the opening should be approximately 10 mm greater than the diameter of the pipe. The remaining gap can be closed with a cuff, suitable sealant or sealing strip.



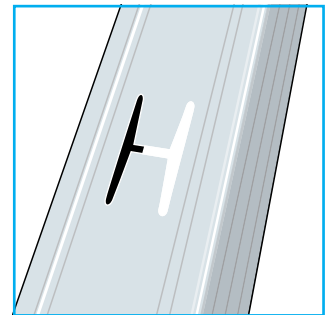
### Profiles

Cut profiles up to 0.7 mm thickness using manual or electrical scissors or use an electrical circular saw with special metal blade. When cutting corrosion-resistant profiles, make sure the cut edges are recoated with appropriate material.



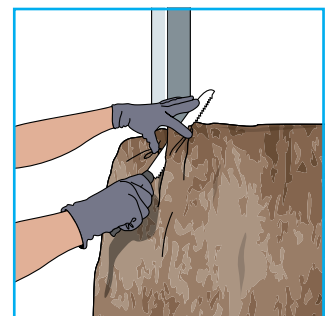
Metal thicknesses bigger than 0.7 mm cannot be cut by scissors. Electric separating tools need to be used. The tool has to be selected according to the coating system. This is especially important for lacquers and other organic coatings, which are damaged by the influence of temperature and flying sparks. The use of a band saw is highly recommended.

For special cut-outs e.g. for pipes, services, only use special pre-fabricated slots as available in the profiles.



### Insulation

Insulation materials are easy to handle and install, being lightweight and easily cut to size, where necessary using an appropriate knife on flat surface to cut. To minimise thermal bridges insulation should fill the complete stud spaces. Do not use small pieces.



# Processing/handling

## Health and safety

Observe the recommendations regarding the handling and storage of materials given earlier in this section. Consult the appropriate product data sheets and material safety data sheets. In addition the following notes are offered for guidance:

- Avoid unnecessary dust on job site when using electrical saw. Keep sanding and other dust generation to a minimum. Maintain adequate ventilation and/or wear suitable protection.
- Exercise care when using power tools and take all necessary precautions.
- Follow instructions on packaging when applying system accessories.
- When using powdered products, mix with water in well-ventilated conditions. Avoid contact with eyes and skin. In the event of contact with the eyes, irrigate with plenty of clean water immediately.
- When handling insulation or cutting boards which contain glass-fibre, wear suitable protection including face mask and gloves. Wear protective glasses when working overhead.
- Follow national health and safety regulations at all times.

A full range of product and safety information sheets are available upon request.

# Installation of Knauf AQUAPANEL® Exterior Wall

Exterior side

This is a step-by-step installation guide for a standard one layer one stud exterior wall using AQUAPANEL® Cement Board Outdoor or AQUAPANEL® Cement Board Outdoor Climateshield.

## 1. Check job site (planning and site preparation)

Conduct general inspection of job site before starting installation procedures. The amount of preparation required will vary from system to system and is also dependent upon the conditions on the site.

Use the correct products for the job:

- Exterior lining
- Interior lining
- Profiles: choose appropriate corrosion resistance
- Insulation: consider the fire, acoustic and thermal performance required

Check static requirements.

Check other performance requirements.

Establish tolerances, positions of openings such as windows, sills etc. Incorporate deflection heads where specified.

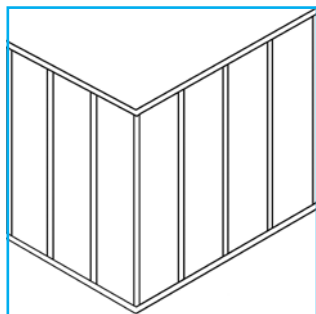
Refer to detailed plans – especially where thermal bridges need to be avoided. Consider cut-outs, electrical installation, heating installations and other services. Check if the installation of services affects the fire or acoustic performance (special detailing should be considered). Minimise the number of openings for services.

## 2. Create substructure

The steel framework must be designed according to the static requirements of the construction.

**2.1** Prepare UW profile by cutting to appropriate length. Protect cut edge against corrosion using recommended material.

Note: for an exterior wall/water managed system/between floors, the maximum permissible excess length of the UW profile without support is one third of the base element.



See section Installation details for details showing anchoring of UW runner considering tolerances.

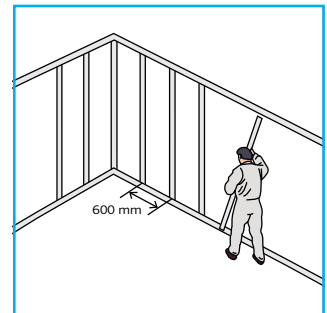
**2.2** Use decoupling tape between ceiling and floor to avoid acoustic bridges, to fill gaps and to even the surface.

**2.3** Mount UW profiles at top and bottom using approved fasteners according to local building regulations (fire resistance) and static requirements (type and quantity of fasteners). Follow rules for distances. Do not use plastic plugs due to fire regulations.



**2.4** Prepare CW profiles by cutting correct lengths for application. Protect cut edge against corrosion using recommended material.

**2.5** Mount CW profiles vertically according to height of wall and static calculation (maximum 600/625 o.c.). Where UW and CW profiles are connected to other building elements such as walls, ceilings and columns, use decoupling tape.

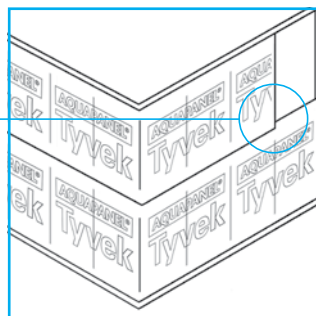
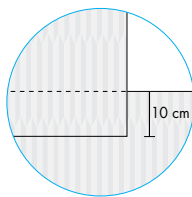
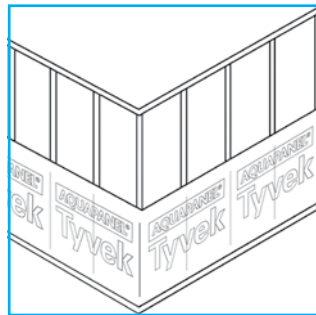


See section Installation details for openings.

### 3. Installation of water barrier

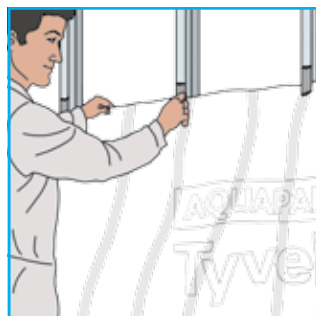
**Note: this step is not required when installing AQUAPANEL® Cement Board Outdoor Climatshield.**

**3.1** A water barrier is required for installation with AQUAPANEL® Cement Board Outdoor. Use AQUAPANEL® Tyvek® StuccoWrap™ as the water barrier. When installing this, start at the foot of the wall and install the water barrier in a shingle lap manner. Overlap all horizontal and vertical joints a minimum of 10 cm.



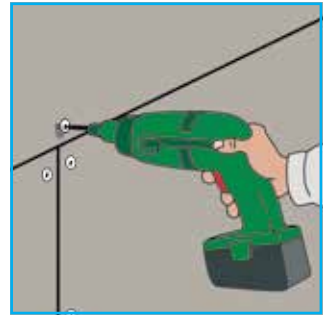
**3.2** A minimum overlap of 10 cm is marked on the AQUAPANEL® Tyvek® StuccoWrap™.

**3.3** Secure the water barrier membrane with adhesive tape or adhesive and immediately apply AQUAPANEL® Cement Board Outdoor panels.



### 4. Fastening with screws

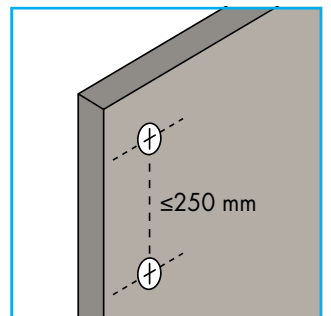
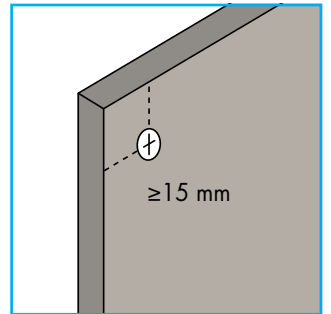
Fasten AQUAPANEL® Cement Board Outdoor to the framework with AQUAPANEL® Maxi Screws. First fasten the screws into the centre of the cement boards; then work towards the ends and the edges. During installation, make sure the cement boards are resting on the framework.



Screw spacing  $\leq 250$  mm.  
Spacing from edge  $\geq 15$  mm.

Screws should not be overtightened.

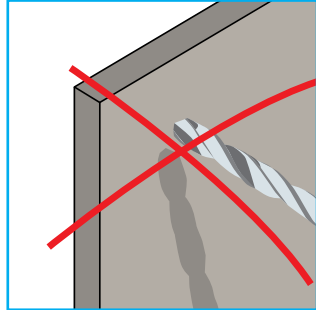
Note: Please observe a gap of 3 – 5 mm between the boards.



# Installation of Knauf AQUAPANEL® Exterior Wall

Exterior side

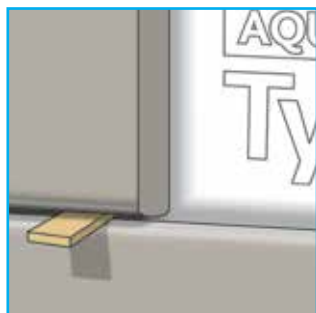
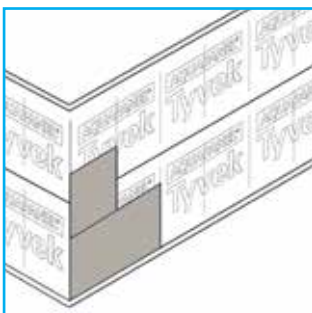
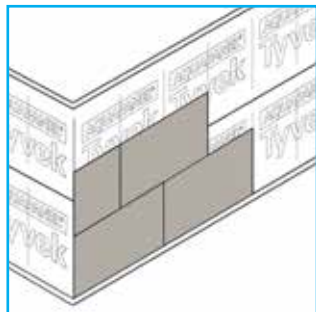
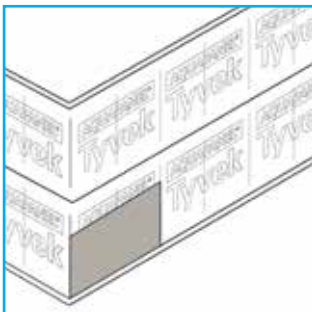
Generally, no pre-drilling of boards is required. However, pre-drilling of boards and profiles is needed if the material thickness of the profiles is more than 2 mm (according to static requirements) and when blind rivets are used.



## 5. Arrangement of AQUAPANEL® Cement Board Outdoor

Apply AQUAPANEL® Cement Board Outdoor panels horizontally with ends over framework. Leave a gap of 3-5 mm between boards using a suitable spacer.

When fitting the subsequent rows of boards, ensure that the vertical joints are offset a minimum of one stud cavity.

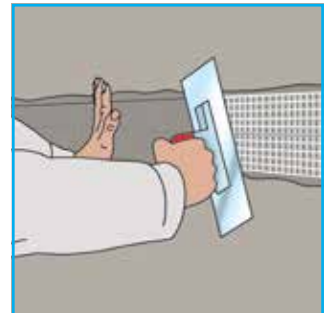


## 6. Joint treatment

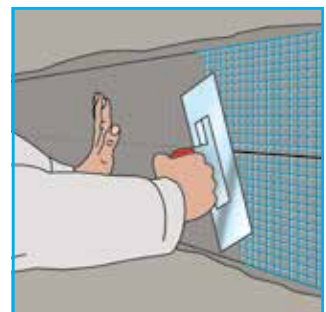
**6.1** Immediately after assembly, protect the framework from weathering by filling all the joints with AQUAPANEL® Joint Filler – grey.



**6.2A** Immediately embed AQUAPANEL® Tape (10 cm) centred over all joints.



**6.2B** If only one coat of paint is to be applied onto AQUAPANEL® Exterior Basecoat or AQUAPANEL® Exterior Basecoat – white, use AQUAPANEL® Exterior Reinforcing Tape which has a width of 33 cm.



**6.3** Fill the screw heads with AQUAPANEL® Joint Filler – grey.

**At this stage the building envelope is closed and protects from weathering allowing inside crafts to start until façade finishing can start.**

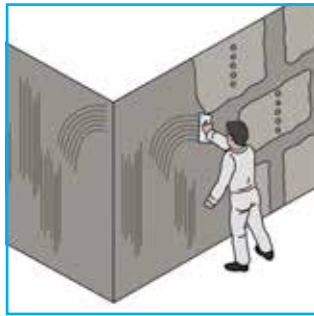


**Note: At this stage, installation steps for AQUAPANEL® Cement Board Outdoor Climateshield are complete. The cladding system can be attached.**

## 7. Applying basecoat layer and embedding reinforcing mesh

AQUAPANEL® Cement Board Outdoor must be rendered with AQUAPANEL® Exterior Basecoat or AQUAPANEL® Exterior Basecoat – white. This is independent of the possible finishing options (painting, rendering, tiling).

By this stage, joints have been treated and tape has been embedded. Screw heads have been covered with AQUAPANEL® Joint Filler – grey.

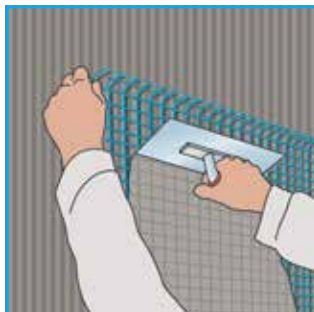


**7A** Cover entire wall with AQUAPANEL® Exterior Basecoat. This is applied by hand using a trowel or by machine (machine recommendation: mixing pump PFT G4 or G5, rotor/stator D4-3, half power, water requirement 200 l/h).

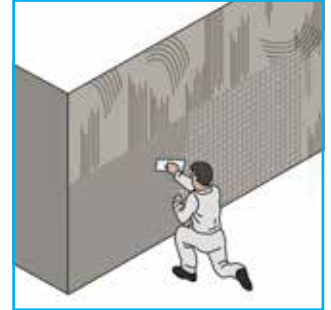


When applying AQUAPANEL® Exterior Basecoat, create a basecoat layer of average 5 mm using a notched tool of 10 mm.

Gently embed/place the mesh.

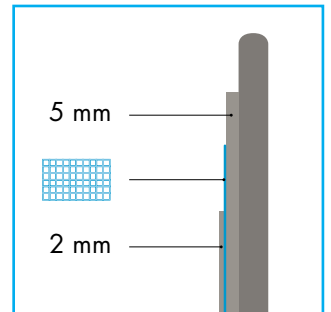


Add an extra 2 mm basecoat layer with smooth trowel to close the surface and to eliminate unevenness. To thickness of the mesh-reinforced basecoat should be 5-7 mm.



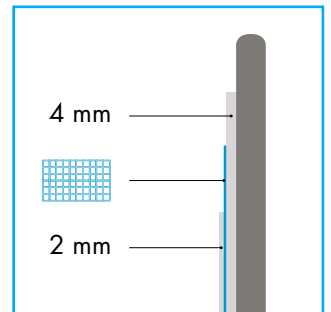
When these steps are completed, the mesh lies in the first third of the basecoat.

Before continuing with the next steps, allow a curing time of 1 day per mm of layer thickness.



7A AQUAPANEL® Exterior Basecoat

**7B** When using AQUAPANEL® Exterior Basecoat – white, create a basecoat layer of 4 mm using a notched tool of 8 mm. Gently embed/place the mesh. Add an extra 2 mm basecoat layer with smooth trowel to close the surface and to eliminate unevenness. The curing time for the AQUAPANEL® Exterior Basecoat – white (complete layer thickness) is 1 day.



7B AQUAPANEL® Exterior Basecoat – white

All time specifications given here are depending on the climate conditions.

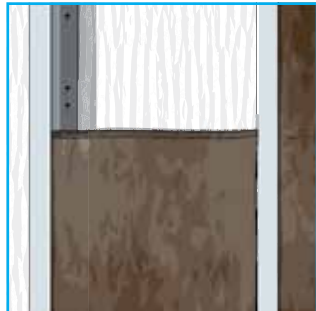
**See section Exterior finishing for more details.**

# Installation of Knauf AQUAPANEL® Exterior Wall

Interior side

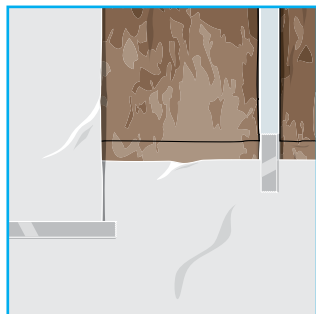
## 8. Place insulation material

Use the right product for the job depending on whether thermal insulation, acoustic insulation or fire protection is required. Cut insulation to width /length with a sharp long bladed knife.



## 9. Apply vapour barrier

Make sure all electrical installation has been completed. To ensure air tightness of building construction, apply vapour barrier to the inside if specified in building physical calculation.



Where the wall construction includes a double layer of Gypsum Board, the vapour barrier can be placed between the two layers for fast easy installation.

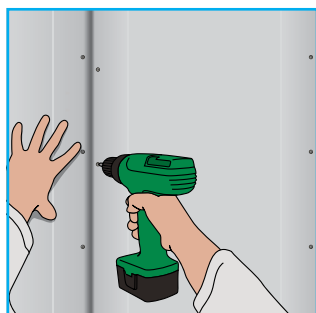
The vapour barrier must overlap where more than 1 layer is placed. It must also overlap when applied at connections to

other building elements. Use suitable glue and tapes.

Where services penetrate the building elements, ensure that the penetrations are sealed in order to obtain optimum air tightness.

## 10. Install Gypsum Board (dry applications only)

Screw Gypsum Boards to substructure using Drywall Screws (TN3.5/35).

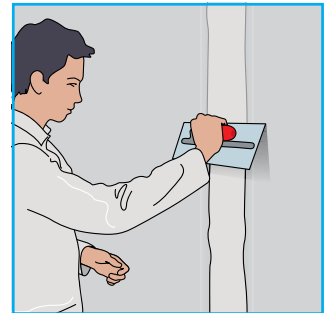


## 11. Joint treatment (dry applications only)

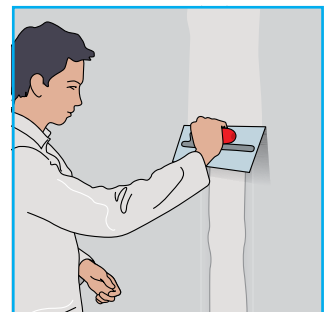
Fill joints (e.g. standard Gypsum Board application with HRAK edge). Use trowel to fill joints with suitable joint filler (UNIFLOTT). For double layer system, the joints of the first layer of board must also be filled before placing the second layer of boards.



Run the trowel progressively down the joint applying sufficient pressure to squeeze out entrapped air. Allow the joint filler to set for approx. 1 hour. If required, sand lightly to remove any high spots. Remove surface dust.



Apply an additional thinner layer of joint filler and remove any surplus filler. Feather out application beyond the joints – approximately 100 to 200 mm.



Allow the joint filler to set for approx. 1 hour. If required, sand lightly to remove any high spots. Remove surface dust.



---

## **Note on interior finishing (dry applications only)**

Once joints have been filled and after drying, if finishing is not satisfactory, use trowel to apply a tight coat of UNIFLOTT joint filler. Feather out beyond previous application of material. Allow the joint treatment to set. Lightly sand to remove any minor imperfections and create a smooth surface.

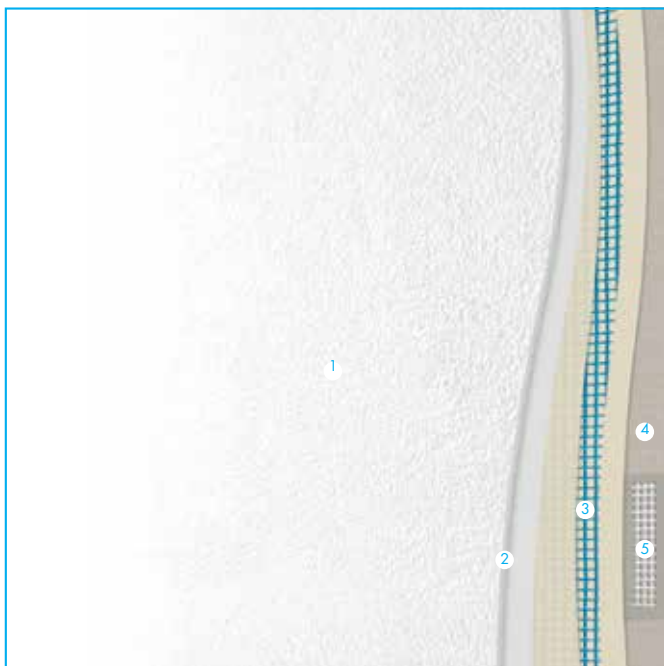
If required, apply a final coat of FINISH-PASTÖS and feather out beyond previous application. Lightly sand to remove minor imperfections. Remove surface dust.

Note: Priming the surface will depend on the selected interior finishing option.

**See section Interior finishing for more details.**

# Exterior finishing

## Exterior system with render



1. AQUAPANEL® exterior render
2. AQUAPANEL® Basecoat Primer
3. AQUAPANEL® Exterior Basecoat – white plus AQUAPANEL® Reinforcing Mesh
4. AQUAPANEL® Joint Filler – grey plus AQUAPANEL® Tape (10 cm)
5. AQUAPANEL® Cement Board Outdoor

AQUAPANEL® exterior renders are available in 212 colour shades in the following product lines (luminosity of H  $\geq$  40%):

- AQUAPANEL® Exterior Mineral Finish and AQUAPANEL® Exterior Equalising Paint
- AQUAPANEL® Exterior Dispersion Plaster
- AQUAPANEL® Exterior Silicon Synthetic Resin Plaster

Request the AQUAPANEL® colour fan from Knauf .



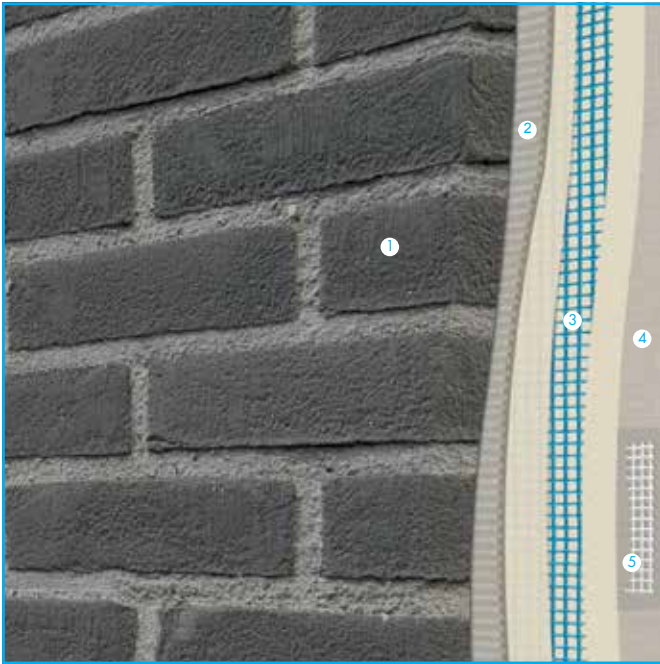
## Exterior system with paint finish



1. Paint finish
2. AQUAPANEL® Exterior Basecoat – white plus AQUAPANEL® Reinforcing Mesh
3. AQUAPANEL® Joint Filler – grey plus AQUAPANEL® Exterior Reinforcing Tape
4. AQUAPANEL® Cement Board Outdoor

Note: For information on colour systems, refer to recommendations and regulations of the manufacturer.

## Exterior system with brick slips plus flexible adhesive



1. Brick slips or tile covering
2. Flexible tile adhesive
3. AQUAPANEL® Exterior Basecoat - white plus  
AQUAPANEL® Reinforcing Mesh
4. AQUAPANEL® Joint Filler - grey plus AQUAPANEL® Tape (10 cm)
5. AQUAPANEL® Cement Board Outdoor

Glue the brick or tile covering in frost-free conditions using a frost-proof process. Select suitable adhesives according to manufacturers' recommendations for cement bases.

Note: For thin brick slip and tile applications, the maximum permitted load of tiling including adhesive is 40 kg per square metre. The max. dimensions are limited to 33 by 33 cm.

Contact Knauf if the load or dimensions are higher.

# Interior finishing

## General

### 1. Interior lining options

The final interior wall lining options depend on the type of application of the Knauf AQUAPANEL® Exterior Wall from the interior wall perspective. Interior linings can be selected depending on standard requirements and needs for moisture rating, fire rating, impact resistance qualities or sound reduction requirements.

See pages 10-12

### 2. Surface finishing and quality levels

Gypsum Boards can be used with every conceivable surface finishing but the quality of the finishing depends on the decorative finish required as part of the contract and the skills of the dryliner.

When closing the joints on the plaster boards, it is possible to achieve four quality levels.

Level of finishing	Q1	Q2 (Standard)	Q3	Q4
	Jointed surface	Smooth surface for normal optical requirements	Smooth surface for higher visual requirements	Smooth surface for high visual requirements
Aesthetic requirements	None	Normal	Enhanced. Few marks and traces under direct light. Shading is still possible under shallow light angles	High end. Minimised appearance of any marks or traces. Shading caused by shallow light angles will be avoided to a large extent.
Application requirements	Joints and screw heads filled with joint compound	Joints and screw heads filled, finished to achieve a continuous transition to the board surface, sanded if necessary	Joints and screw heads filled, finished (Q2), plus wide finish trowelling and a sharp trowelled full cover of the plaster board surface (filling the paper pores), sanded if necessary.	Joints and screw heads filled, finished (Q2) plus a complete surface covering skim coat of min 1 mm thickness, sanded if necessary.
Finished surface suitability	Only suitable for functional applications such as stability, fire resistance and sound insulation. E.g. filling joints of the first board layer which is under tile coverings or thick layered plasters.	Medium and coarse-structured wall coverings, matt filling, medium and coarse-structured paint coatings/coats, top coats (particle size/ largest particle over 1 mm).	Fine-structured wall coverings, matt, fine-structured paint coatings/coats, top coats (largest particle size less than 1 mm).	Smooth or glossy wall coverings, e.g. metal-based or vinyl wallpapers, scumbles, paints or coats up to medium gloss, stucco marble or similar specialist decorative finishes.
Flatness requirements	Refer to National standards			
Note: Priming the surface will depend on the selected interior finishing option. Quality level of surface finishing depends on the skills of the dryliner.				

Quality classification according to leaflet no 2 "Skimming of Plaster Boards - Surface Qualities" of the Plasterboard Industry Group Association, which provides for four levels of quality.



# Interior finishing

Dry applications



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### 3. Joint treatment: Gypsum Boards

In order to close the joints and to prepare the surface for the finishing options the following materials can be used:

**UNIFLOTT:** "The original"

**TRIAS:** "The efficient"

**READYGIPS:** "The quickstarter"

**MULTI-FINISH/MULTI-FINISH M:** "The noble"

**Joint Tape KURT**

**PUTZGRUND**

## Quality levels

**HRAK - semi-circular flattened longitudinal edge / HRK - semi-circular longitudinal edge / AFK - long side panel edge**

TRIAS / UNIFLOTT / UNIFLOTT impregnated

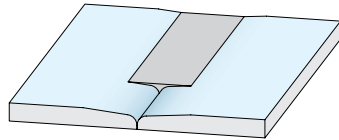
**Cut edge and develled/mixed joint**

TRIAS / UNIFLOTT / UNIFLOTT impregnated

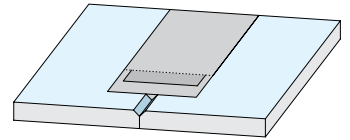
### Q1

**The technically required surface – without optical requirements**

TRIAS / UNIFLOTT /  
UNIFLOTT impregnated



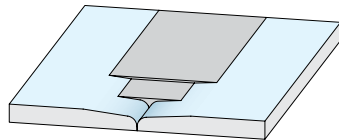
TRIAS / UNIFLOTT /  
UNIFLOTT impregnated +  
Joint Tape KURT



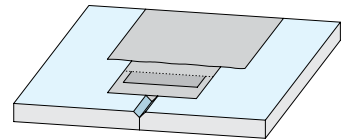
### Q2

**For surfaces with conventional optical requirements**

TRIAS / UNIFLOTT /  
UNIFLOTT impregnated



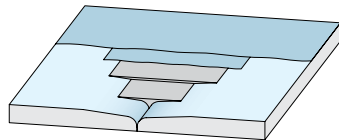
TRIAS / UNIFLOTT /  
UNIFLOTT impregnated +  
Joint Tape KURT



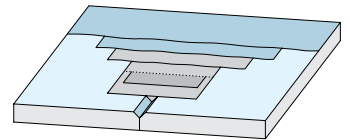
### Q3

**For surfaces with higher optical requirements**

TRIAS / UNIFLOTT /  
UNIFLOTT impregnated  
READYGIPS



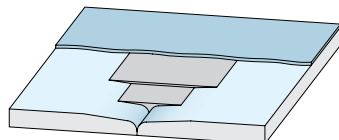
TRIAS / UNIFLOTT /  
UNIFLOTT impregnated +  
Joint Tape KURT  
READYGIPS



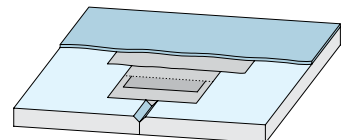
### Q4

**For surfaces with highest optical requirements**

TRIAS / UNIFLOTT /  
UNIFLOTT impregnated  
READYGIPS or PUTZGRUND  
and MULTI-FINISH /  
MULTI-FINISH M



TRIAS / UNIFLOTT /  
UNIFLOTT impregnated +  
Joint Tape KURT  
READYGIPS or PUTZGRUND  
and MULTI-FINISH /  
MULTI-FINISH M

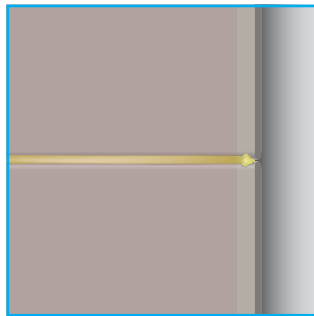


# Interior finishing

Humid and wet applications

## 4. Joint treatment: AQUAPANEL® Cement Board Indoor

The cement boards are glued with AQUAPANEL® Joint Adhesive (PU). After hardening, the excess AQUAPANEL® Joint Adhesive (PU) must be scraped off – usually the next day. After priming with AQUAPANEL® Board Primer, **the system is ready for tiling.**

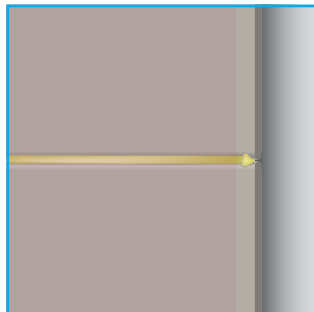


## 4a. Standard application to achieve impact-resistant walls

**Option 1: System using AQUAPANEL® Joint Filler & Skim Coating – white.**

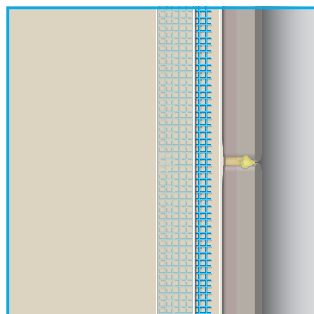
### Step 1 To achieve Q1 quality

Scrape off the hardened AQUAPANEL® Joint Adhesive (PU). Prime the whole surface with AQUAPANEL® Board Primer.



### Step 2 To achieve Q2 quality

Coat the whole surface with the AQUAPANEL® Joint Filler & Skim Coating – white and embed mesh. Apply a second thin layer of AQUAPANEL® Joint Filler & Skim Coating – white. Smooth the surface.



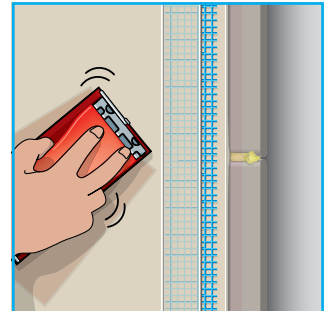
**Note: Impact resistance is now achieved.**

## Additional finishing option:

### Step 3

#### To achieve Q3 quality

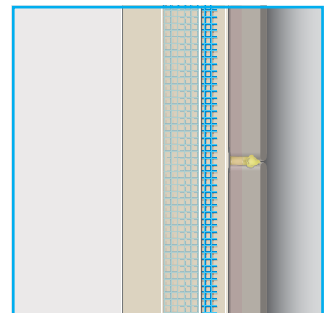
After the surface is dry, sand the entire surface with a 120 grid or finer.



### Step 4

#### To achieve Q4 quality

Remove all dust. Apply a thin layer of AQUAPANEL® Q4 Finish and sand. Q4 quality can be achieved, depending on skills of dryliner. (AQUAPANEL® Q4 Finish not suitable with spray water).



## 4b. Application without reinforcing mesh (non-spray-water environments).

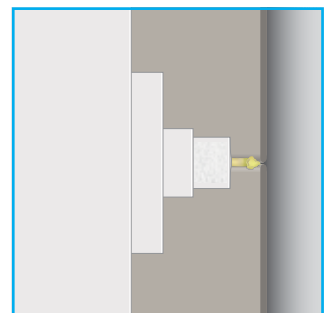
**Option 2: System using AQUAPANEL® Q4 Finish only. This quick option without reinforcement.**

### Step 1

Scrape off the hardened AQUAPANEL® Joint Adhesive (PU). Prime the whole surface with AQUAPANEL® Primer.

### Step 2

Cover the joints with AQUAPANEL® Q4 Finish embedding a glass fibre tape. Use an additional thin layer of AQUAPANEL® Q4 Finish to fill the screw heads. Any excess material should be removed.



### Step 3

Apply an additional layer of AQUAPANEL® Q4 Finish of around 20 cm so it overlaps the first layer by approx. 5 cm on each side. Fill the screw heads and remove excess material.

---

**Step 4****To achieve Q3 quality**

Apply AQUAPANEL® Q4 Finish with a trowel to put a layer with a thickness of at least 1 mm.

After drying, the surface probably has to be sanded.

Continue to add a further layer of AQUAPANEL® Q4 Finish with a thickness of 0.5 mm. When this is dry, sand the entire surface with a 120 grid or finer.

**Step 5****To achieve Q4 quality**

Apply a very thin layer of AQUAPANEL® Q4 Finish and sand, Q4 quality, depending on skills of dryliner, is achieved.

# Installation details

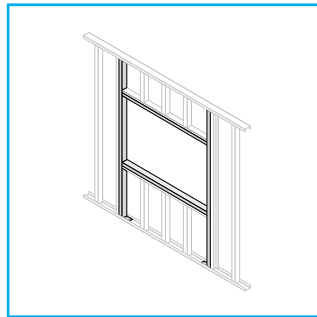
## Installation of openings

### Boards

When creating window/door openings, consider building statics requirements and create auxiliary structure. Consider vapour barrier for sealing interior lining according to building specifications.

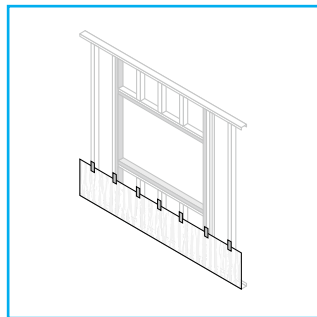
#### Step 1

Place the substructure in the correct position and install necessary anchors. Apply AQUAPANEL® Tyvek® StuccoWrap™ starting from the bottom-up.



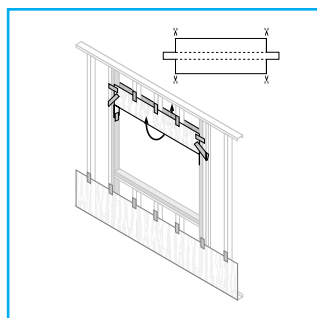
#### Step 2

Apply AQUAPANEL® Tyvek® StuccoWrap™ horizontally. Self-adhesive tape can be used to fix AQUAPANEL® Tyvek® StuccoWrap™ before panels are installed.



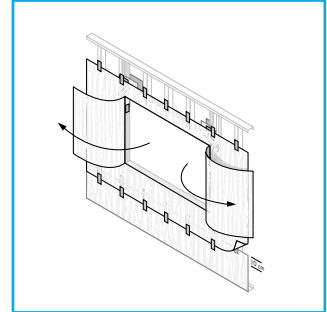
#### Step 3

At the top horizontal reveal, apply an additional piece of AQUAPANEL® Tyvek® StuccoWrap™ (see pattern) and secure with glue. Overlap all joints with minimum of 15 cm.



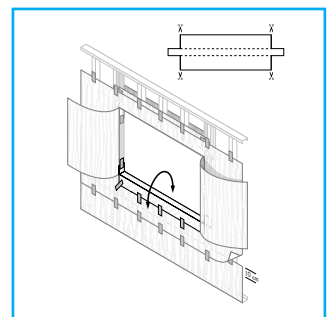
#### Step 4

Apply the water barrier in a shingle lap manner. Overlap all horizontal and vertical joints with a minimum of 10 cm. When applying AQUAPANEL® Tyvek® StuccoWrap™ around openings, incisions are required.



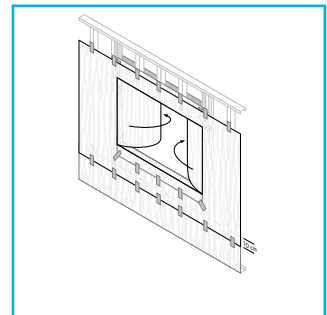
#### Step 5

At the bottom horizontal reveal, an additional piece of AQUAPANEL® Tyvek® StuccoWrap™ (see pattern) should be applied and secured with tape. Overlap all joints with minimum of 15 cm.



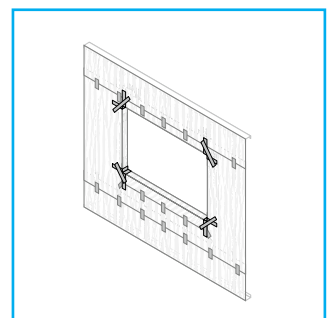
#### Step 6

Fold AQUAPANEL® Tyvek® StuccoWrap™ into the vertical reveals and secured with tape.



#### Step 7

Reinforce window corners with an extra piece of tape, which is applied at an angle of 45°. Use the same tape which is used to attach the vapour barrier.

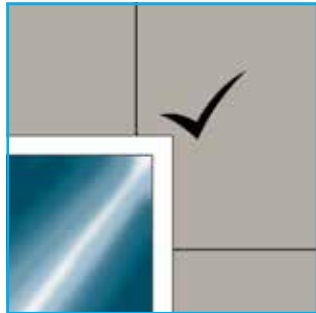
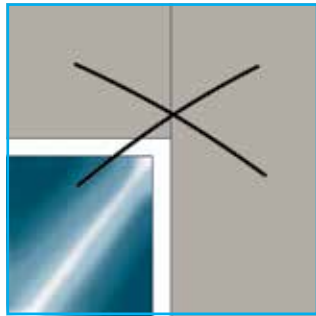




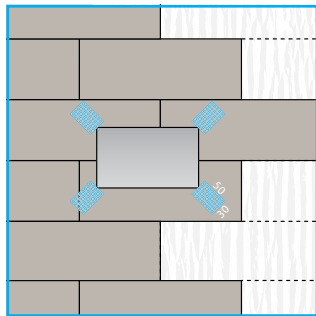
# Installation details

## Windows and door openings only

Take the boards up to the window and down to the window ledge. There must be no continuous joints as these could lead to cracks and leaks.



Reinforce window corners with extra pieces of AQUAPANEL® Reinforcing Mesh, size 50 x 30 cm, applied as shown.



## Reinforcing corners

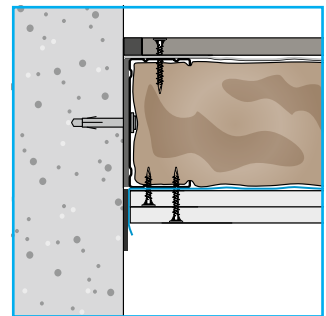
Corners are reinforced by applying AQUAPANEL® Exterior Basecoat. To protect the corners, place a corner profile using the AQUAPANEL® Exterior Basecoat.



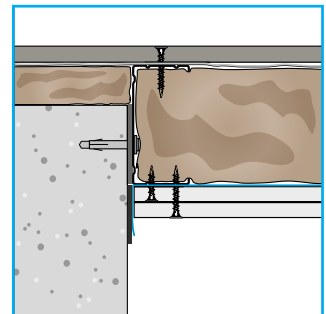
## Connections

Note: It is important to seal all connections to prevent leakage.

When connecting to a solid wall, the two walls need to be decoupled to allow flexibility for movement and eliminate stress.

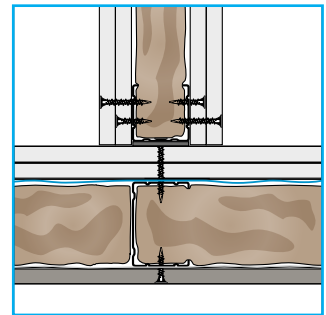


When connecting to a column, the wall and ceiling need to be decoupled to allow flexibility for movement and eliminate stress.

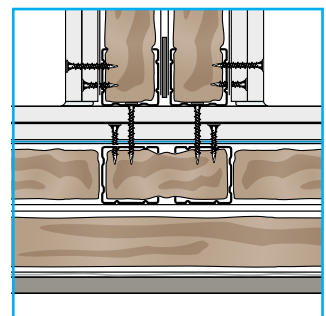


Ensure wind and air tightness through effective overlapping of AQUAPANEL® Tyvek® StuccoWrap™ and the vapour barrier.

III. T-connection exterior wall to interior wall, single stud system.

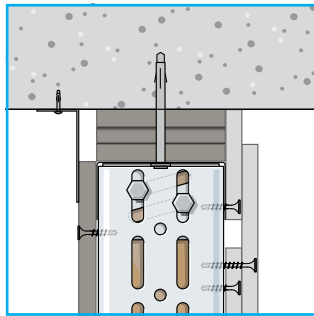


III. T-connection exterior wall to interior wall, double stud system.

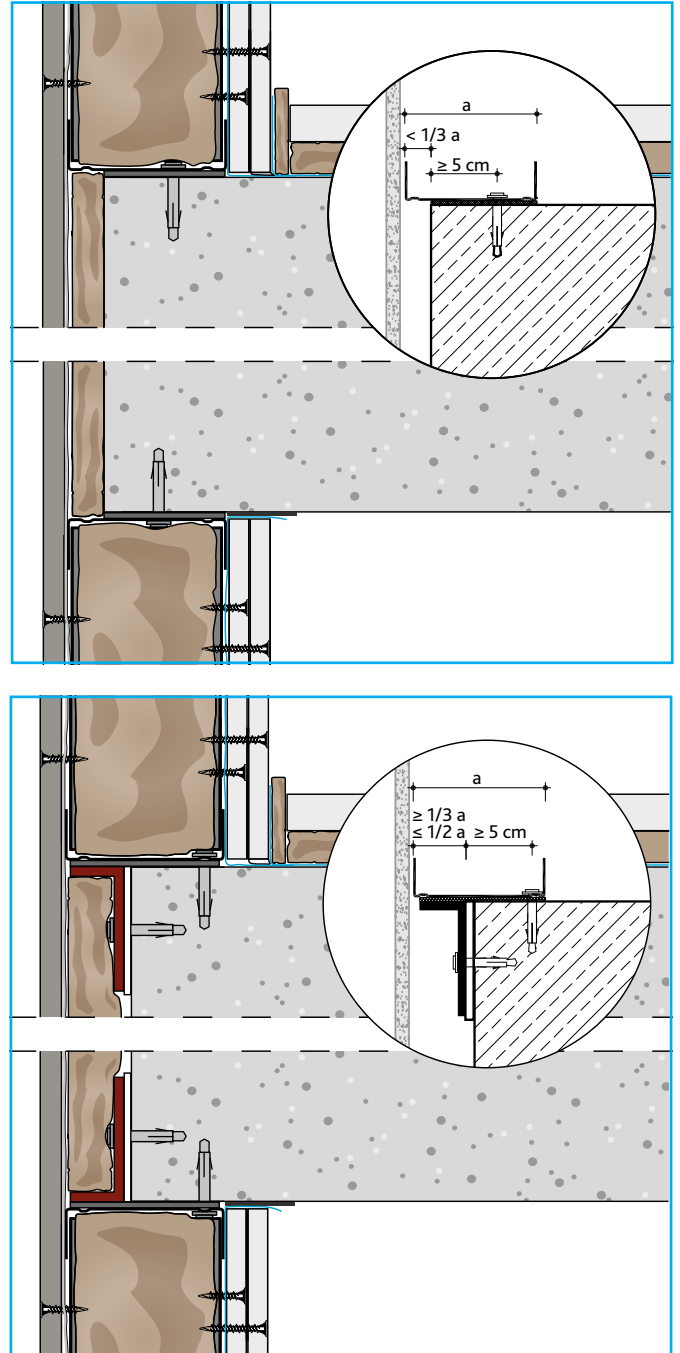


## Sliding ceiling connection

Incorporate deflection heads where specified. Make sure the distances between anchors and brackets, as well as their dimensions, are according to statics requirements. Use appropriate fasteners according to the type of application.



## Ceiling socket floor connection



# Installation details

## Curved exterior walls and façade constructions

### **AQUAPANEL® Cement Board Outdoor**

AQUAPANEL® Cement Board Outdoor is ideally suited for applications such as arches and curved walls. These must be pre-formed dry before installing the boards.

Before installation, bend the cement board panel. The fine cracks that occur on the board surface will not cause any loss of performance. Install the framework (relevant curved shape) to take the pre-formed AQUAPANEL® Cement Board Outdoor. For small radii, we recommend the additional installation of studs and support sections. A distance of no more than 300/312.5 mm should be chosen for the studs or support sections. The radii of curvature of AQUAPANEL® Cement Board are possible up to determined radii of the overall construction.

#### **Bending radius:**

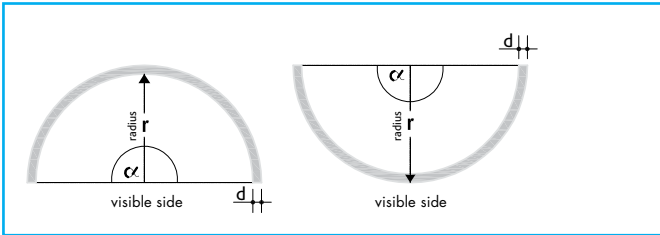
Board size: 900 x 1200/2400/1250/2500 mm;  
minimum bending radius  $\geq 3$  m

Board size: 1200 x 900 / 2000 / 2400 / 2500 / 2800 / 3000  
minimum bending radius  $\geq 3$  m

Strip size: 300 x 1200/2400/1250/2500 mm;  
minimum bending radius  $\geq 1$  m.

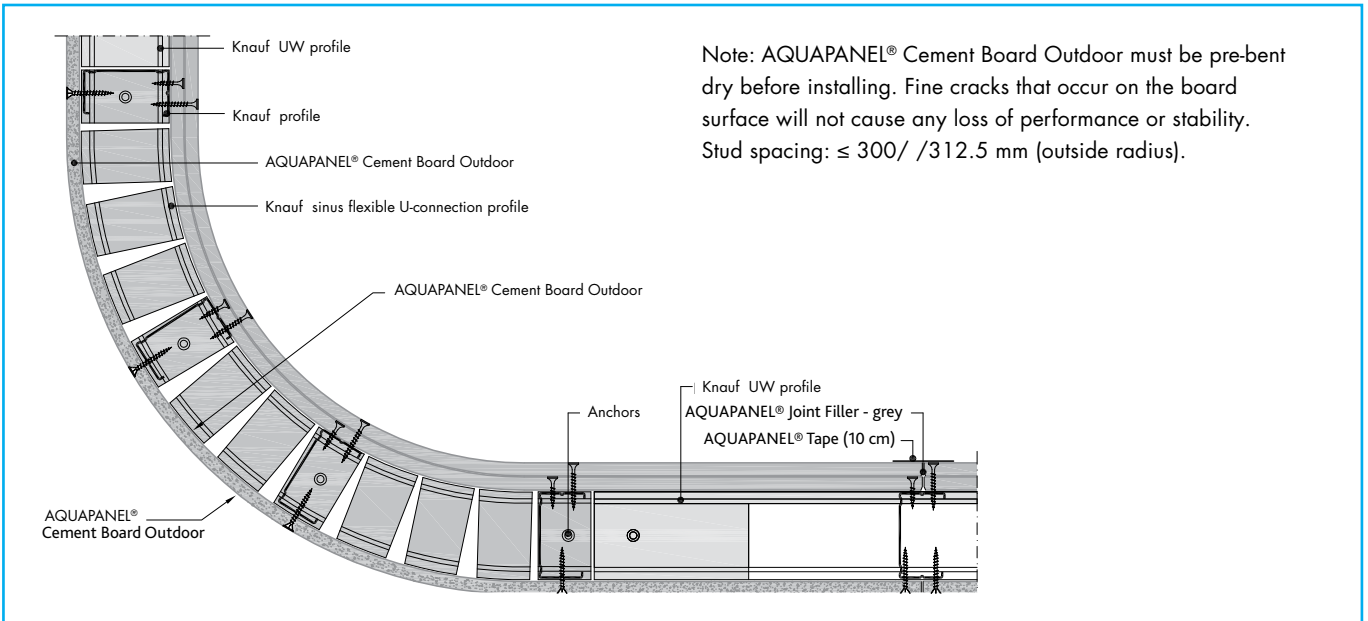
## Curved wall and façade constructions

### Inside arch - concave, outside arch - convex

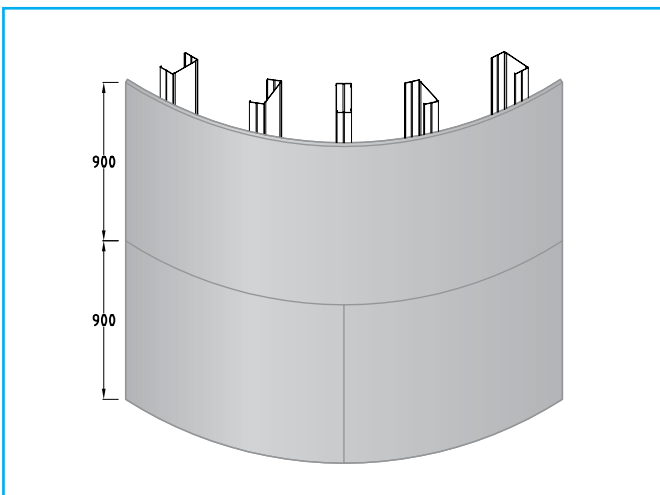


Board thickness	Bending radius r of AQUAPANEL® Cement Board Outdoor	
d	Width 300 mm	Width 900 mm
mm	mm	mm
12.5	≥ 1000	≥ 3000
Length of layout-L		
Angle = 90°	Angle = 180°	All angles up to = 180°

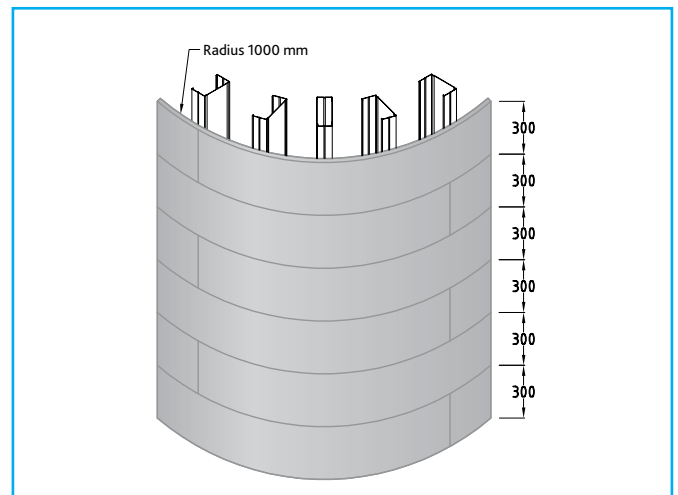
### Details Scale 1:5



### Installation of AQUAPANEL® Cement Board Outdoor with different radius



Assembly with 900 mm or 1200 mm width panels for  $r \geq 3.0$  m



Assembly with 300 mm width panels for  $r \geq 1.0$  m

# Installation details

## Curved interior walls

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### **Gypsum Board**

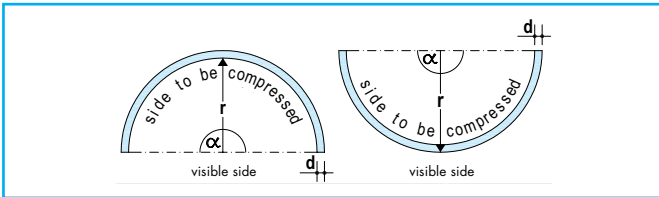
Gypsum Board may be used to form almost any cylindrically curved surface. To prevent flat spots on the curved surface, profiles must be spaced more closely together than required for typical flat wall or ceiling surfaces.

Gypsum Board should be bent wet. Evenly spray water on the surface so that the water is allowed to soak into the core before application. The board must be dried within 24 hours of wetting to prevent the development of mould. Fans and mechanical dehumidifiers should be used to accelerate drying when conditions are not conducive to natural drying. When the Gypsum Board dries thoroughly, its original hardness is regained.

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## Curved interior wall construction

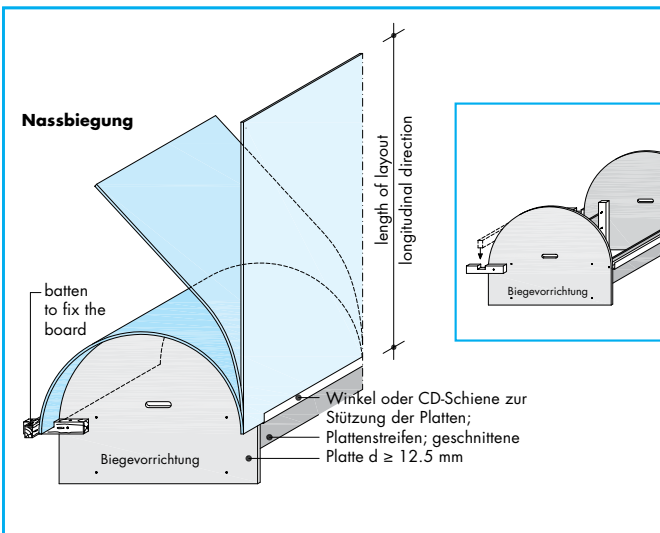
### Inside arch - concave, outside arch - convex



Board thickness d mm	Bending radius r of AQUAPANEL® Cement Board Outdoor	
	Dry bending mm	Wet bending mm
6.5	≥ 1000	≥ 300
9.5	≥ 2000	≥ 500
12.5	≥ 2750	≥ 1000
<b>Longitudinal bending only</b>		

Length of layout L		
Angle $\alpha = 90^\circ$	Angle $\alpha = 180^\circ$	All angles up to $\alpha = 180^\circ$

### Bending process



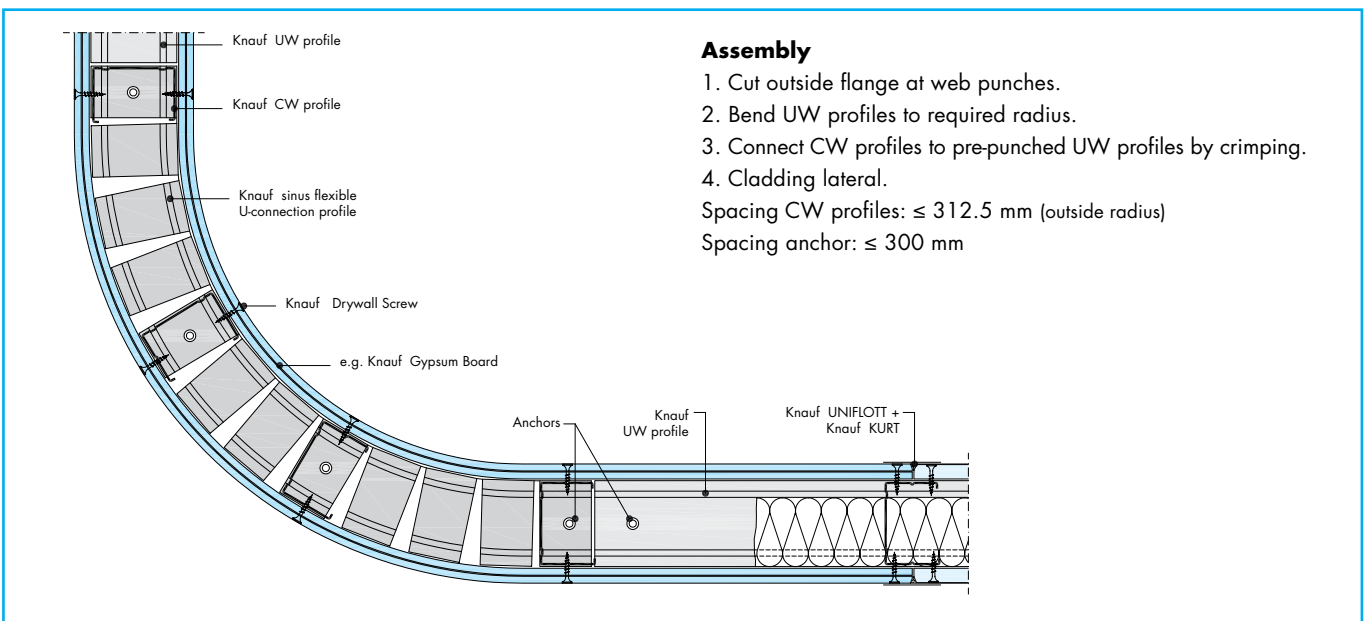
### Wet bending

1. Put the cut-to-length Gypsum Boards on a grid made of channels or similar with the side to be compressed on top and excessing the grid on the perimeters (so excess water can drip off).
2. Perforate the board laterally and longitudinally with spike roller.
3. Wet the board by spraying or with lambskin roller and let it settle for a few minutes. Repeat process until excessive water drains.
4. Lay board on precast moulding device, fix with tape and let it dry.

### Dry bending

1. Bend Gypsum Boards over grid or frame.
2. Fix with Drywall Screws following the bending continuously.

### Details Scale 1:5



### Assembly

1. Cut outside flange at web punches.
2. Bend UW profiles to required radius.
3. Connect CW profiles to pre-punched UW profiles by crimping.
4. Cladding lateral.

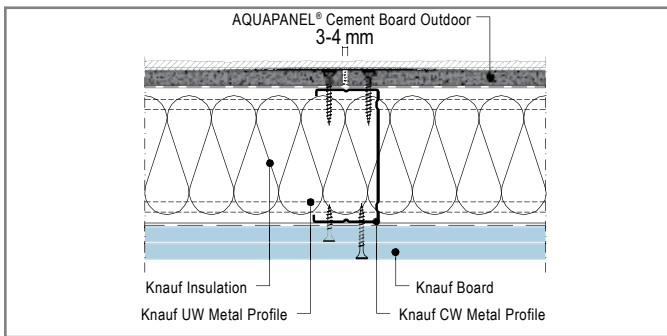
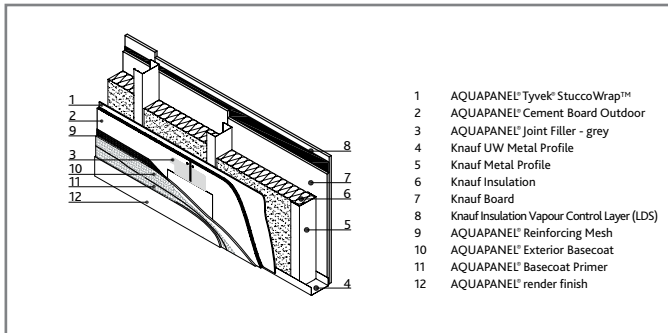
Spacing CW profiles:  $\leq 312.5$  mm (outside radius)

Spacing anchor:  $\leq 300$  mm

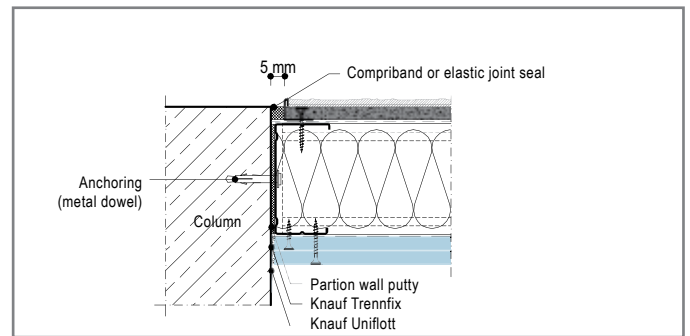
# II. Details

## a. Constructions between floors

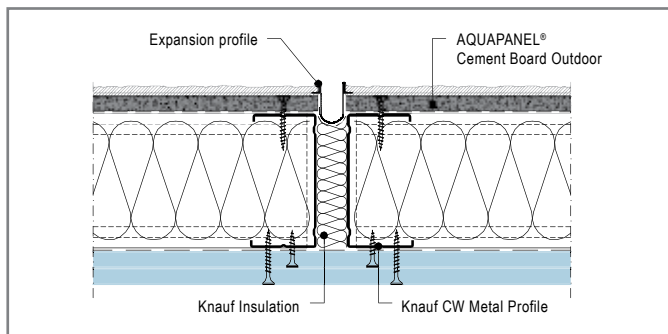
### Single stud



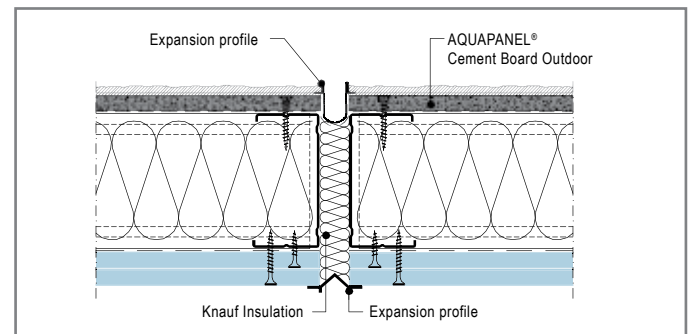
W384E-B1 Cross section with joint



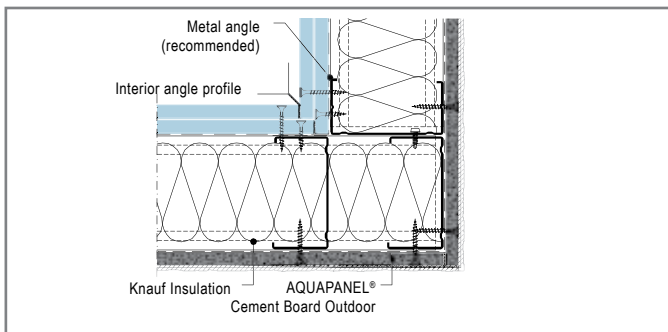
W384E-A1 Connection to solid wall



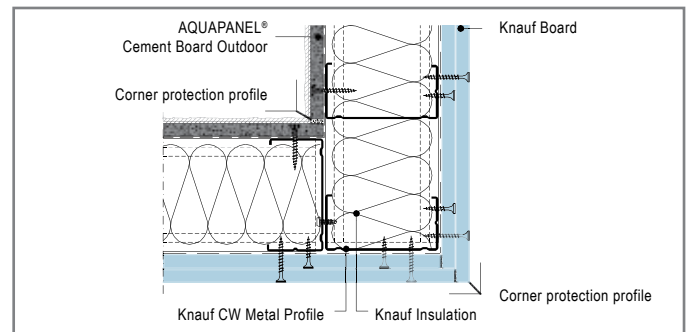
W384E-BFU1 Expansion joint (vertical)



W384E-BFU2 Structural expansion joint



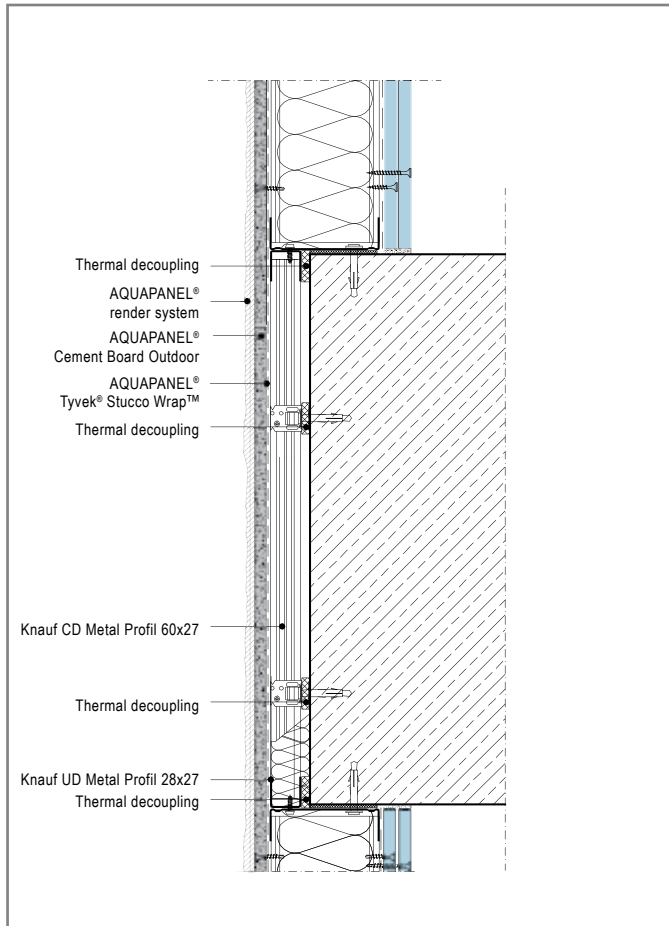
W 384E-E1 Outside corner



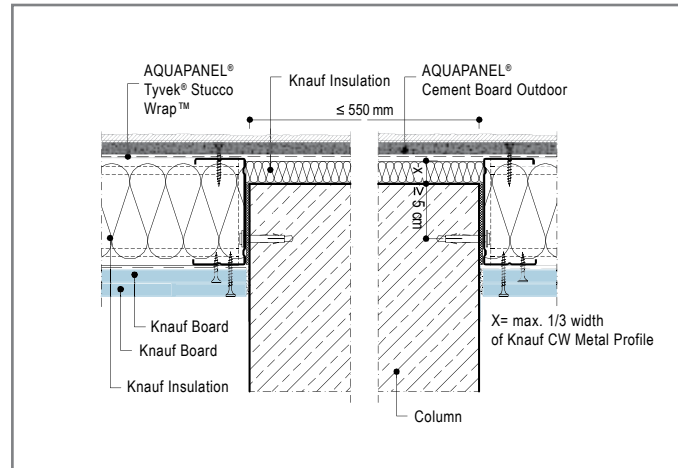
W 384E-D1 Inside corner

# Constructions between floors

## Single stud



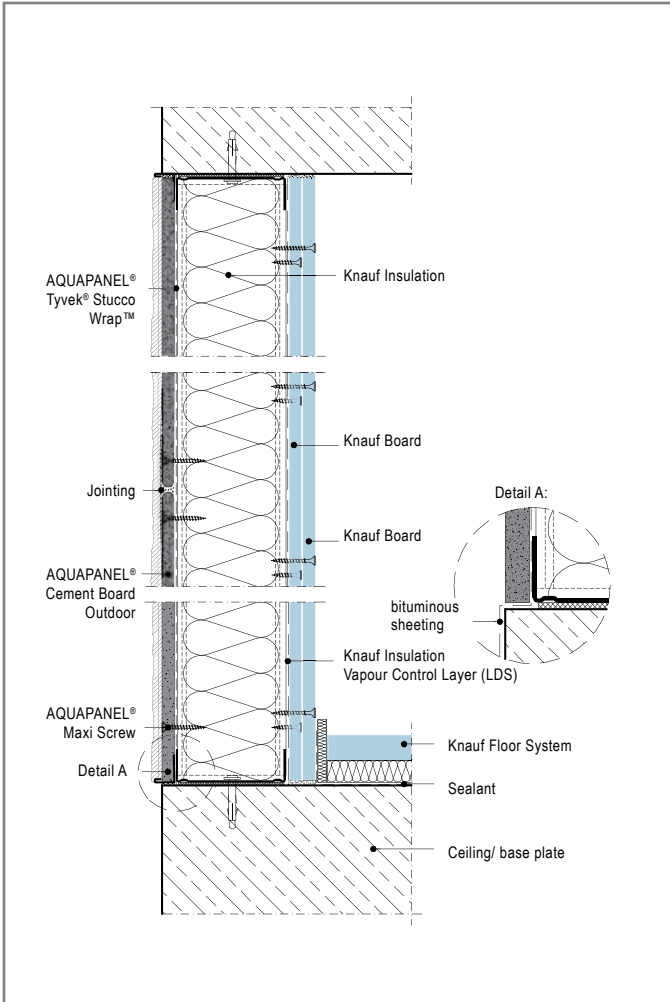
W384E-VM1 Connection to ceiling



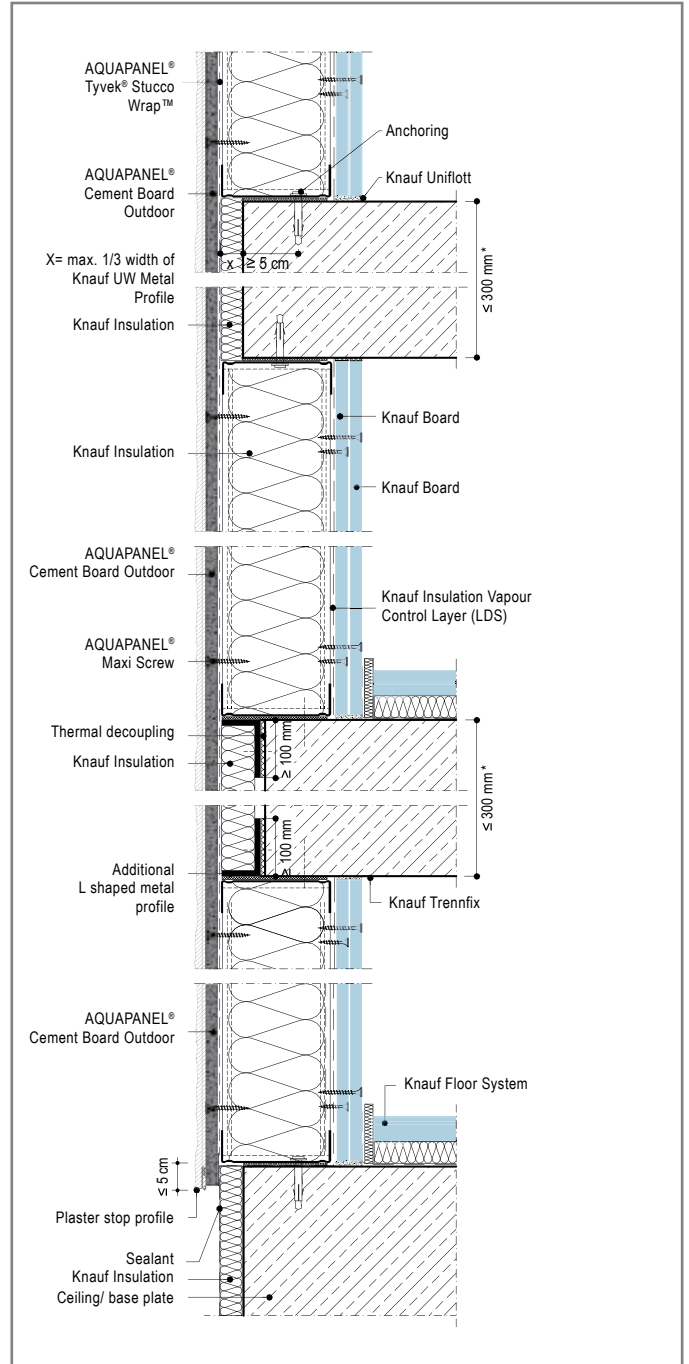
W384E-HS1 Connection to column

# Constructions between floors

## Single stud



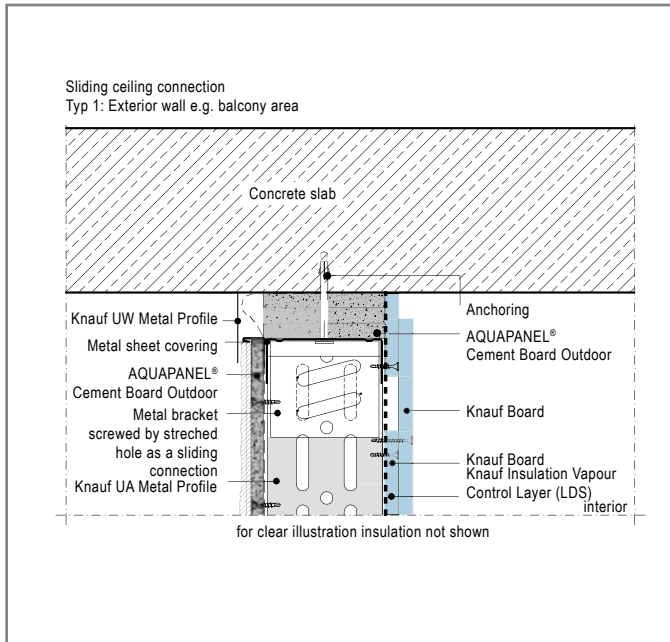
W 384E-V1 Vertical cross section, option 1



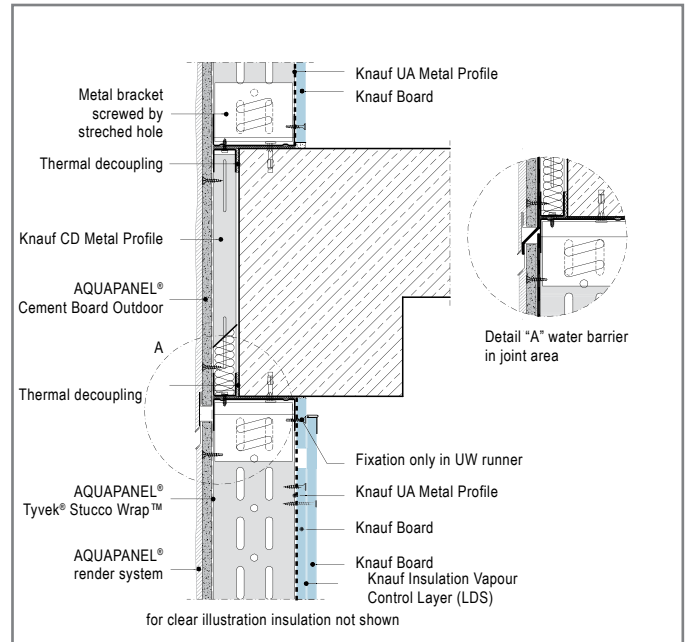
W 384E-V2 Vertical cross section, option 2

# Constructions between floors

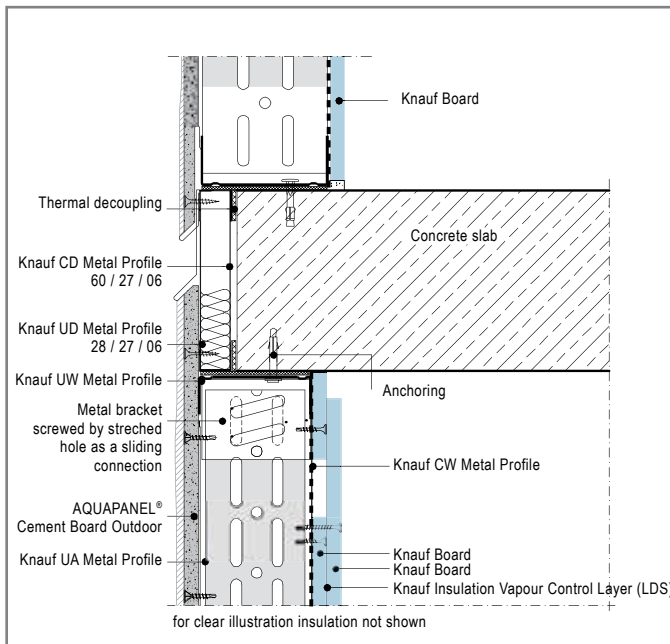
## Single stud



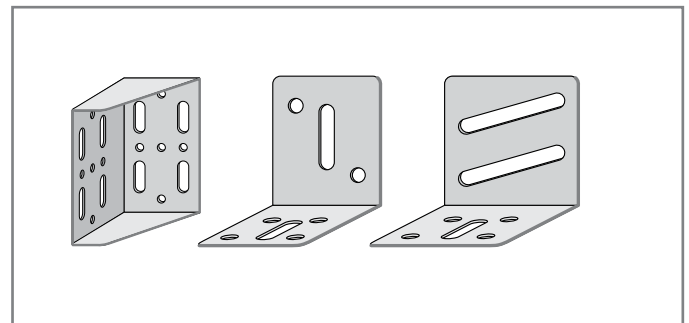
W384E-VOG1 Sliding ceiling connection, option 1



W384E-VMG2 Sliding ceiling connection, option 2



W384E-VMG1 sliding ceiling connection, option 1

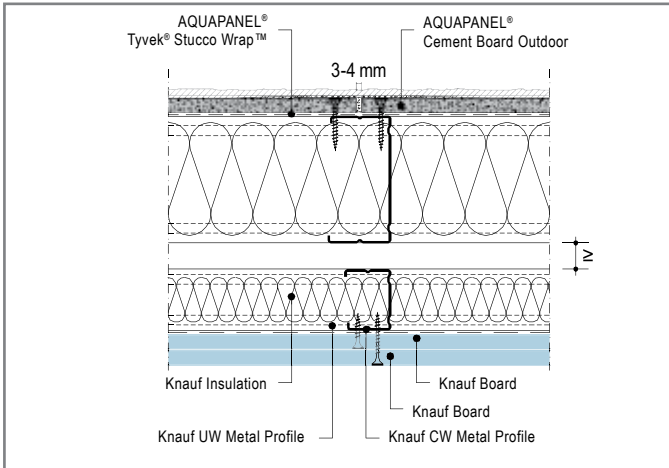


### Solutions with angles

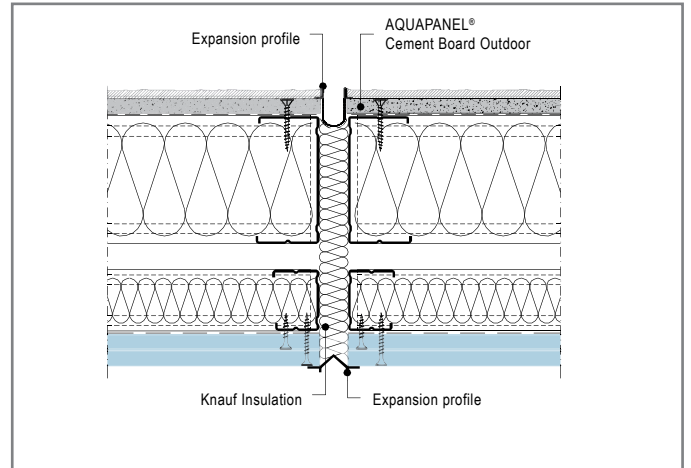
Depending on wind loads and static calculation, brackets should be used for fixation of vertical profiles at top and foot points. Angles can be used for Knauf UA Metal Profiles and Knauf CW Metal Profiles. The fastening of profiles and angles should be completed using appropriate screws, either self-drilling, or machine screws with pre-drilled holes. Anchors or dowels must be approved according to the static calculation. The corrosion protection requirements for profiles, fasteners and anchors must be fulfilled.

# Constructions between floors

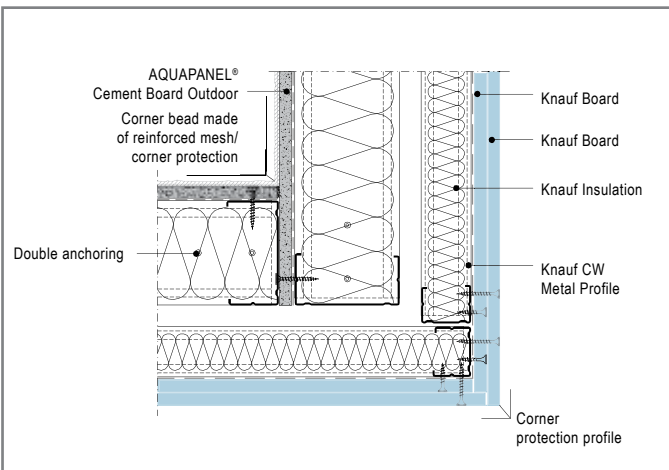
## Double stud



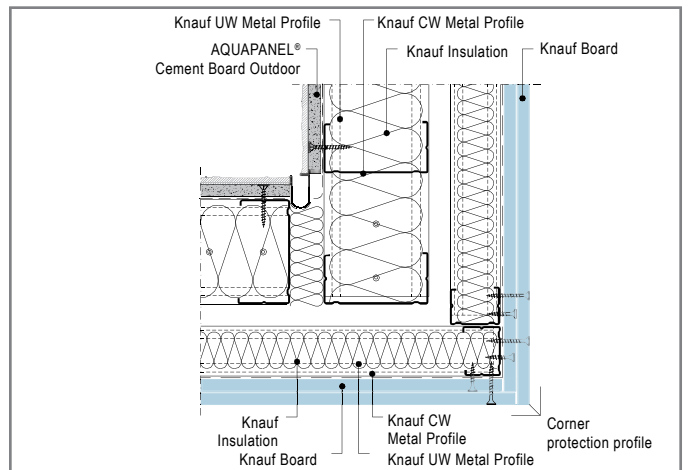
W388E-B1 Cross-section with joint



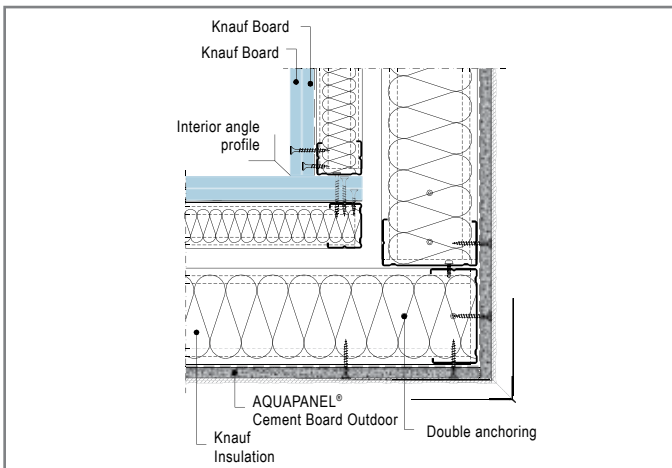
W388E-BFU1 Structural expansion joint



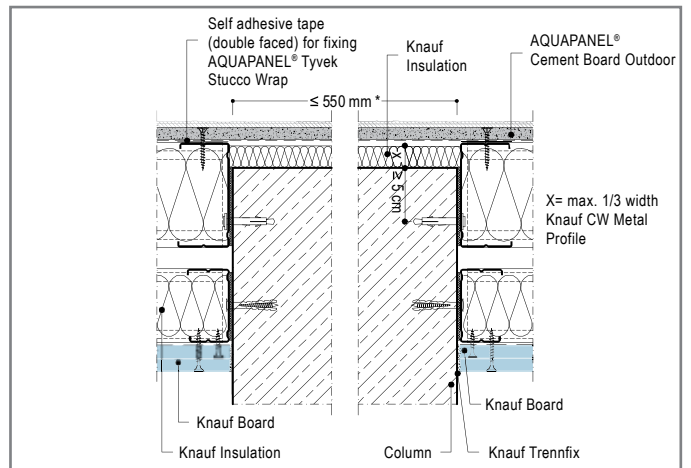
W388E-D1 Inside corner with expansion joint



W388E-DBFU1 Inside corner with expansion joint



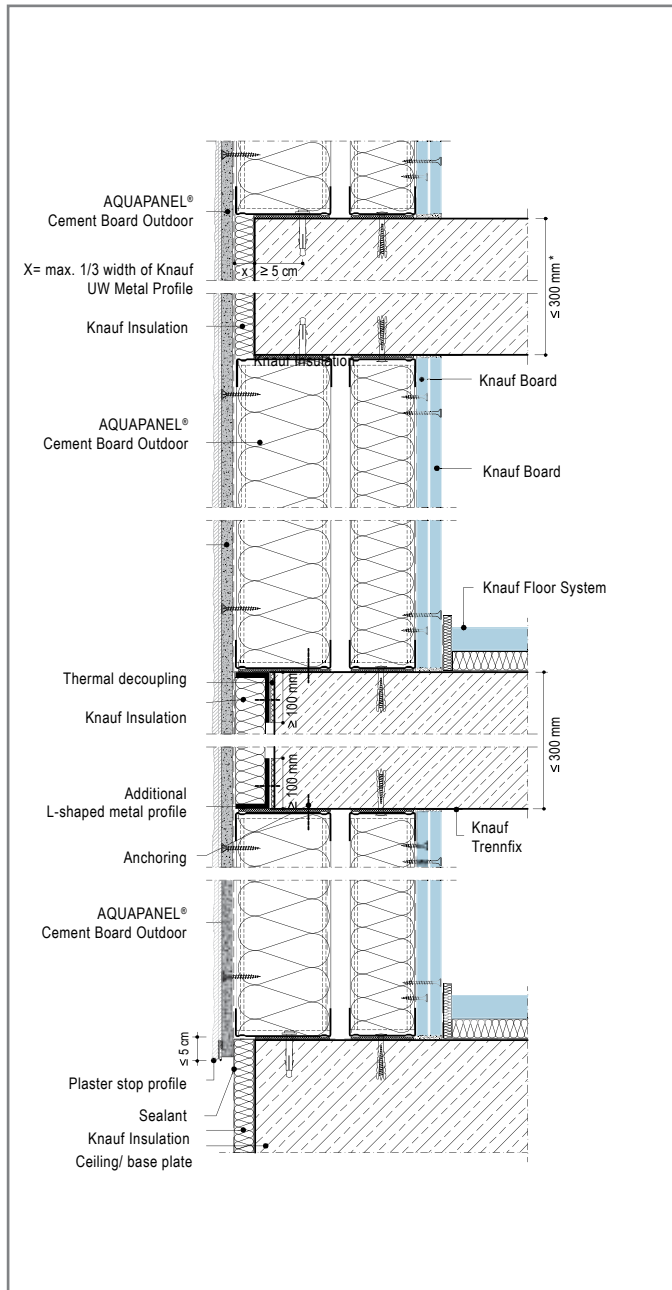
W388E-E1 Outside corner



W388E-HS1 Connection to column

# Constructions between floors

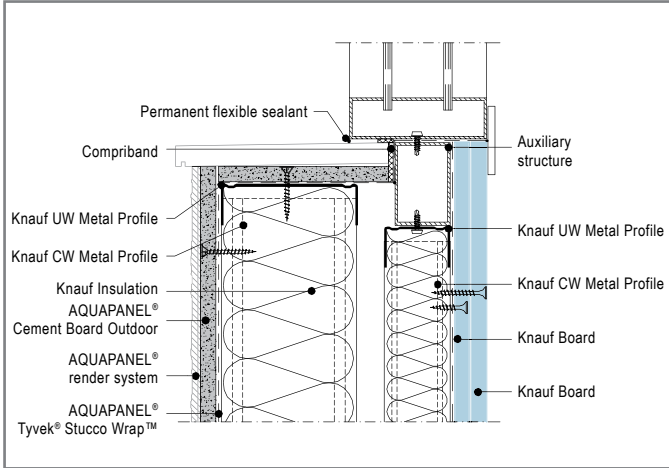
## Double stud



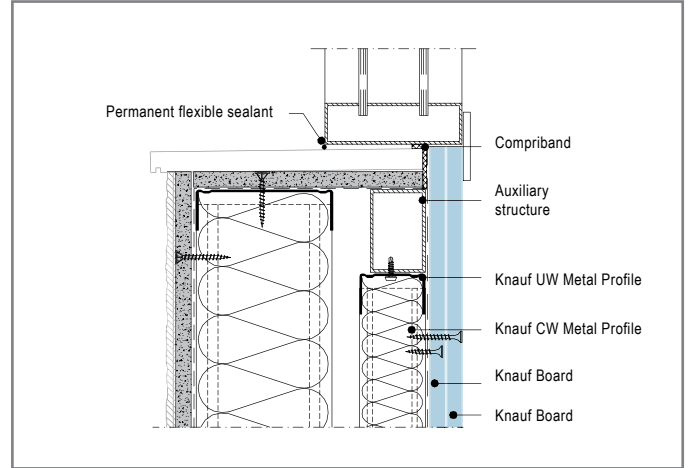
W388E-V1 Vertical cross section

# Constructions between floors

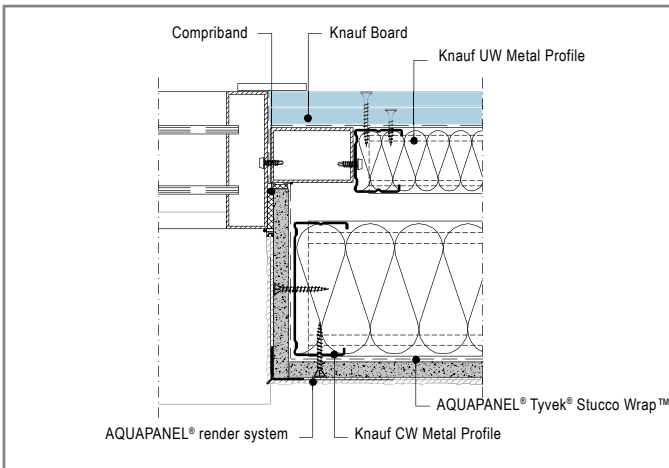
## Double stud, window connections



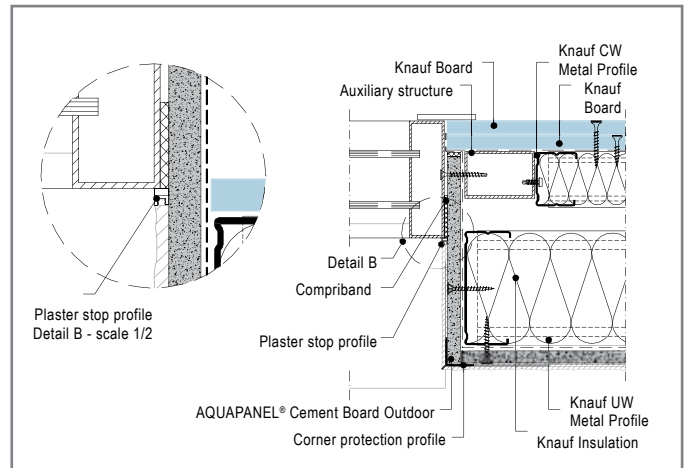
W388E-FE-VU1 Lower window connection, option 1



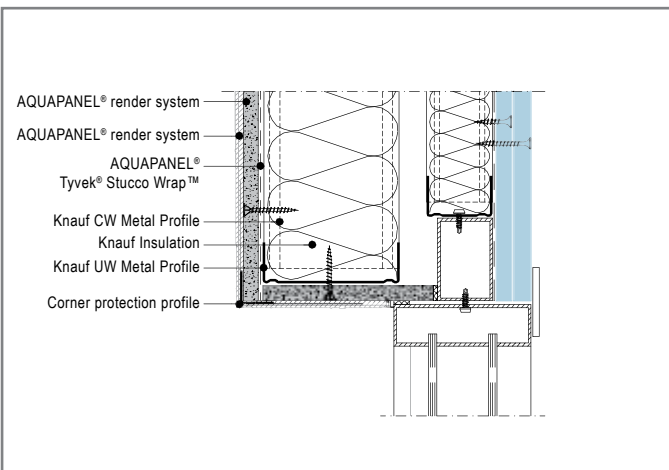
W388E-FE-VU2 Lower window connection, option 2



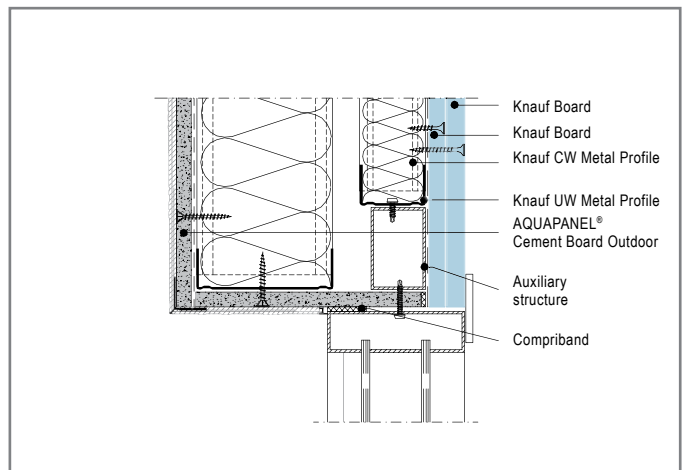
W388E-FE-VM1 Side connection to window, option 1



W388E-FE-VM2 Side connection to window, option 2



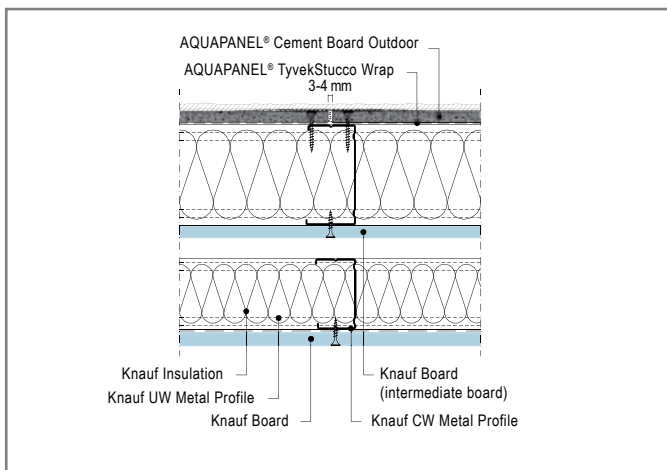
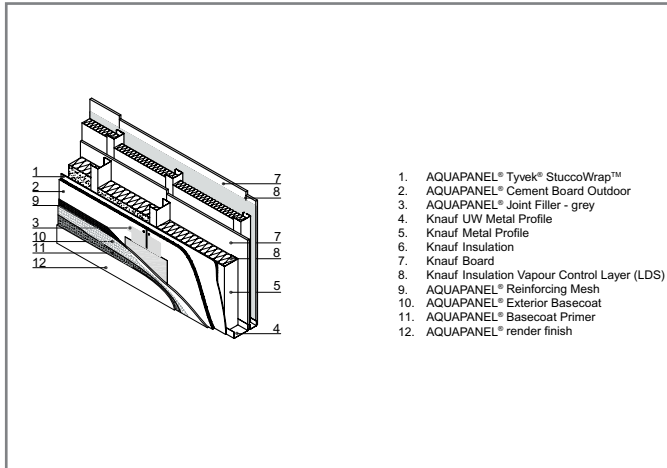
W388E-FE-VO1 Upper connection to window, option 1



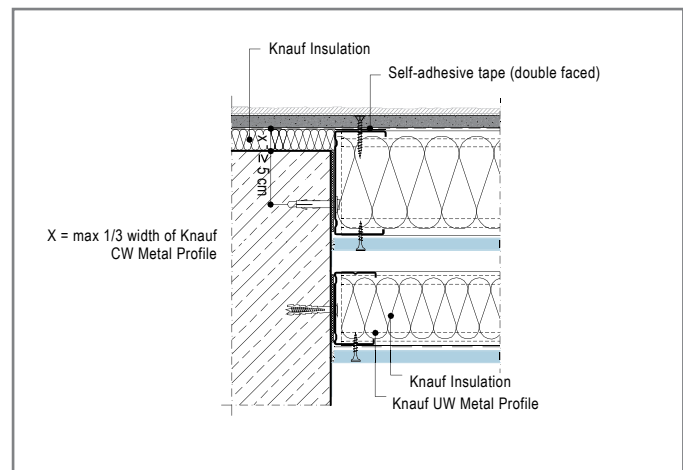
W388E-FE-VO2 Upper connection to window, option 2

# Constructions between floors

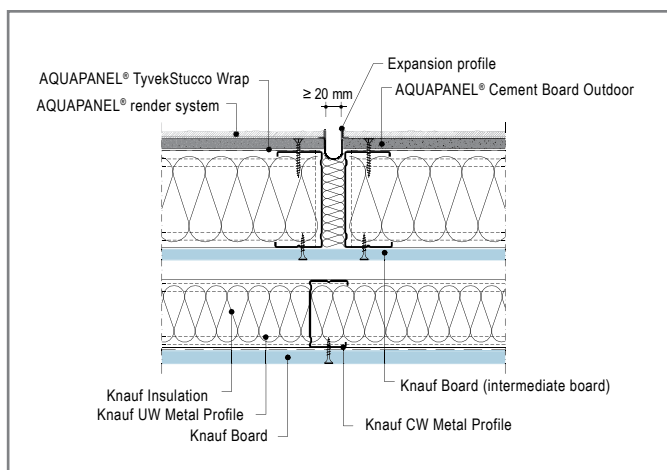
## Double stud with intermediate board



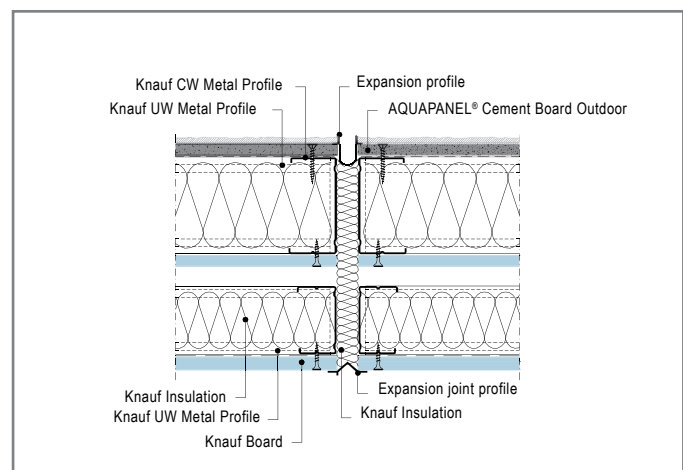
W387E-B1 Cross section with joint



W387E-A1 Connection to solid wall



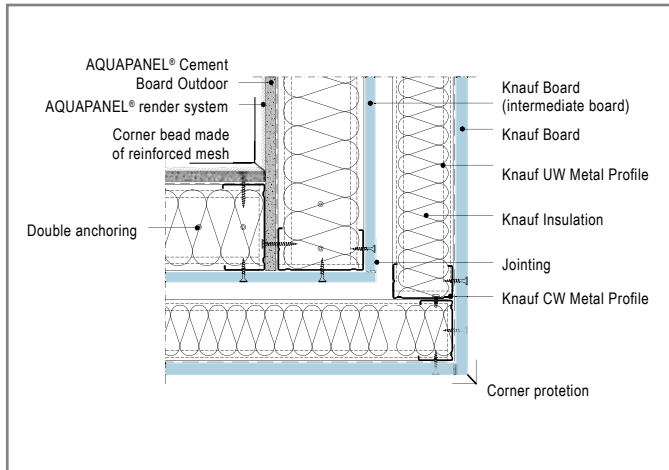
W387E-BFU1 Expansion joint (vertical)



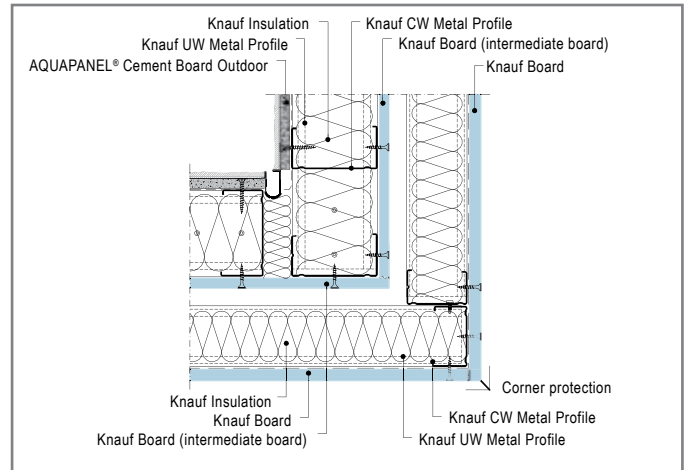
W387E-BFU2 Structural expansion joint

# Constructions between floors

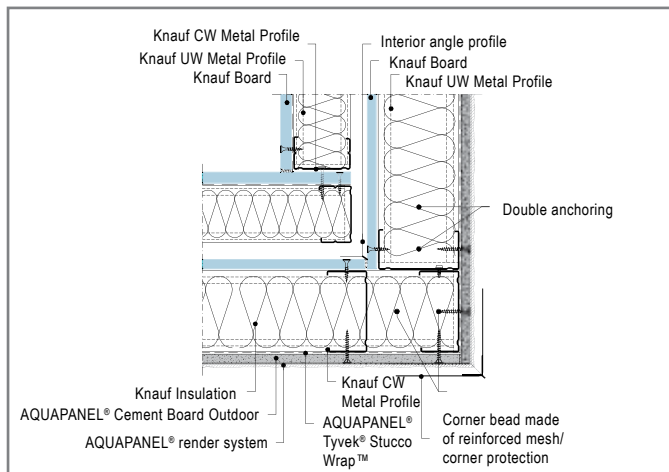
## Double stud with intermediate board



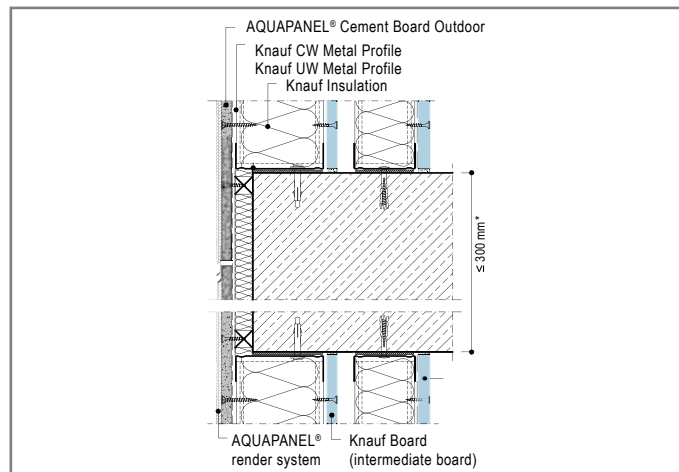
E387E-D1 Inside corner without expansion joint



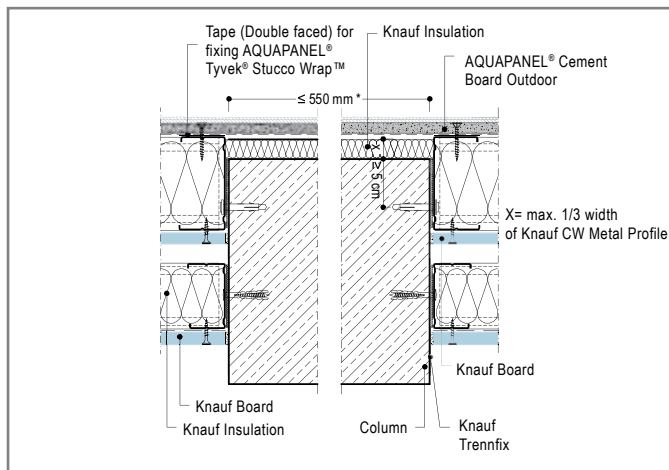
W387E-DBFU1 Inside corner with expansion joint



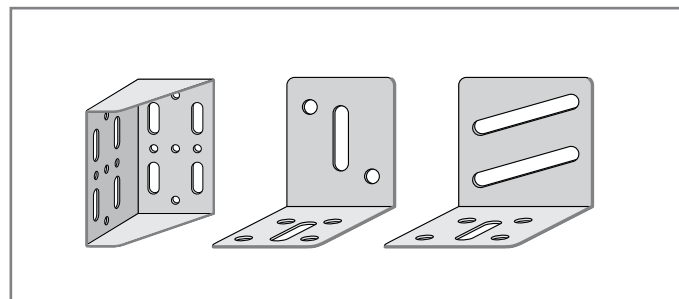
W387E-E1 Outside corner



W387E-VM1 Expansion joint (horizontal)



W387E-HS1 Connection to column

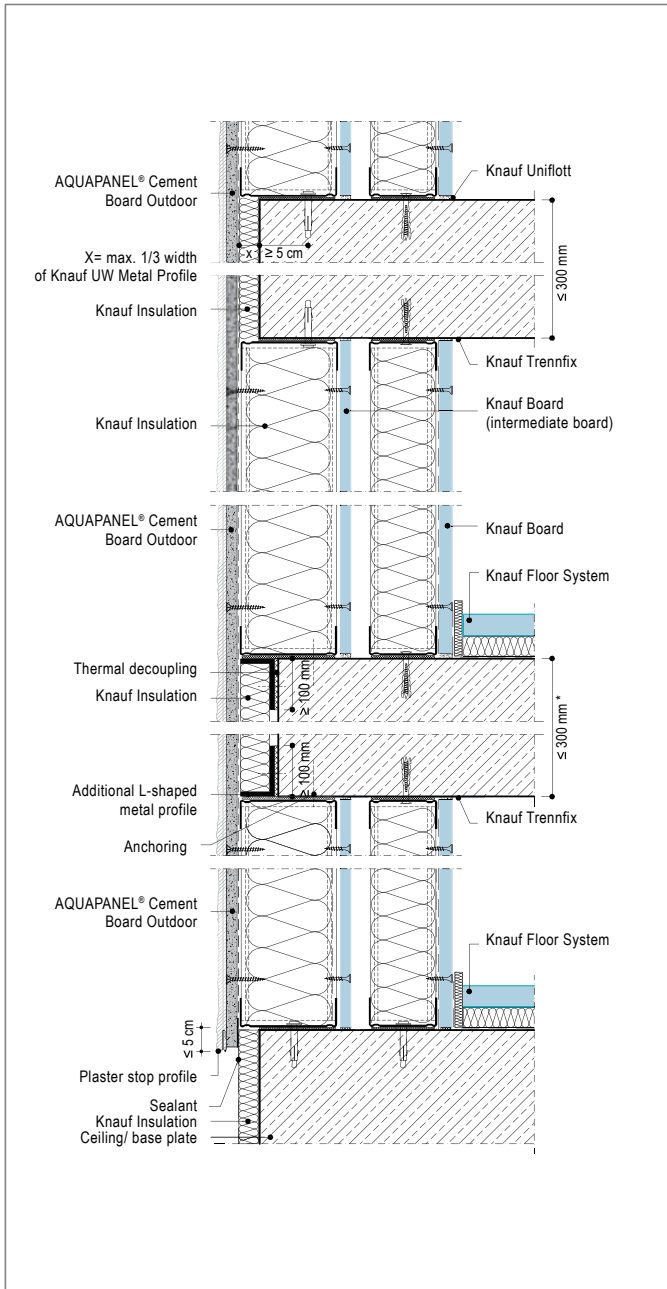


### Solutions with angles

Depending on wind loads and static calculation, brackets should be used for fixation of vertical profiles at top and foot points. Angles can be used for Knauf UA Metal Profiles and Knauf CW Metal Profiles. The fastening of profiles and angles should be completed using appropriate screws, either self-drilling, or machine screws with pre-drilled holes. Anchors or dowels must be approved according to the static calculation. The corrosion protection requirements for profiles, fasteners and anchors must be fulfilled.

# Constructions between floors

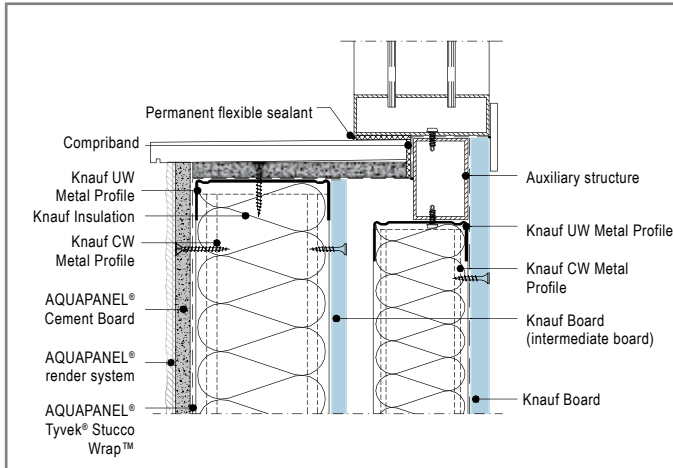
## Double stud with intermediate board



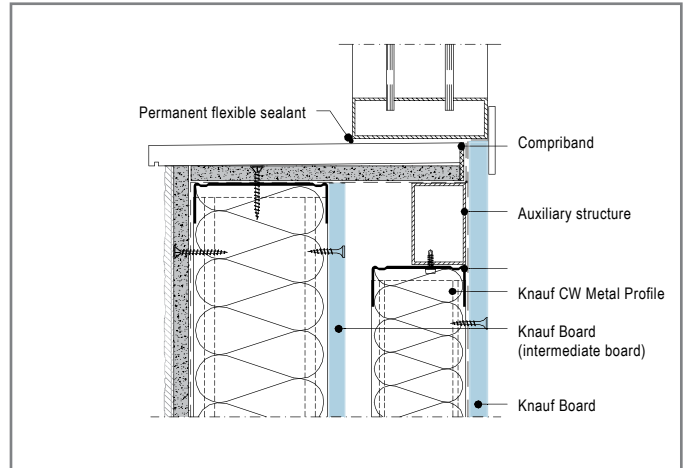
W387E-V1 Vertical cross-section

# Constructions between floors

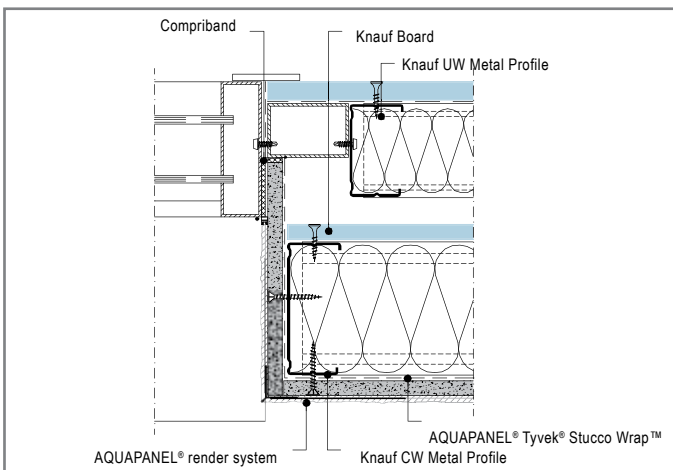
## Double stud with intermediate board, window connections



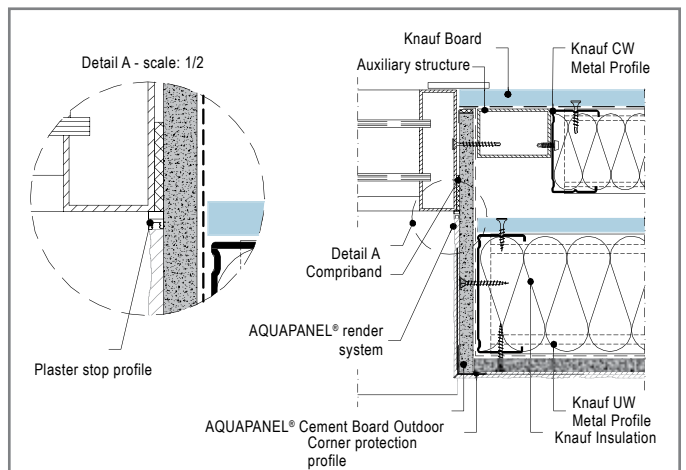
W387E-FE-VU1 Lower connection to window, option 1



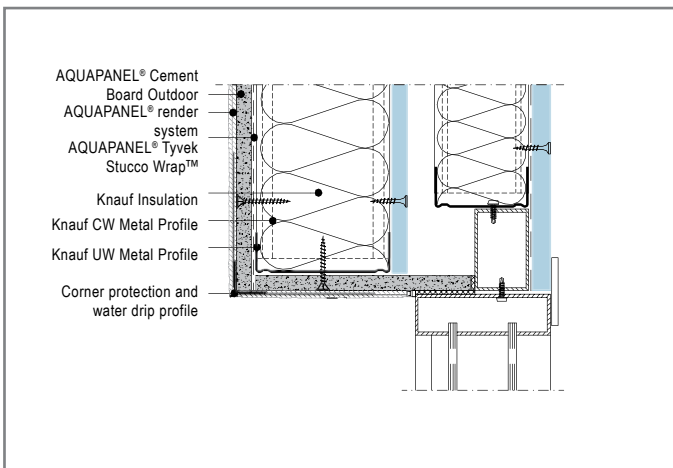
W387E-FE-VU2 Lower connection to window, option 2



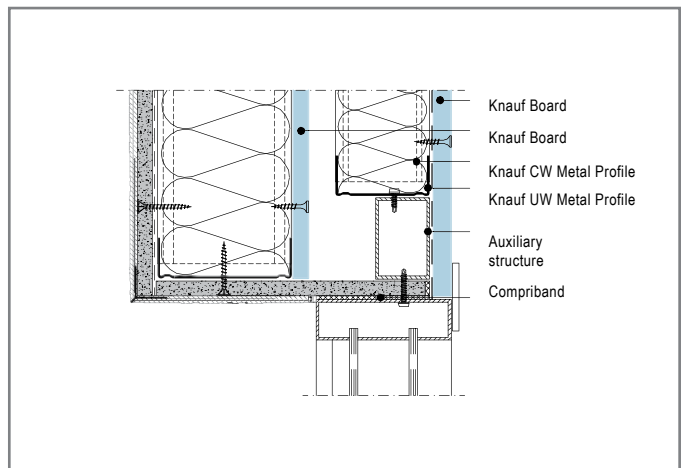
W387E-FE-HM1 Side connection to window, option 1



W387E-FE-HM2 Side connection to window, option 1



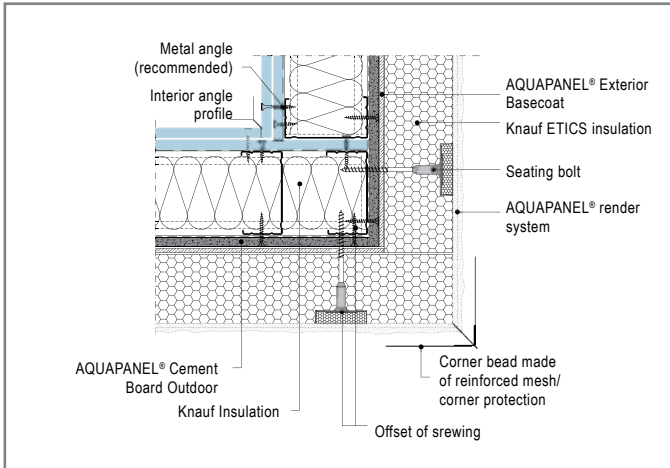
W387E-FE-VO1 Upper connection to window, option 1



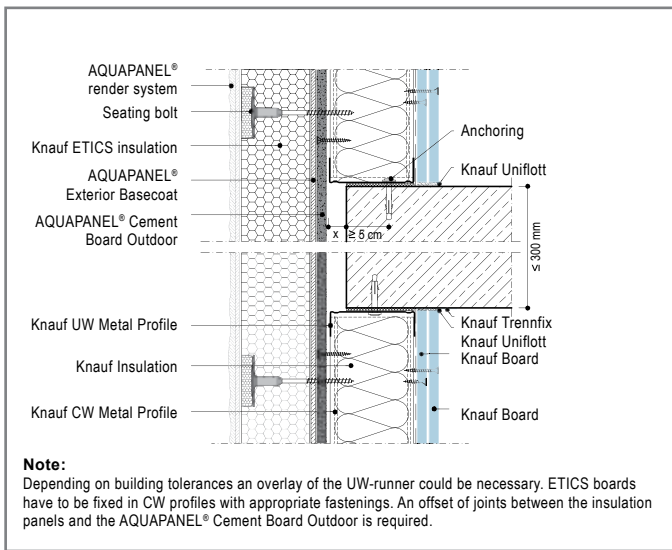
W387E-FE-VO2 Upper connection to window, option 2

# Constructions between floors

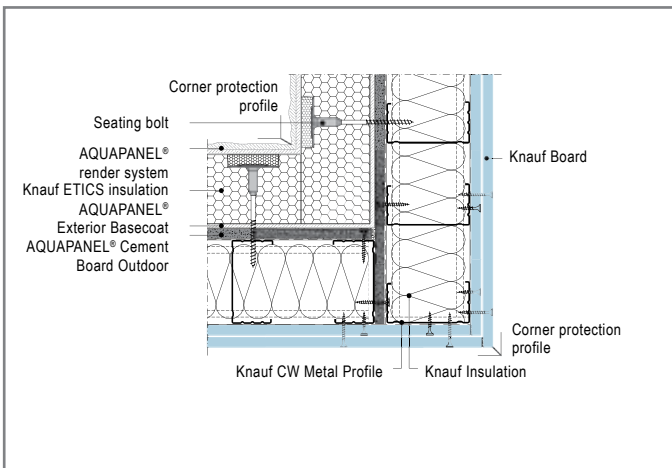
## Single stud with ETICS



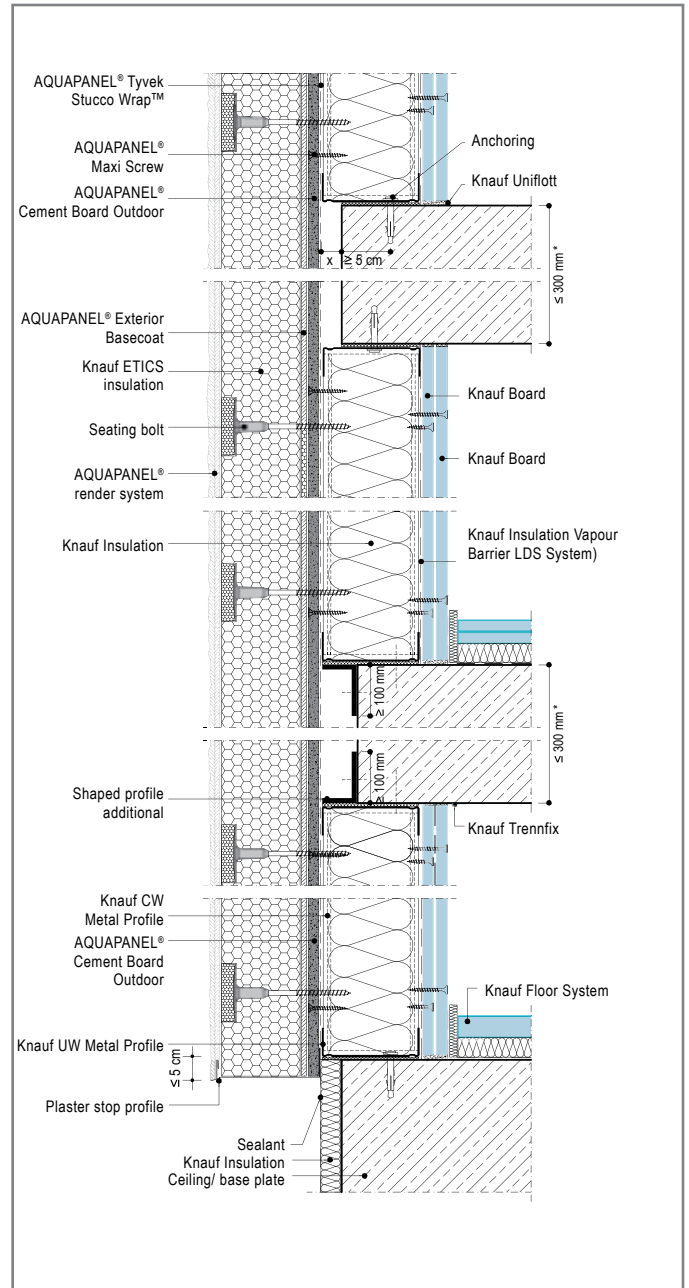
W384E-E-ETICS1 Outside corner with ETICS



W384E-VM-ETICS1 Inside corner with ETICS



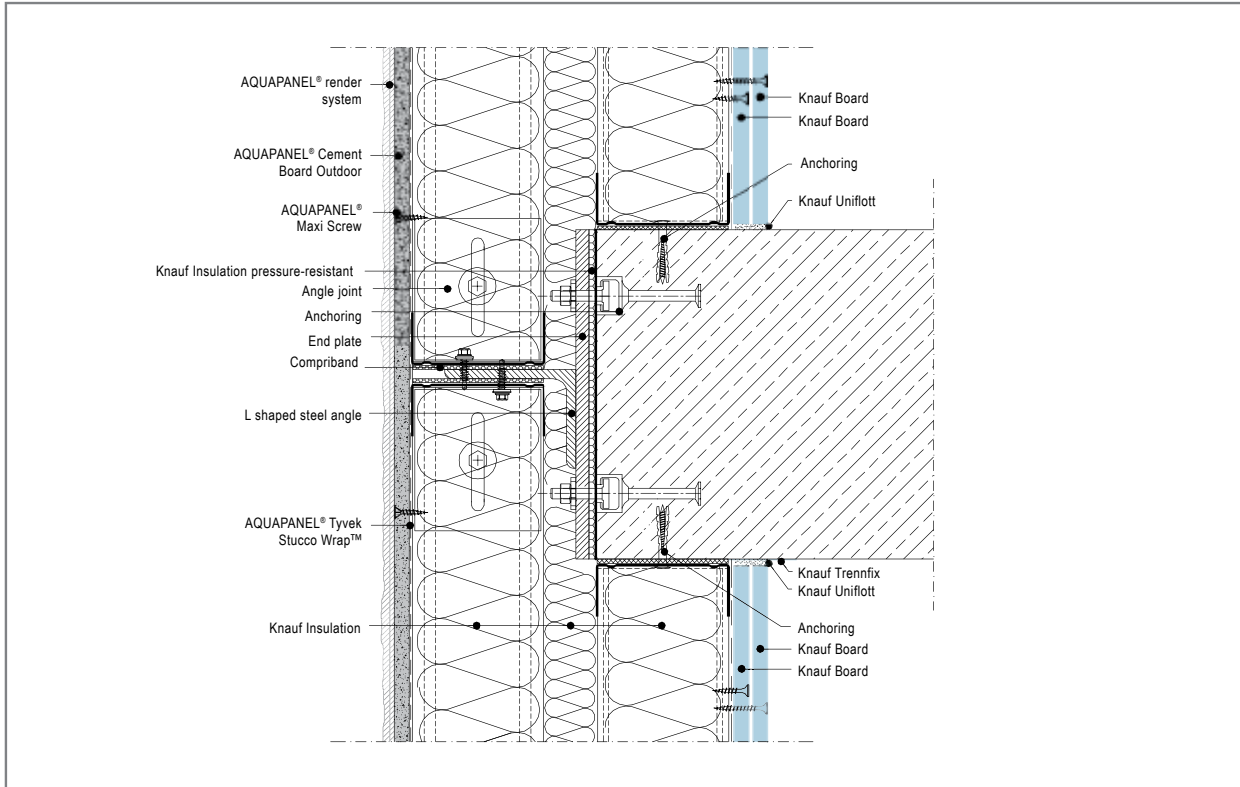
W384E-D-ETICS1 Exterior wall with insulation material and ETICS



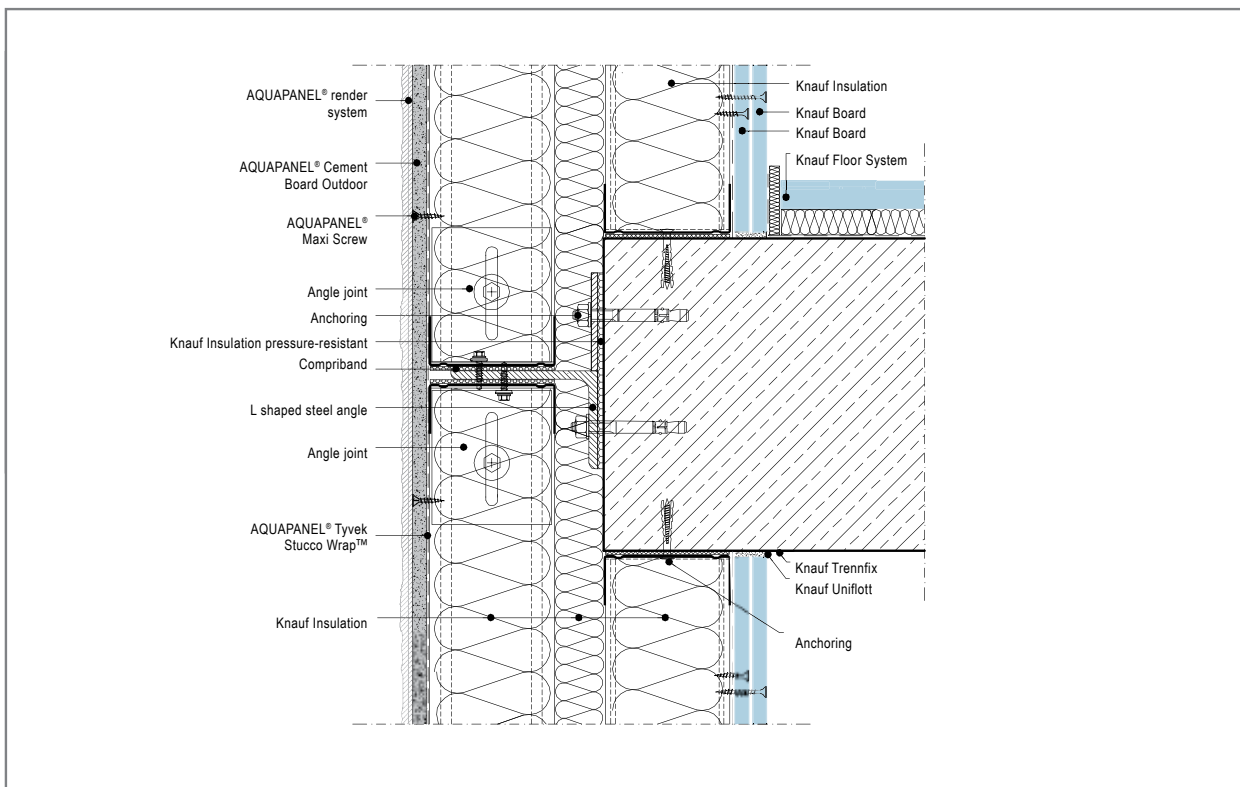
W384E-V-ETICS1 Vertical cross-section

## b. Constructions in front of floors

### Double stud



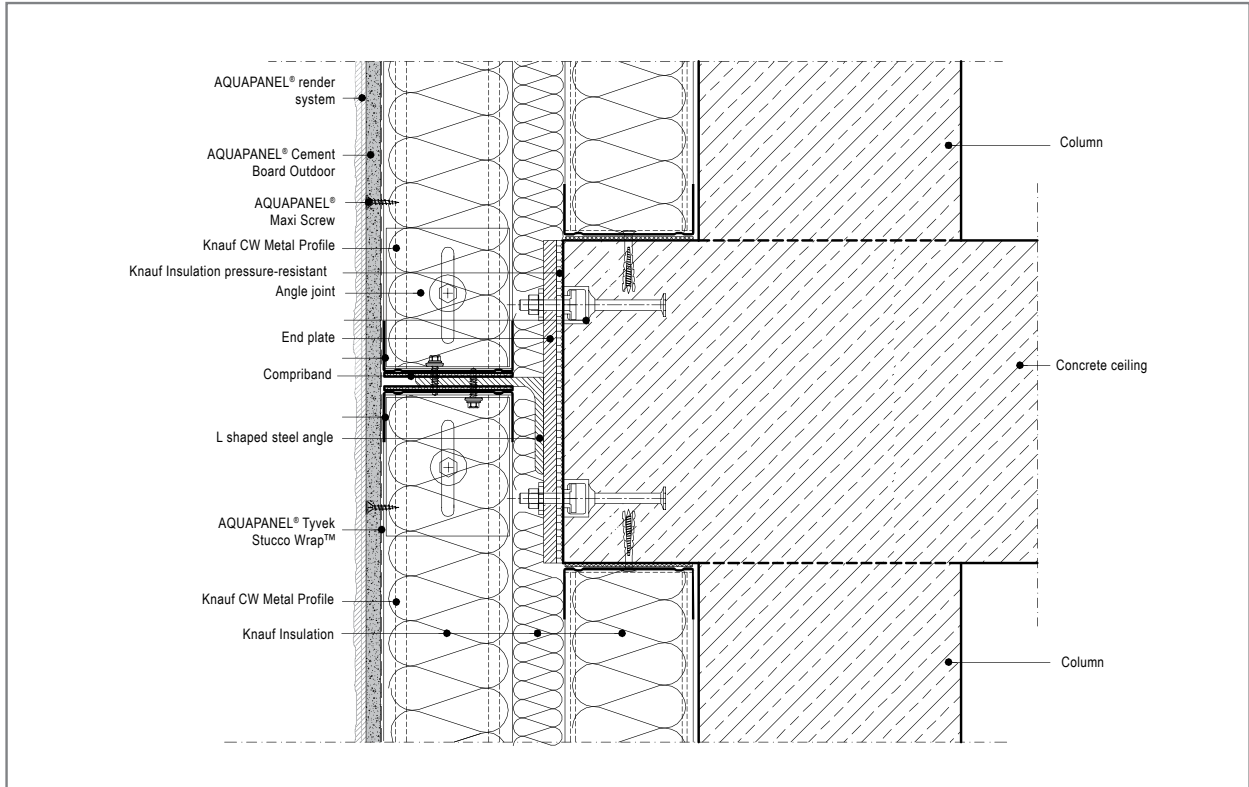
W388E-VM1 – Connection to ceiling: Steel angle and end plate, option 1



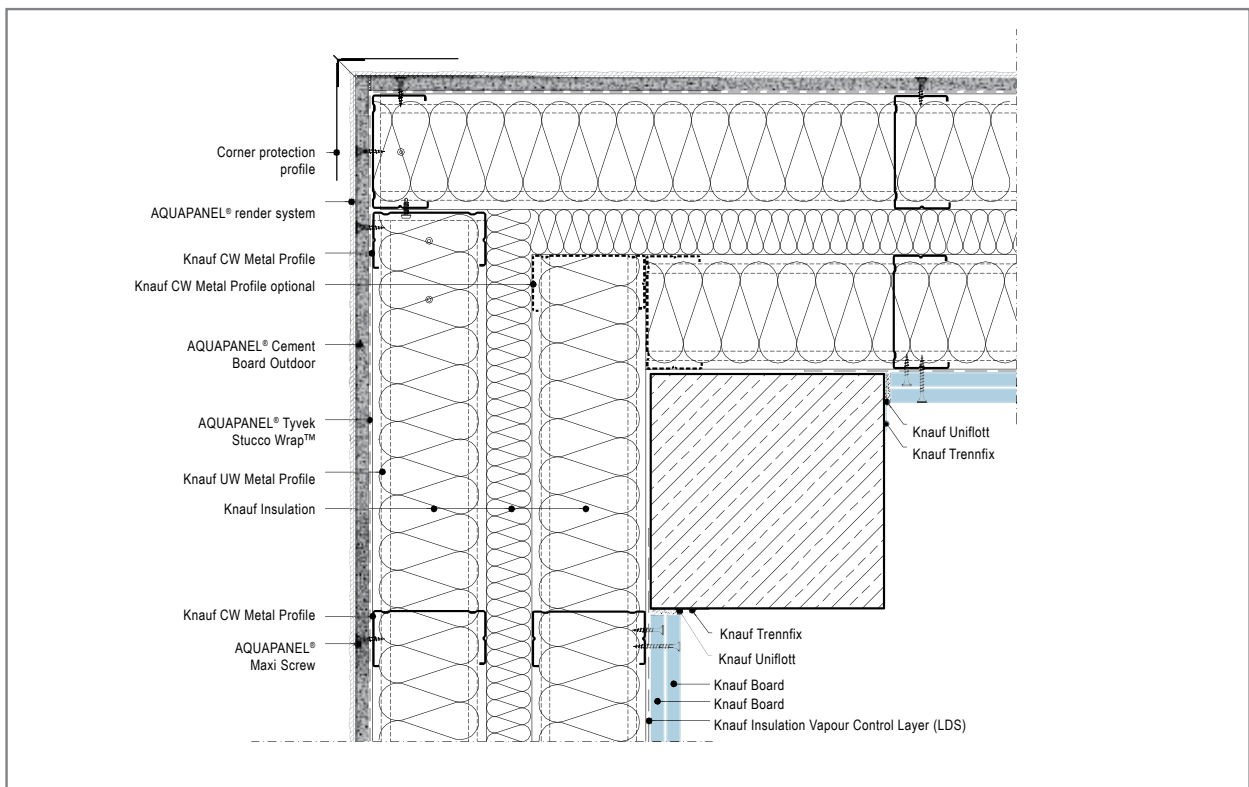
W388E-VM2 Connection to ceiling: Steel angle and end plate, option 2

# Constructions in front of floors

## Double stud



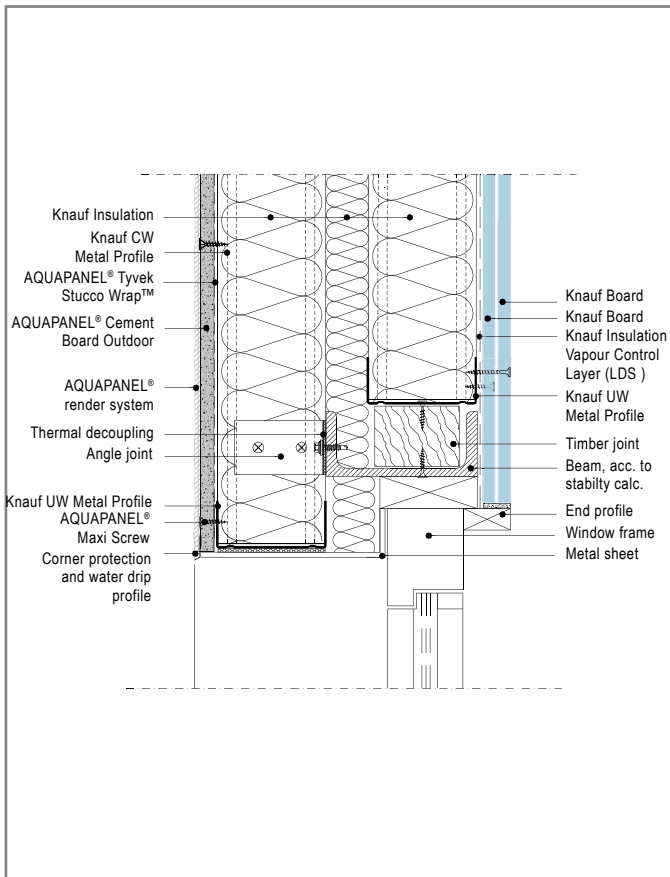
W388E-VMS1 Connection to column: Steel angle and end plate, option 1



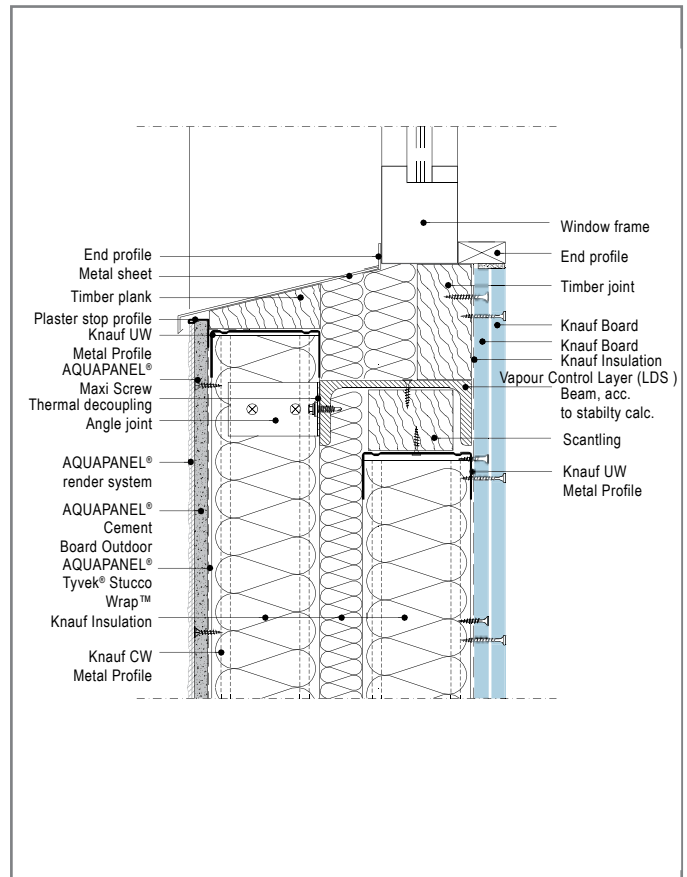
W388E-ES1 – Outside corner, horizontal section

# Constructions in front of floors

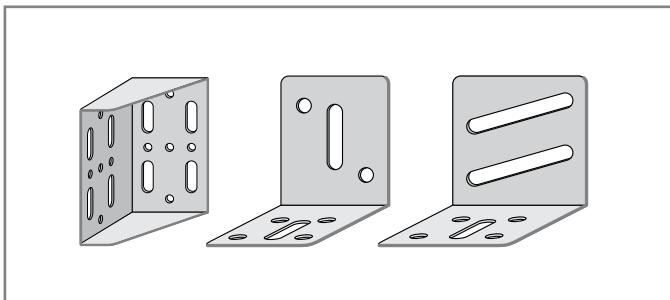
## Double stud window connections



W388E-FE-VO1 Upper connection to window



W388E-FE-VU1 Lower connection to window



### Solutions with angles

Depending on wind loads and static calculation, brackets should be used for fixation of vertical profiles at top and foot points. Angles can be used for Knauf UA Metal Profiles and Knauf CW Metal Profiles. The fastening of profiles and angles should be completed using appropriate screws, either self-drilling, or machine screws with pre-drilled holes. Anchors or dowels must be approved according to the static calculation. The corrosion protection requirements for profiles, fasteners and anchors must be fulfilled.



# III. Technical considerations

## a. Stability and construction

### a. Stability and construction

#### 1a. Substructure and fastening

##### Stud spacing:

In the constructions shown, AQUAPANEL® Cement Board Outdoor is fastened at a centre distance of 600/625 mm.

The vertical laths should have a minimum flange width of 50 mm to allow for the relevant edge gaps of the fasteners.

In buildings with eaves of over 8.0 m in height the distance between vertical support sections must be reduced to 300/312.5 mm at the corners and edges of the façade.

##### Double panelling:

The use of double panelling with AQUAPANEL® Cement Board Outdoor or other board material under the exterior panelling for fire protection purposes can also be done.

##### Anchoring, fastenings and connectors:

The effects on the façades resulting from wind, snow, ice and particular loads are dissipated in the load-bearing structure by the substructure and its anchorings, fastenings and connectors. In this, the components mentioned above fulfil the following functions.

##### Anchorings:

A component which mechanically anchors the substructure to the ground.

##### Fastenings:

A metal unit that mechanically fastens the cladding to the substructure. The load-bearing strength of the substrate should be checked. Appropriate fixation materials should be used. An alternative fastening method is with steel staples or nail screws.

##### Connectors:

A metallic component which joins the substructures together.

With regards to standardisation, special requirements exist for anchoring, fastening and connectors; these are indicated on the following pages under the design recommendations.

##### Profile connection to primary structure:

Profiles which take wind loads have to be connected by brackets to the load bearing primary structure.

Note: The sizes of profiles, brackets, screws and anchoring material has to be calculated by a specialised planner.

### 2a. Material selection and corrosion protection

External façades are designed to resist changing weather conditions.

A suitable material is to be selected for the substructure, depending on moisture loading. For the metal substructure and fastening kits, sufficient corrosion protection must be observed. Where different materials are being combined, compatibility must be checked in each case.

Note: The relevant moisture loads and resulting corrosion protection classes are to be set by the specialist planner.

AQUAPANEL® Maxi Screws have a special corrosion resistant coating, which gives an approved 720 hours corrosion resistance in a salt spray test.

#### Corrosion protection classes:

Corrosion protection classes acc. to EN 13964	Description
A	Building components generally exposed to varying relative humidity up to 70% and varying temperatures up to 25°C but without corrosive pollutants.
B	Building components frequently exposed to varying relative humidity up to 90% and varying temperature up to 30°C but without corrosive pollutants.
C	Building components exposed to an atmosphere with a level of humidity higher than 90% and accompanied by a risk of condensation. This includes typical swimming pool environments.
D	More severe than the above. Includes conditions typical in salt-water swimming pools, thermal baths, steam saunas.

# Stability and construction

## 3a. Pre-dimensioning of substructure according to windload

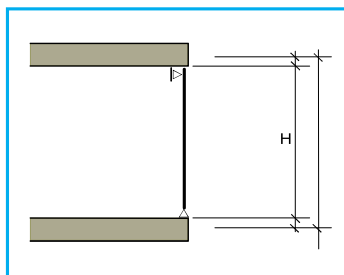
Along with their own weight, external façades, depending on the height and geometry of the building, are mainly subject to the effect of wind.

The dimensions and cross-sections of the substructure must be matched to the effects of wind pressure and wind suction. In certain cases, snow and ice must be taken into consideration. The functionality of the individual elements of the substructure is to be technically demonstrated. Proof of fitness for use is shown by a deformation limit of max.  $f=l/500$ .

Note: For proof of components, the relevant norms and standards should be considered.

Table to identify substructure																	
Windload [kN / m <sup>2</sup> ]		Recommended solution (depending on heights between floors)															
		250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400
0.50	400/417	A	A	A	A	A	B	B	B	B	B	B	B	B	C	C	C
	600/625	B	B	B	B	C	C	C	C	C	D	D	D	D	D	E	E
0.60	400/417	A	A	A	A	B	B	B	B	B	B	C	C	C	C	C	C
	600/625	B	B	C	C	C	C	C	D	D	D	D	D	E	E	E	E
0.70	400/417	A	A	B	B	B	B	B	B	B	C	C	C	C	C	C	D
	600/625	B	C	C	C	C	D	D	D	D	D	E	E	E	F	F	F
0.80	400/417	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D
	600/625	C	C	C	C	D	D	D	D	D	E	E	E	F	F	F	F
0.90	400/417	B	B	B	B	B	C	C	C	C	C	C	C	D	D	D	D
	600/625	C	C	C	D	D	D	D	E	E	E	F	F	F	F	F	F
1.00	400/417	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
	600/625	C	C	D	D	D	D	E	E	E	F	F	F	F	F	G	G
1.10	400/417	B	B	B	B	C	C	C	C	C	D	D	D	D	D	E	E
	600/625	C	D	D	D	D	E	E	E	F	F	F	F	F	G	G	G
1.20	400/417	B	B	B	C	C	C	C	C	D	D	D	D	D	E	E	E
	600/625	C	D	D	D	E	E	E	F	F	F	F	F	G	G	G	G
1.30	400/417	B	B	C	C	C	C	C	D	D	D	D	D	E	E	E	E
	600/625	D	D	D	D	E	E	F	F	F	F	F	G	G	G	G	G
1.40	400/417	B	B	C	C	C	C	C	D	D	D	D	E	E	E	E	F
	600/625	D	D	D	E	E	F	F	F	F	F	G	G	G	G	G	G
1.50	400/417	B	C	C	C	C	C	D	D	D	D	D	E	E	E	F	F
	600/625	D	D	E	E	E	F	F	F	F	G	G	G	G	G	G	G

### Construction between floors



### Profile types

- A Knauf CW 75/50/06
- B Knauf CW 100/50/06
- C Knauf CW 125/50/06
- D Knauf CW 150/50/06
- E 2 x Knauf CW 125/50/06
- F 2 x Knauf CW 150/50/06
- G 2 x Knauf UA 125/40/20

### Note:

Profiles for regular facade areas are shown according to their proven adequacy. The table gives a selection of possible profiles. It provides an indication for preliminary design purposes only. Final selection of profiles should be made based on actual wall constructions and the proof of stability report. Constructions should be chosen according to national climatic conditions, under consideration of avoiding thermal bridges.

# Stability and construction

## 4a. Expansion joints

Expansion joints should be installed at a spacing of at most 15 m to accommodate expansion and contraction due to weather. Expansion joints from the load-bearing construction must be taken up into the façade.

The installation of additional expansion joints may be required for certain façade geometries, such as complex surfaces and façades subject to increased stress.

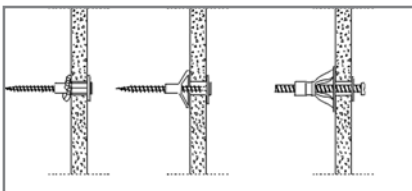
## 5a. Particular loads on façades

Particular loads, resulting from advertising facilities, external wall greening or solar protection devices for example, are to be included in the load-bearing sub- or primary construction, independently of the AQUAPANEL® Cement Board Outdoor cladding and where necessary included in the standard safety declaration.

Light loads, such as from the inherent weight of ornamental elements, decorative sections and lighting may be anchored into the AQUAPANEL® Cement Board Outdoor using at least two metal cavity wall plugs. The gap between the plugs must be at least 75 mm. For wall constructions the amount of the light load is to be restricted to a maximum of 25 kg using individually occurring, non-plane point loads.

## 6a. Plug load capacity for interiors e.g. under tension and shear

Panelling thickness mm	Plastic cavity plug Ø 8 or Ø 10 mm	Metal cavity plug screw M5 or M6
1 x 12.5	25 kg	30 kg
2 x 12.5	40 kg	50 kg



Cavity plug

## Interior shaft of double stud construction: stability and maximum height

Indoor partition walls with Knauf Gypsum Board or AQUAPANEL® Cement Board Indoor are non-loadbearing, interior partition walls similar to DIN 4103.

They have no loadbearing function within the building but are suitable for bearing console loads and higher wall loads. DIN 4103 differs between two partition walls depending on their application.

# Stability and construction

## 7a. Substructure for interiors

### Installation range I

Areas less frequented by people as are assumed in e.g. flats, hotel rooms, offices or wards and similarly used rooms including corridors.

### Installation range II

Areas highly frequented by people as are assumed in e.g. larger meeting rooms, lecture theatres, exhibition and retail spaces and similarly used rooms.

Additionally, rooms with a height difference of the floors of 1 m or more are categorised in installation range II.

Earthquake-proof walls are in the category installation range II.

Differing maximal wall heights are admissible depending on the location of installation. These are specified separately for every wall construction.

Admissible wall heights for installation range II with Knauf Gypsum Boards are listed below according to board thicknesses and profile sizes.

### Maximal wall height h for installation range II of shaft walls, free-standing facings and partition walls with separated double stud frames:

with Knauf Gypsum Boards: 12.5 mm and 15 mm thick according to DIN 18180 (unit of h in m)

Metal stud frame (d = 0.6 mm)	Distance between centres in mm	Board thickness in mm		
		1 x 12.5	2 x 12.5	2 x 15
CW 50	<b>625</b>	<b>(2.65)/-</b>	<b>(2.95)/-</b>	<b>(3.10)/-</b>
	417	(3.20)/2.45	(3.60)/3.15	3.80
	312.5	(3.60)/3.30	4.00	4.00
	156.3	N/A	4.05	4.25
CW 75	<b>625</b>	<b>4.00</b>	<b>4.00</b>	<b>4.00</b>
	417	4.00	4.00*	4.15
	312.5	4.15	4.50	4.75
	156.3	N/A	5.95	6.25
CW 100	<b>625</b>	<b>4.15</b>	<b>4.50</b>	<b>4.65</b>
	417	4.90	5.40	5.60
	312.5	5.55	6.10	6.35
	156.3	N/A	7.95	8.25
CW 125	<b>625</b>	<b>5.25</b>	<b>5.80</b>	<b>6.00</b>
	417	6.25	6.90	7.15
	312.5	7.00	7.75	8.05
	156.3	N/A	9.80	10.10
CW 150	<b>625</b>	<b>6.45</b>	<b>7.15</b>	<b>7.35</b>
	417	7.60	8.40	8.65
	312.5	8.50	9.30	9.60
	156.3	N/A	11.35	11.60

( ) value for installation range I

\*Deflection  $\leq h/350$

N/A - Not specified

# Stability and construction

Maximal wall height h of shaft walls, free-standing facings and partition walls with separated double stud frames:  
with Knauf Gypsum Boards 20 mm and 25 mm thick according to DIN 18180 (unit of h in m):

Metal stud frame (d = 0.6 mm)	Distance between centres in mm	Board thickness in mm	
		2 x20	2x25
CW 50	<b>1000</b>	<b>(2.70)/-</b>	<b>(3.10)/-</b>
	625	(3.55)/2.80	4.00
	417	4.00	4.00
	312.5	4.00	4.05
	156.3	4.80	5.40
CW 75	<b>1000</b>	<b>3.95</b>	<b>4.00</b>
	625	4.00	4.05
	417	4.55	4.95
	312.5	5.20	5.70
	156.3	6.85	7.50
CW 100	<b>1000</b>	<b>4.00</b>	<b>4.10</b>
	625	5.00	5.40
	417	6.10	6.55
	312.5	6.90	7.45
	156.3	8.90	9.50
CW 125	<b>1000</b>	<b>4.95</b>	<b>5.25</b>
	625	6.40	6.85
	417	7.70	8.20
	312.5	8.60	9.15
	156.3	10.65	11.15
CW 150 (value for installation range I)	<b>1000</b>	<b>6.15</b>	<b>6.50</b>
	625	7.85	8.30
	417	9.20	9.70
	312.5	10.10	10.60
	156.3	12.00	12.00

## b. Thermal properties

### b. Thermal properties

#### 1b. Thermal insulation standards

Energy saving and controlling carbon dioxide emission are today central topics of environmental protection. In Germany the proportion of energy consumed by private households is approximately 44%. The significance of energy saving for buildings is also high. The German Energy Saving Directive (EnEV) combines The Thermal Insulation Directive and The Heating System Directive. It considers the energy impact as a whole for the entire building.

An important change to the German Energy Saving Directive is the intention to convert the requirements for new buildings from the annual heating requirement to the annual primary energy requirement of the building. Gearing the requirements to the primary energy need takes into account that by deciding in favour of a certain configuration of building and facilities, the client is making a long-term selection in favour of the energy consumption associated with the heating of the building. The primary energy requirement includes the whole path of energy generation, which apart from system losses is also subject to the losses incurred in acquiring, producing, enriching and transporting the relevant energy category. New buildings with normal internal temperatures, i.e. buildings heated to an internal temperature of 19°C and more, as well as more than four months in the year, must be built so that the annual primary energy requirement and the figures for specific heat transmission losses are not exceeded.

The level of annual primary energy requirement essentially depends on the following determining factors:

- $A/V_g$  = ratio of the heat-transmitting envelope area to the volume it encloses ( $m^2/m^3$ )
- $A_N$  = heated useable floor space in the building ( $m^2$ )
- type of water heating

The German Energy Saving Order provides for two possible verification procedures for calculating the annual primary energy requirement. These calculations are based on the European standard EN 832, entitled 'Thermal Performance of Buildings - Calculation of Energy Use for Heating - Residential Buildings'. For buildings with a proportionate window area not exceeding 30% either a simplified or the detailed energy balance procedure can be applied. For other buildings adherence to the detailed procedure must be verified. For a large number of dwellings it will be possible to calculate in accordance with the simplified verification procedure. The annual primary energy requirement is determined in a simplified fashion based on the following equation.

$$Q_p = (Q_h + Q_w) * e_p$$

$Q_p$  for the annual primary energy requirement,  
 $Q_h$  for the annual heating requirement,  
 $Q_w$  for the supplement for water heating and  
 $e_p$  for the installation cost figure

#### 2b. Avoiding thermal bridges

According to European standards thermal bridges need to be avoided. In general the minimizing of a thermal bridge can be done by one or several layers of insulation.

A fire resistant mineral insulation a wool especially a stone wool is appropriate. The conductivity of the insulation with  $\lambda = 0.035 \text{ W/mK}$  will provide good results.

A thermal bridge is an area within a building (e.g. wall edge or connection between two different building sections such as a window and wall) that conducts the heat to the exterior more readily compared to the rest of the building. In brief it is a leak in the building shell.

According to German norm (DIN 4108) thermal bridges occur only when a structure is not separated by at least two different materials and the insulation, with a  $\lambda$  value of  $0.040 \text{ W/mK}$ , has a thickness of at least 100mm. The energy always flows from a warm to a cold area and could therefore cause different façade appearance or moisture in areas where it is not allowed (e.g. inner surface).

Simply put, the U-value represents the thermal conductivity of a wall. The smaller the value, the better the insulation of the wall. Below are some of the possible construction types of a double structured wall.

To avoid condensation on the interior surface the temperature according to German norms must not fall under  $12.6 \text{ °C}$ . This limit has been considered for the construction details for the Knauf AQUAPANEL® Exterior Wall system. Nevertheless the details make no claim of being complete.

Note: For each individual case the construction details should be checked for thermal bridges and appropriate U-value by a specialised planner.

#### 3b. Determining U-values for construction types

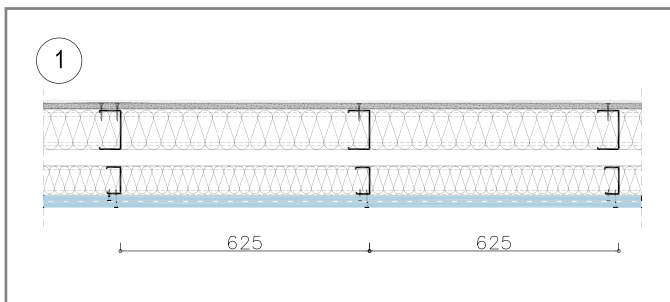
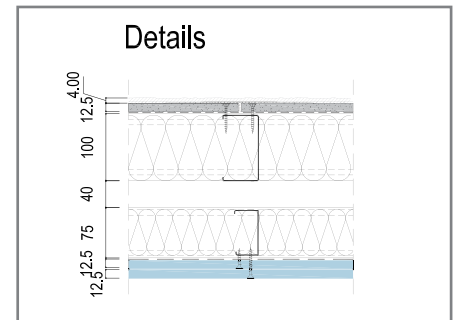
The thermal insulation quality of the individual components is important for the verification and is described by the U-value, which is necessary for determining heat transmission losses. The U-value describes the heat compensation resulting from a difference in temperature between two different energy systems. Constructional details must be taken into account as well as the quality of the components. It is therefore necessary to investigate thermal bridges, for example.

Where external walls or roofs are not ventilated the entire construction from the internal cladding to the outer cladding is taking into account when determining the U-value. For ventilated external walls, only the areas from the internal cladding to the ventilation level are included. A rear ventilated façades makes an important contribution to thermal insulation because it keeps wind, rain and snow away from the second wall shell and so prevents rapid cooling.

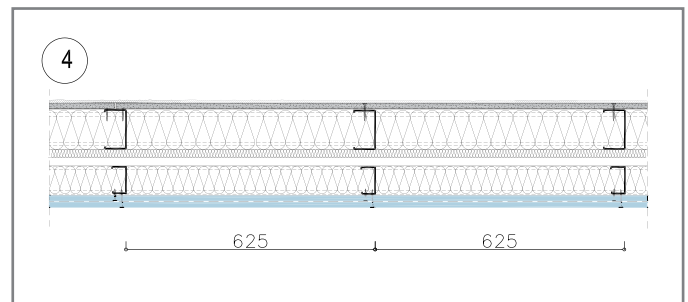
# Thermal properties

## Summary of U-values for construction types

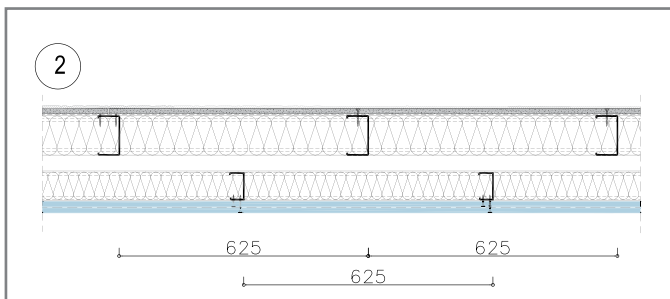
	U-value with profiles	U-value without profiles	ψ-value
	[W/m <sup>2</sup> K]	[W/m <sup>2</sup> K]	[W/mK]
01 - Standard construction	0.28	0.18	0.0635
02 - Construction staggered profiles	0.25	0.18	0.0415
03 - Construction with fish plated profiles	0.29	0.18	0.0667
04 - Construction with intermediate insulation	0.22	0.16	0.0396
05 - Construction with slotted profiles	0.22	0.18	0.0259
06 - Combination of staggered profiles 02 and intermediate insulation 04 construction	0.20	0.16	0.0280



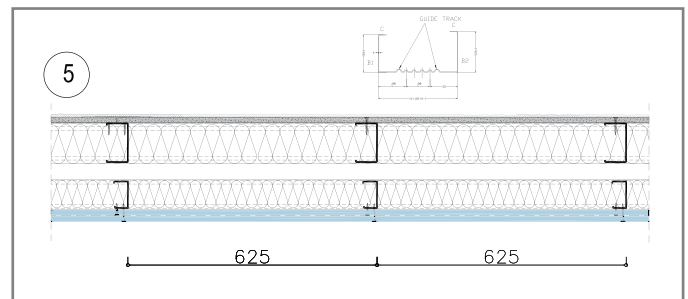
01 Standard construction



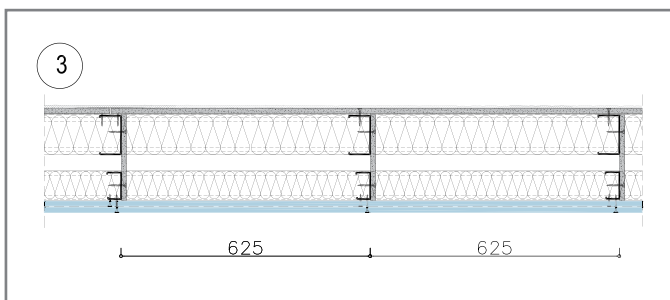
04 Construction with intermediate insulation



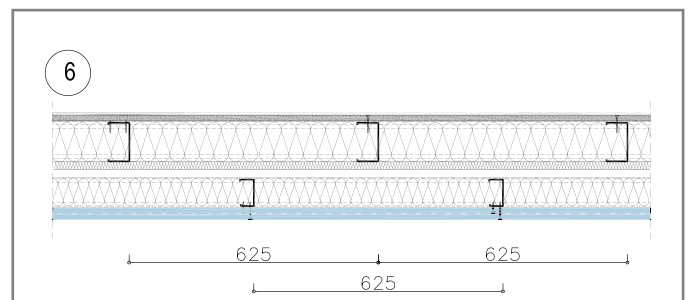
02 Construction staggered profiles



05 Construction with slotted profiles



03 Construction with fish plated profiles



06 Combination of staggered profiles 02 and intermediate insulation 04 construction

## c. Moisture proofing

### c. Moisture proofing

The most important task of a façade is protection against wind and weather. The basic structure is protected from the damaging effects of weather, moisture, damp or driving rain. A façade cladding must therefore have the following characteristics as far as weather-proofness is concerned:

- resistance to moisture and dimensional stability of the cladding and other components.
- resistance to freeze-thaw cycles
- resistance to mould and algae
- resistance to wind
- resistance to driving rain and hail

AQUAPANEL® Cement Board Outdoor meets moisture proofing requirements ideally with the appropriate surface coatings. AQUAPANEL® Cement Board Outdoor is 100% moisture-resistant. It exhibits extremely slight and essentially non-detrimental structural changes when subject to water loading, and changes neither its structural coherence nor its static characteristics. AQUAPANEL® Cement Board Outdoor in combination with AQUAPANEL® Tyvek® StuccoWrap™ protects the basic structure safely from the effects of driving rain.

AQUAPANEL® Cement Board Outdoor is due to its alkalinity resistant to the growth of mould, as verified by the Institute for Building Biology in Rosenheim in its report No. 3008-308. This means that AQUAPANEL® Cement Board Outdoor, as a purely mineral structural panel, is ideally suitable as a render substrate in façade constructions. AQUAPANEL® render finishes are also fungicidal.

### Response to diffusion:

In exterior components condensation can form at any time of the year from convection or vapour diffusion. A wall system must be structured in such a way to ensure that moisture from convection and diffusion is safely directed outside.

With ventilated structures it is generally the air layer that takes on the task of conducting water vapour safely to the outside air. Non ventilated external walls must be constructed so that condensation arising in bad weather can safely diffuse into the outside air. This means that to achieve the correctly layered construction the planner must ensure a suitable sequence of vapour-inhibiting and diffusion-tolerant materials. In recent years more work has been carried out with permeable wall structures. AQUAPANEL® Cement Board Outdoor displays very good vapour diffusion behaviour for cement-bound boards, with a diffusion resistance of  $\mu = 66$ . This ensures that the panelling does not exhibit any vapour-inhibiting behaviour, which is extremely important to ensure the best possible layer construction from a building point of view.

Note: Protecting wooden structures by constructional or chemical means is laid down in DIN 68800 "Wood preservation". By planning the construction carefully it is often possible to avoid using chemical wood preservatives. Front-mounted, ventilated façades, such as the plaster façade with AQUAPANEL® Cement Board Outdoor, can also contribute to reducing the use of chemicals with the ventilated façade forming a secure weather protection for all external wall constructions.

Thermal and moisture-related characteristics			
Material	Water vapour diffusion resistance ( $\mu$ )	$s_d$ (m)	Thermal conductivity $\lambda$ (W/mK)
AQUAPANEL® Cement Board Outdoor	66	0.825	0.35
AQUAPANEL® Tyvek® StuccoWrap™	50	0.02	-
AQUAPANEL® Exterior Basecoat – white	15-35	0.075 – 0.175	0.87
AQUAPANEL® Exterior Mineral Finish– white	7	0.014	0.47 at P = 50% 0.54 at P = 90%
AQUAPANEL® Exterior Equalising Paint	<500	<0.05	-

# d. Fire protection

## d. Fire protection

'The protection of people and property from fire is the essential aim of fire protection.'

Preventative structural fire protection has to meet the following planning and construction requirements:

- Fire risk is reduced if as many non-flammable building materials as possible are used.
- In the event of a fire, people within the building must be able to leave the building safely.
- The construction must be such that it remains stable sufficiently long in the event of fire, and prevents spread of fire and smoke to other buildings or other parts of the building for long enough.

From these requirements comes the need to research building materials and components both structurally and technically for their applicable fire behaviour and ability to protect against fire. Each building material is given a building material classification according to how it behaves during a fire. AQUAPANEL® Cement Board Outdoor is classified as "non-combustible", building material class A1 in accordance with EN 13501.

The behaviour of AQUAPANEL® Cement Board Outdoor constructions in the event of a fire has been proven by extensive fire tests.

Before the formation of the European community, the tests took place according to national standards, e.g. according to DIN 4102. This brochure also contains constructions whose behaviour in case of fire is proven according to DIN 4102.

The fire resistance tests according to European standards are conducted to EN 1364 for non-load bearing components and to EN 1365 for load-bearing ones, in each case following EN 1363.

The fire resistance time of the tested AQUAPANEL® Cement Board Outdoor constructions extends, according to the type of construction, up to a maximum of 120 minutes and is indicated by a precise fire resistance classification for each component. Based on the classification designation, you can recognise whether the test was carried out according to national DIN 4102 or European standard. National tests use designations F or particularly W for non load-bearing external walls. The European standard uses different designations. The most important designations for the description of the performance criteria are given below, together with their meanings.

The following table shows the allocation of the fire grading periods according to DIN and EN.

Comparison of fire resistance classifications				
Allocation of classes for fire resistance of construction components according to EN 1364/ EN1365				
Building designation	Load-bearing construction		Non-load bearing inner wall	Non-load bearing exterior wall
	Without enclosure of space	With enclosure of space		
Fire-retardent	R 30	REI 30	EI 30	E 30 (i→o) and EI 30 (i←o)
	[F 30]	[F 30]	[F 30]	[W 30]
	R 60	REI 60	EI60	E 60 (i→o) and EI 60 (i←o)
	[F 60]	[F 60]	[F 60]	[W 60]
Fire-resistant	R 90	REI 90	EI 90	E 90 (i→o) and EI 90 (i←o)
	[R 90]	[R 90]	[F 90]	[W 90]
Fire-resistance 120 min.	R 120	REI 120	-	-
	[R 120]	[F 120]	-	-
Firewall	--	REI-M90	EI-M 90	-

Testing and classification must also only be carried out on one side. Independent of the test/tests performed, the classifications are described as follows:

i -> o, when the intention is to classify from inside to outside;

i <- o, when the intention is to classify from outside to inside;

i <-> o, when the intention is to classify from inside to outside and from outside to inside.

According to EN, the description of fire resistance is described by the following performance criteria:

Derivation of abbreviation	Criterion
R (Résistance - Strength)	Bearing capacity
E (Etanchéité - Seal)	Room sealing
I (Isolation - Insulation)	Heat insulation (under the effect of fire)
W (Radiation)	Limitation of radiation penetration
M (Mechanical)	Mechanical effect on walls (impact load)
i -> o i <- o i <-> o (in-out)	Direction of classification of fire resistance

# Fire protection

## Single stud

Fire resistance	Profile	Measurements from inside to outside	Wall thickness	Insulation	System properties			
					Weight (kg/m <sup>2</sup> )	Fire	Approx. sound insulation*	Sound insulation dB R <sub>w,P</sub> (R <sub>w,R</sub> )
PB 3031/2742	CW 75	GKF 12.5 + CW75 + OD 12.5	100 mm	40 mm (40 kg/m <sup>3</sup> )	28.6	EI 30	420001590-9 + insulation	50 (48)
PB 3032/2752	Timber stud 60/60	ID 12.5 + HS 60 + OD 12.5	85 mm	40 mm (40 kg/m <sup>3</sup> )	34.8	EI 60	N/A	-
PB 3220/5032	CW 75	ID 12.5 + CW 75 + OD 12.5	100 mm	60 mm (30 kg/m <sup>3</sup> )	33.6	EI 30	N/A	-
PB 3973/1183	CW 75	2x GKF12.5 + CW 75 + 12.5 OD	112.5 mm	60 mm (50kg/m <sup>3</sup> )	40.2	EI 60	420001276-8	48 (46)
PB 3321/2155	CW 100	2x ID 12.5 + CW 100 + 2x OD 12.5	150 mm	80 mm (30kg/m <sup>3</sup> )	65.3	EI 120	N/A	-
PB 3258/1525	CW 50	ID 12.5 + CW 50 + OD 12.5	75 mm	none	31.7	EI 30	N/A	-
PB 3015/2882	CW 75	2x ID 12.5 + CW 75 + 2x OD 12.5	125 mm	60 mm (50 kg/m <sup>3</sup> )	65.8	EI 120	N/A	-
PB 3672/6696	CW 50	2x ID 12.5 + CW 50 + 2x OD 12.5	100 mm	none	62.7	EI 90	N/A	-
PB 3054/119/09	CW 50	ID 12.5 + CW 50 + OD 12.5	75 mm	none	31.7	EI 30	N/A	-
	CW 75	ID 12.5 + CW 75 + OD 12.5	100 mm	none	31.8		N/A	-
	CW 100	ID 12.5 + CW 100 + OD 12.5	125 mm	none	31.9		N/A	-
	CW 50	GKFi 12.5 + CW 50 + OD 12.5	75 mm	none	26.9		420001276-7 + insulation	45 (43)
	CW 75	GKFi 12.5 + CW 75 + OD 12.5	100 mm	none	27		AC3-D2-05-XVI + insulation	50 (48)
	CW 100	GKFi 12.5 + CW 100 + OD 12.5	125 mm	none	27.1		420001590-9 + insulation	50 (48)
	CW 50	GKBi 12.5 + CW 50 + OD 12.5	75 mm	none	26		420001276-7 + insulation	45 (43)
	CW 75	GKBi 12.5 + CW 75 + OD 12.5	100 mm	none	26.1		AC3-D2-05-XVI + insulation	50 (48)
	CW 100	GKBi 12.5 + CW 100 + OD 12.5	125 mm	none	26.2		420001590-9 + insulation	50 (48)
abP 3239/5122	CW 50	2xID 12.5 + CW 50 + 2xOD 12.5	100 mm	none	62.7	F 90-A	N/A	-
	CW 75	2xID 12.5 + CW 75 + 2xOD 12.5	125 mm	none	62.8		N/A	-
	CW 100	2xID 12.5 + CW 100 + 2xOD 12.5	150 mm	none	62.9		N/A	-
	CW 50	ID 12.5 + GKF 12.5 + CW 50 + GKF 12.5 + OD 12.5	100 mm	none	52.1		N/A	-
	CW 75	ID 12.5 + GKF 12.5 + CW 75 + GKF 12.5 + OD 12.5	125 mm	none	52.2		N/A	-
	CW 100	ID 12.5 + GKF 12.5 + CW 100 + GKF 12.5 + OD 12.5	150 mm	none	52.3		N/A	-
	CW 50	2x GKF 12.5 + CW 50 + 2x OD 12.5	100 mm	none	53.1		420001276-8 + insulation	48 (46)
	CW 75	2x GKF 12.5 + CW 75 + 2x OD 12.5	125 mm	none	53.2		AC3-D2-05-XVI + insulation	50 (48)
	CW 100	2x GKF 12.5 + CW 100 + 2x OD 12.5	150 mm	none	53.3		AC3-D2-05-XIX + insulation	50 (48)
	CW 50	2x GKF 12.5 + CW 50 + GKF 12.5 + OD 12.5	100 mm	none	47.3		N/A	-
	CW 75	2x GKF 12.5 + CW 75 + GKF 12.5 + OD 12.5	125 mm	none	47.4		N/A	-
	CW 100	2x GKF 12.5 + CW 100 + GKF 12.5 + OD 12.5	150 mm	none	47.5		N/A	-
	CW 50	ID 12.5 + GKF 12.5 + CW 50 + 2x OD 12.5	100 mm	none	57.9		N/A	-
	CW 75	ID 12.5 + GKF 12.5 + CW 75 + 2x OD 12.5	125 mm	none	58		N/A	-
	CW 100	ID 12.5 + GKF 12.5 + CW 100 + 2x OD 12.5	150 mm	none	58.1		N/A	-

GKB = Knauf Standard Gypsum Board    GKFi = Knauf Impregnated Fireboard    OD = AQUAPANEL® Cement Board  
 GKBi = Impregnated Gypsum Board    ID = AQUAPANEL® Cement Board    Outdoor  
 GKF = Fireboard    Indoor

\* To reach the appropriate sound insulation an additional or different insulation may be necessary

# Fire protection

## Single stud

Fire resistance	Profile	Measurements from inside to outside	Wall thickness	Insulation	System properties			
					Weight (kg/m <sup>2</sup> )	Fire	Approv. sound insulation*	Sound insulation dB R <sub>w,P</sub> (R <sub>w,R</sub> )
Approval No								
abP 3244/5172	CW 75	2x ID + CW 75 + 2x OD	125 mm	60 mm (50kg/m <sup>3</sup> )	65.8	F 120-A	N/A	-
	CW 100	2x ID 12.5 + CW 100 + 2x OD 12.5	150 mm	60 mm (50 kg/m <sup>3</sup> )	65.9		N/A	-
P 3649/9454	CW 50	1x ID 12.5 + CW 50 + 1x OD 12.5	75 mm	60 mm (25kg/m <sup>3</sup> ) or MW 40 mm (40 kg/m <sup>3</sup> )	33.3	F 30-A	N/A	-
	CW 75	1x ID 12.5 + CW 75 + 1x OD 12.5	100 mm	60 mm (25kg/m <sup>3</sup> ) or MW 40 mm (40 kg/m <sup>3</sup> )	33.4		N/A	-
	CW 100	1x ID 12.5 + CW 100 + 1x OD 12.5	125 mm	60 mm (25kg/m <sup>3</sup> ) or MW 40 mm (40 kg/m <sup>3</sup> )	33.5		N/A	-

## Double stud

Fire resistance	Profile	Measurements from inside to outside	Wall thickness	Insulation	System properties			
					Weight (kg/m <sup>2</sup> )	Fire	Approv. sound insulation*	Sound insulation dB R <sub>w,P</sub> (R <sub>w,R</sub> )
Approval No								
P 3650/9464	CW 50	2x ID 12.5 + CW 50 + e = 50 mm + CW 50 + 2x OD 12.5	200 mm	60 mm (30 kg/m <sup>3</sup> )	65.2	F 90-A	N/A	-
	CW 75	2x ID 12.5 + CW 75 + CW 75 + 2x OD 12.5	200 mm	60 mm (30 kg/m <sup>3</sup> )	65.4		N/A	-
	CW 100	2x ID 12.5 + CW 100 + CW 100 + 2x OD 12.5	250 mm	60 mm (30 kg/m <sup>3</sup> )	65.6		N/A	-
	CW 50	1xID 12.5 + 1x GKF 12.5 + CW 50 + e = 50 mm + CW 50 + 2x OD 12.5	200 mm	60 mm (30 kg/m <sup>3</sup> )	58.6		N/A	-
	CW 75	1xID 12.5 + 1x GKF 12.5 + CW 75 + CW 75 + 2x OD 12.5	200 mm	60 mm (30 kg/m <sup>3</sup> )	60.6		N/A	-
	CW 100	1xID 12.5 + 1x GKF 12.5 + CW 100 + CW 100 + 2x OD 12.5	250 mm	60 mm (30 kg/m <sup>3</sup> )	60.8		N/A	-
	CW 50	2x GKF 12.5 + CW 50 + e = 50 mm + CW 50 + CW 50 + 2x OD 12.5	200 mm	60 mm (30 kg/m <sup>3</sup> )	55.6		AC3-D2-05 XVIII	62 (60)
	CW 75	2x GKF 12.5 + CW 75 + CW 75 + 2x OD 12.5	200 mm	60 mm (30 kg/m <sup>3</sup> )	55.8		AC3-D2-05 XVII	58 (56)
	CW 100	2x GKF 12.5 + CW 100 + CW 100 + 2x OD 12.5	250 mm	60 mm (30 kg/m <sup>3</sup> )	56		N/A	-
	CW 50	2x GKF 12.5 + CW 50 + e = 50 mm + CW 50 + 1x GKF 12.5 + 1x OD 12.5	200 mm	60 mm (30 kg/m <sup>3</sup> )	49.8		N/A	-
	CW 75	2x GKF 12.5 + CW 75 + CW 75 + 1x GKF 12.5 + 1x OD 12.5	200 mm	60 mm (30 kg/m <sup>3</sup> )	50		N/A	-
	CW 100	2x GKF 12.5 + CW 100 + CW 100 + 1x GKF 12.5 + 1x OD 12.5	250 mm	60 mm (30 kg/m <sup>3</sup> )	50.2		N/A	-

Note: e = Distance between studs/profiles of inner and outer shell.

Combination of profile sizes are possible as long as the minimum wall thickness is reached

## e. Sound protection

### e. Sound protection

Protecting people in living rooms from unreasonable disturbance by sound transmission is the meaning and objective of sound protection. The increasing demand for sound protection in buildings is at the same time raising the demands placed on materials and constructions.

The requirements and verification for noise protection in structural engineering are laid down in DIN 4109. The requirements have been introduced by the building inspectorate and are therefore binding (minimum) requirements. Increased sound protection and sound protection in one's own living and working area may be agreed depending on the planning requirement.

Components meeting the minimum requirements of DIN 4109 can be produced using AQUAPANEL® Cement Board Outdoor. These minimum requirements can be verified by adequately testing the components. The requirements are made in the form of necessary evaluated sound insulation measures ( $R'_{w}$ ) for airborne sound emissions and necessary (i.e. maximum permissible) evaluated standard impact sound levels ( $L'_{n,w}$ ) for impact sound insulation. The exterior wall is evaluated as a total construction including the windows. The DIN requirements are formulated as  $R'_{w,RES}$ -values. They give the required, resultant sound insulation measure of the exterior component while taking into account the entire exterior services of wall and windows. The values required in DIN are increased or reduced depending on the respective ratio of the entire exterior surface of the room to its floor space. The requirements for airborne sound insulation by exterior components are geared to the respective exterior noise level. Depending on the space category they come to required.  $R'_{w} = 30-50$  dB for the resultant sound insulation by external walls including windows and for the wall portion alone between 30 and 60 dB depending on the existing window surface. In residential areas a resultant sound insulation measure of  $R'_{w} = 35$  dB is often sufficient. In noisy residential areas a maximum  $R'_{w}$  value of 60 dB may be necessary. DIN 4109, Supplement 2 even suggests a value of  $R'_{w} = 67$  dB for increased sound protection for house separating walls between single family semi-detached or terraced houses. Curtained façades normally have a positive impact on sound protection, provided the gap between the curtain layer and the actual wall is at least 40 mm. With smaller gaps unpleasant resonances may arise.

Note: The above information is based on the German national DIN standard and is given as a reference for sound and insulation requirements for a project. Other national or local requirements may differ.

# Sound protection

## Single stud

Sound insulation	Profile	Measurements from inside to outside	Wall thickness	Insulation	System properties	
Approval No			mm	Weight	Weight [kg/m <sup>2</sup> ]	Sound insulation dB R <sub>w,P</sub> (R <sub>w,R</sub> )
420001276-7	CW50	1x GKF+CW50+1x OD	75	50 mm (MW 22 kg/m <sup>3</sup> )	28	45 (43)
420001276-8	CW50	2x GKF+CW50+1x OD	87.5	50 mm (MW 22 kg/m <sup>3</sup> )	38.2	48 (46)
AC3-D2-05 XVI	CW75	2x GKB+CW75+1x OD	112.5	40 mm (40 kg/m <sup>3</sup> )	37	50 (48)
420001590-9	CW100	1x GKF+CW100+1x OD	125	80 mm (14 kg/m <sup>3</sup> )	28.2	50 (48)
AC3-D2-05 XIX	CW100	2x GKB+CW100+1x OD	137.5	40 mm (40 kg/m <sup>3</sup> )	35.5	50 (48)
AC3-D2-05 XXI	CW100	2x GKB (GKB15 mm)+CW100+1x OD	142.5	40 mm (40 kg/m <sup>3</sup> )	29.7	51 (48)

## Double stud

Sound insulation	Profile	Measurements from inside to outside	Wall thickness	Insulation	System properties	
Approval No			mm	Weight	Weight [kg/m <sup>2</sup> ]	Sound insulation dB R <sub>w,P</sub> (R <sub>w,R</sub> )
420001276-6	CW 50	1x GKF+CW50+e=120 mm+CW50+12.5 (fish plated)	245	2x 50 mm (22 kg/m <sup>3</sup> )	29.8	53 (51)
5,013,871	MC48+CW50	1x GKB (15 mm)+MC48+e=39.5 mm+CW50+1x OD	165	2x 40 mm (40 kg/m <sup>3</sup> )	31.8	52 (50)
AC3-D2-05-XVIII	MC48+CW75	2x GKB+MC48+e=20 mm+CW75+1x OD	180.5	40 mm + 60 mm (40 kg/m <sup>3</sup> )	40.1	62 (60)
AC3-D2-05-XXII	MC48+CW100	2x GKB+MC48+e=20 mm+CW100+1x OD	205.5	3x 40 mm (40 kg/m <sup>3</sup> )	41	64 (62)
AC3-D2-05-XXIII	MC48+CW100	2x GKB (15 mm)+MC48+e=20 mm+CW100+1x OD (with basecoat)	210.5	3x 40 mm (40 kg/m <sup>3</sup> )	44.8	65 (63)
AC3-D2-05-XXIV	MC48+CW100	2x GKB (15 mm)+MC48+e=20 mm+CW100+1x OD (with render)	210.5	3x 40 mm (40 kg/m <sup>3</sup> )	44.8	66 (64)
AC3-D2-05-XVII	MC70+CW75	1x GKB (15 mm)+MC70+GKB12.5+20 mm+CW75+1x OD	205	2x 60 mm (40 kg/m <sup>3</sup> )	42.9	58 (56)
AC3-D2-05-XX	MC70+CW100	1x GKB (15 mm)+MC70+GKB12.5+20 mm+CW100+1x OD	230	60 mm (40 kg/m <sup>3</sup> ) + 2x 40 mm (40 kg/m <sup>3</sup> )	43.8	61 (59)
420001276-9	Timber 60/120	1x GKF+1x Vidiwall(15 mm)+HS 120+1x Vidiwall (15mm)+1x OD	175	120 mm (26 kg/m <sup>3</sup> )	65,7*	47 (45)
420001276-10	Timber 60/120	1x GKF+HS 120+1x Vidiwall (15 mm)+2x Battens 30mm+1x OD	220	120 mm (26 kg/m <sup>3</sup> )	57,7*	50 (48)
PB 0093-09-P 138	CW75+CW150	2x GKB+CW75+40 mm+CW150+1x OD (fishplated with a=416 mm)	302.5	140 mm (18 kg/m <sup>3</sup> ) + 40 mm (15 kg/m <sup>3</sup> )	30.4	58 (56)
PB 0092-09 - P 138	CW75+CW150	2x GKB+CW75+40 mm+CW150+1x OD (fishplated with a=625 mm)	302.5	140 mm (18 kg/m <sup>3</sup> ) + 40 mm (15 kg/m <sup>3</sup> )	30.2	60 (58)

\* weight without timber batten/beam material

In case of fire resistance the dimension of the wall (thickness) or the dimension of single wall components could always be increased. Further the dry density of the insulation can be increased (acc. EN1364-1). In case of sound insulation note the following: an increased wall thickness (with increased dimensions of the wall components) always benefits the system (excluding an increased material thickness of the stud). A flow resistance of  $\geq 5$  for the insulation material is always a benefit for the system in case of sound issues. An increased dry density of the insulation could downgrade the sound performance of the system.

Weight of components	kg/m	Board type	kg/m <sup>2</sup>
CW 50	0.70	GKB 12.5 mm	9.3
CW 75	0.80	GKF 12.5 mm	10.2
CW 100	0.90	GKF 15 mm	13.3
CW 125	0.95	Diamant 12.5 mm	12.8
CW 150	1.00	Diamant 15 mm	16.0
		Vidiwall 12.5 mm	15.0
		Vidiwall 15 mm	18.2

## f. System properties

### System properties

#### European technical approval, declared product life

ETA-07/0173	European Technical Approval ETA-07/0173 for AQUAPANEL® Cement Board Outdoor declared product life of 50 years
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#### Serviceability and freeze-thaw cycle resistance

Report no. EOTA 01.1.01/1	Tested serviceability of ventilated systems, including climate chamber tests (according to EOTA standard)
Report no. EOTA 02.1.15/1	Tested serviceability in directly-applied systems including climate chamber tests (according to EOTA standard)
Freeze/thaw cycle resistance	according to: EN 12467

#### Impact resistance

Report no. 220004884	Impact tests of AQUAPANEL® Cement Board Outdoor (according to BS 8200)
Impact tests of AQUAPANEL® Cement Board Outdoor ( according to BS 8200)	Testing of AQUAPANEL® Cement Board Outdoor (according to ASTM Standard C 1325-04)
Testing of AQUAPANEL® Cement Board Outdoor (according to ASTM Standard C 1325-04)	Certified hygrothermal behaviour of AQUAPANEL Cement Board Outdoor of Scientific Centre for Building Techniques, France (CSTB)

#### Ecology and sustainability

Certificate of mold resistance, material safety and hygiene of AQUAPANEL® Cement Board Outdoor and AQUAPANEL® Cement Board Indoor	Expert assessment of building biology and mold resistance for AQUAPANEL® Cement Board Outdoor and AQUAPANEL® Cement Board Indoor Certified and recommended according to the criteria of the Institute for Building Biology in Rosenheim, Germany (IBR) as part of the IBR report no. 3008-008
Certificate of material safety and hygiene of Knauf Gypsum Board	Certified and recommended according to the criteria of the Institute for Building Biology in Rosenheim, Germany (IBR)
Environmental Exterior Wall System Certificate of Knauf AQUAPANEL® Exterior Wall	Environmental Exterior Wall System Certificate according to the Life Cycle Assessments for Environmental Product Declarations (EPD) acc. to ISO 14025 Calculation of the CO <sub>2</sub> output and the primary energy consumption for the Knauf AQUAPANEL® Exterior Wall Project: IAL-10-0356 (WESSLING Beratende Ingenieure GmbH, Germany)
Environmental Product Declaration (EPD) of AQUAPANEL® Cement Board Outdoor and AQUAPANEL® Cement Board Indoor	Registered for sustainable building at the Institute of Construction and Environment, Königswinter, Germany (IBU) under the declaration number EPD-KNA-2010111-D The Environmental Product Declaration is developed according to ISO 14025, Type III
Blauer Engel product label of Knauf Insulation glass mineral wool materials	Certified for environmental friendliness and free from hazardous substances (formaldehyde-free bonding material ECOSE® for most glass mineral wool insulation materials)

# System properties

## Features of exterior wall components

### AQUAPANEL® Cement Board Outdoor

Physical properties	
According to ETA-07/0173	
Min. bending radius for 900/1200 mm wide board (m)	3
Min. bending radius for 300 mm wide strip (m)	1
Dry bulk density (kg/m <sup>3</sup> ) according to EN 12467	approx. 1150
Bending strength (MPa) according to EN 12467	9.6
Tensile strength perpendicular to the plane of the board (N/mm <sup>2</sup> ) according to EN 319	0.65
Shearing strength (N) according to EN	607
pH-value	12
E-modulus (N/mm <sup>2</sup> )	approx. 4000-7000
Thermal conductivity (W/mK) according to EN ISO 10456	0.35
Thermal expansion (10 <sup>-6</sup> K)	7
Water vapour diffusion resistance $\mu$ (-) according to EN ISO 12572	66
Length variation 65% - 85% humidity (mm/m) according to EN 318	0.23
Thickness variation 65% - 85% humidity (mm/m) according to EN 318	0.2
Building material class according to EN 13501	A1, non-combustible

### AQUAPANEL® Cement Board Outdoor Climateshield

Physical properties	
Weight per unit area (kg/m <sup>2</sup> )	approx. 11
Dry density (kg/m <sup>3</sup> )	approx. 1375
Building material class acc. to EN 13501	A1, non-combustible

\* Driving rain protection limit for building envelope made with the AQUAPANEL® Cement Board Outdoor Climateshield system is 0-300 Pa according to SP method (SP Technical Research Institute of Sweden), according to EN 12865.

### Standard Gypsum Board

Physical properties	
Board type acc. EN 520	A

### Impregnated Gypsum Board

Physical properties	
Board type acc. EN 520	H2

# System properties

## AQUAPANEL® Cement Board Indoor

Physical properties	
According to ETA-07/0173	
Min. bending radius for 900/1200 mm wide board (m)	3
Min. bending radius for 300 mm wide strip (m)	1
Dry bulk density (kg/m <sup>3</sup> ) according to EN 12467	approx. 1050
Bending strength (MPa) according to EN 12467	8.75
Tensile strength perpendicular to the plane of the board (N/mm <sup>2</sup> ) according to EN 319	0.49
Shearing strength (N) according to EN	696
pH-value	12
Thermal conductivity (W/mK) according to EN ISO 10456	0.35
Thermal expansion (10 <sup>-6</sup> K)	7
Water vapour diffusion resistance $\mu$ (-) according to EN ISO 12572	50
Length variation 65% - 85% humidity (mm/m) according to EN 318	0.25
Thickness variation 65% - 85% humidity (%) according to EN 318	0.1
Building material class according to EN 13501	A1, non-combustible

## Vidiwall Gypsum Fibre Board

Physical properties	
Density (kg/m <sup>3</sup> )	≥ 1050
Compression strength (N/mm <sup>2</sup> )	~ 25
Bending tensile strength (N/mm <sup>2</sup> )	≥ 5,8
Bending E-Modulus (N/mm <sup>2</sup> )	3900
Water vapour diffusion coefficient ( $\mu$ )	~ 21
Thermal conductivity $\lambda$ (W/mK)	0,30
Building material class acc. DIN EN 13501	A2; A2-s1, d0

# Material consumption tables

## Exterior side

Material requirement: AQUAPANEL®	Unit	Per m <sup>2</sup>
AQUAPANEL® Cement Board Outdoor (single layer)	m <sup>2</sup>	1.0
AQUAPANEL® Cement Board Outdoor Climateshield	m <sup>2</sup>	1.0
AQUAPANEL® Tyvek® StuccoWrap™	m <sup>2</sup>	1.1
AQUAPANEL® Maxi Screws (SN, SB)	pieces	15 m <sup>2</sup> , stud spacing 600 mm
AQUAPANEL® Maxi Screws (SN, SB)	pieces	20 m <sup>2</sup> , stud spacing 400 mm
AQUAPANEL® Maxi Screws (SN, SB)	pieces	25 m <sup>2</sup> , stud spacing 300 mm
AQUAPANEL® Rustproofed Screw	pieces	15 m <sup>2</sup> , stud spacing 600/625 mm
AQUAPANEL® Joint Filler – grey	kg	0.7
AQUAPANEL® Tape (10 cm)	m	2.1
AQUAPANEL® Exterior Reinforcing Tape	m	2.1
AQUAPANEL® Exterior Basecoat	kg	7.8 dry layer thickness 5 mm
AQUAPANEL® Exterior Basecoat – white	kg	6.3 dry layer thickness 4 mm
AQUAPANEL® Reinforcing Mesh	m <sup>2</sup>	1.1
AQUAPANEL® Basecoat Primer	g	100-150
AQUAPANEL® Exterior Mineral Finish	kg	approximately 3.1 for a 2 mm layer (grain size 2 mm)
AQUAPANEL® Exterior Equalising Paint	l	0.22 (for AQUAPANEL® Exterior Mineral Finish)
AQUAPANEL® Exterior Dispersion Plaster	kg	3.1 (grain size 2 mm)
AQUAPANEL® Exterior Silicon Synthetic Resin Plaster	kg	3.1 (grain size 2 mm)

## Interior side

Material requirement	Unit	Per m <sup>2</sup>
Gypsum Board (single layer)	m <sup>2</sup>	1
Drywall Screw	pieces	20
UNIFLOTT	kg	0.5
TRIAS	kg	0.5
FUGENFÜLLER LEICHT	kg	0.5
READYGIPS	kg; joint filling, surface quality level Q2 (4AK boards)	depends on joint ratio
	kg; full surface scrape filling, surface quality level Q3 based on Q2	0.7
	kg; full area skim coating e.g. surface quality level Q4	1.5
JOINTFILLER SUPER	kg	0.6
MULTI-FINISH /MULTI-FINISH M	kg; layer thickness 1 mm	1.0
EASYPUTZ (1 mm grain size) (0.5 mm grain size)	g	950
	g	500 – 650
Joint Tape KURT	m	2.1
TIEFENGRUND	ml	70 - 100
SPEZIALGRUND	g	100 – 200
PUTZGRUND	kg	0.25
AQUAPANEL® Cement Board Indoor	m <sup>2</sup>	1
AQUAPANEL® Maxi Screws (SN, SB)	pieces	20, stud spacing 400 mm
AQUAPANEL® Maxi Screws (SN, SB)	pieces	25, stud spacing 300 mm
AQUAPANEL® Maxi Screws (SN, SB)	pieces	15, stud spacing 600/625 mm
AQUAPANEL® Joint Adhesive (PU)	ml	50
AQUAPANEL® Board Primer	g	40 -60
AQUAPANEL® Joint Finish & Skim Coating - white	kg; layer thickness 1 mm	0.7 (3.5 dry layer thickness 5 mm)
AQUAPANEL® Reinforcing Mesh	m <sup>2</sup>	1.1
AQUAPANEL® Q4 Finish	kg; layer thickness 1 mm	1.7 (3.4 dry layer thickness 2 mm)
GLASFASERFUGENDECKSTREIFEN	m	2.1

# Reference of additional documentation

## **Information on interior systems with**

### **Knauf Gypsum Board**

W11 Knauf Metal Stud Partitions

Brandschutz mit Knauf

Knauf Wände – Schallschutz mit System – Anforderungen, Empfehlungen, Berechnungsverfahren

## **Information on special interior Knauf panels**

K716 Knauf Diamant

W15 Knauf Diamant

D179 Knauf Soundboard

K451 / K751 Fireboard

K717 Knauf Silentboard

K811 Knauf Vidiwall

W35 / W61 / W62 Massivbauplatte

## **Information on Knauf gypsum joint compounds**

K432 Knauf Trennfix

K434 Knauf Dichtungsband

K442a Knauf Fugendestreifen Kurt

K451 Knauf Tiefengrund

K459 Knauf Spezialgrund

K462 Knauf Finish Pastös

K462 Knauf Fugenfüller Leicht

K463 Knauf Jointfiller Super

K464 Knauf Readygips

K467 Knauf Uniflott

Zeige mir deine Fugen und ich sag dir, wer du bist

Trockenausbau – einfach, schnell und sicher

Knauf Readygips – Hochwertige Oberflächen mit Spaßfaktor

Perfektion hat Hintergründe – Grundierungen von Knauf

## **Information on interior systems with**

### **AQUAPANEL® Cement Board Indoor**

AQUAPANEL® Interior Systems

W381 AQUAPANEL® Cement Board Indoor

## **Information on Knauf Insulation**

Luftdichtheit schützt die Bausubstanz

