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**Exterior Cladding Innovation:**  
Thermally broken rainscreen systems

# Thermally broken rainscreen systems

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Presented by: U-kon Façade Systems LTD.  
#501-1155 Robson Street, Vancouver, BC,  
Canada, V6E 1B5

Description: Main principles of rainscreen systems. Two main methods to design rainscreen systems in North America  
differents, similarities, requirements.  
Cladding substructure supports system - design, solutions, implementation.

Supported in  
Ontario by: Façade Systems Inc  
158 Glengarry Avenue, Toronto, ON  
Canada, M5M 1E2

# Purpose and Learning Objectives

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## **Purpose:**

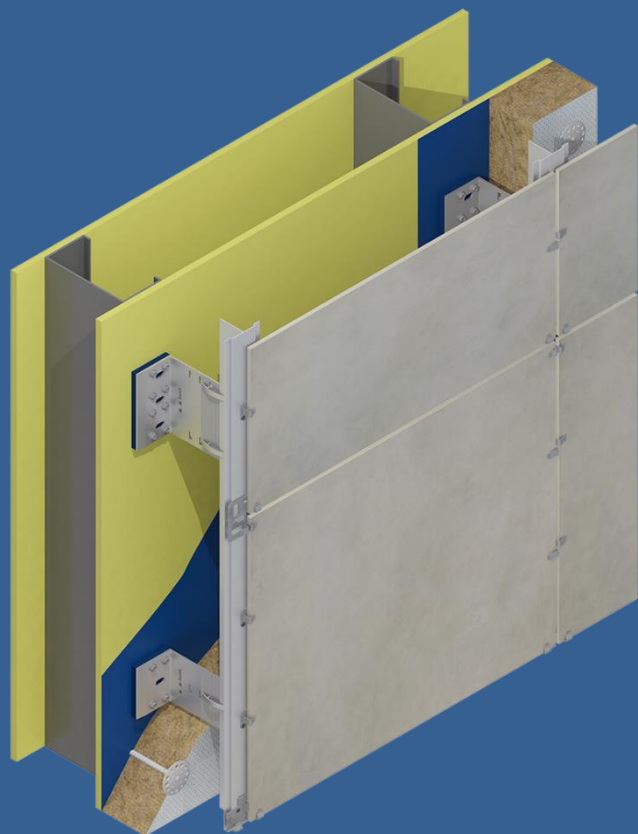
The façade is the one of the important part of the building envelope not just as visual appearance, but also as structural wall component, element of thermal efficiency and protective element against any external impacts.

This course will explore a variety of thermally broken attachment systems and fixing solutions for wide range of cladding materials. Explains potential design options and case studies.

Provides an overview of the characteristics, technical information, and benefits of aluminum extrusions used as a building material, with a focus on whole building design, sustainability and application possibilities.

## **Learning Objectives:**

- Understand the concept of back ventilated cladding systems
- Understand benefits of using aluminum extrusion as a main component of substructure system in term of strength and durability
- How to proper calculate a thermal performance of the cladding system
- Understand proc and cons of various solution thermally broken attachments systems
- Outline the sustainable characteristics of substructure systems



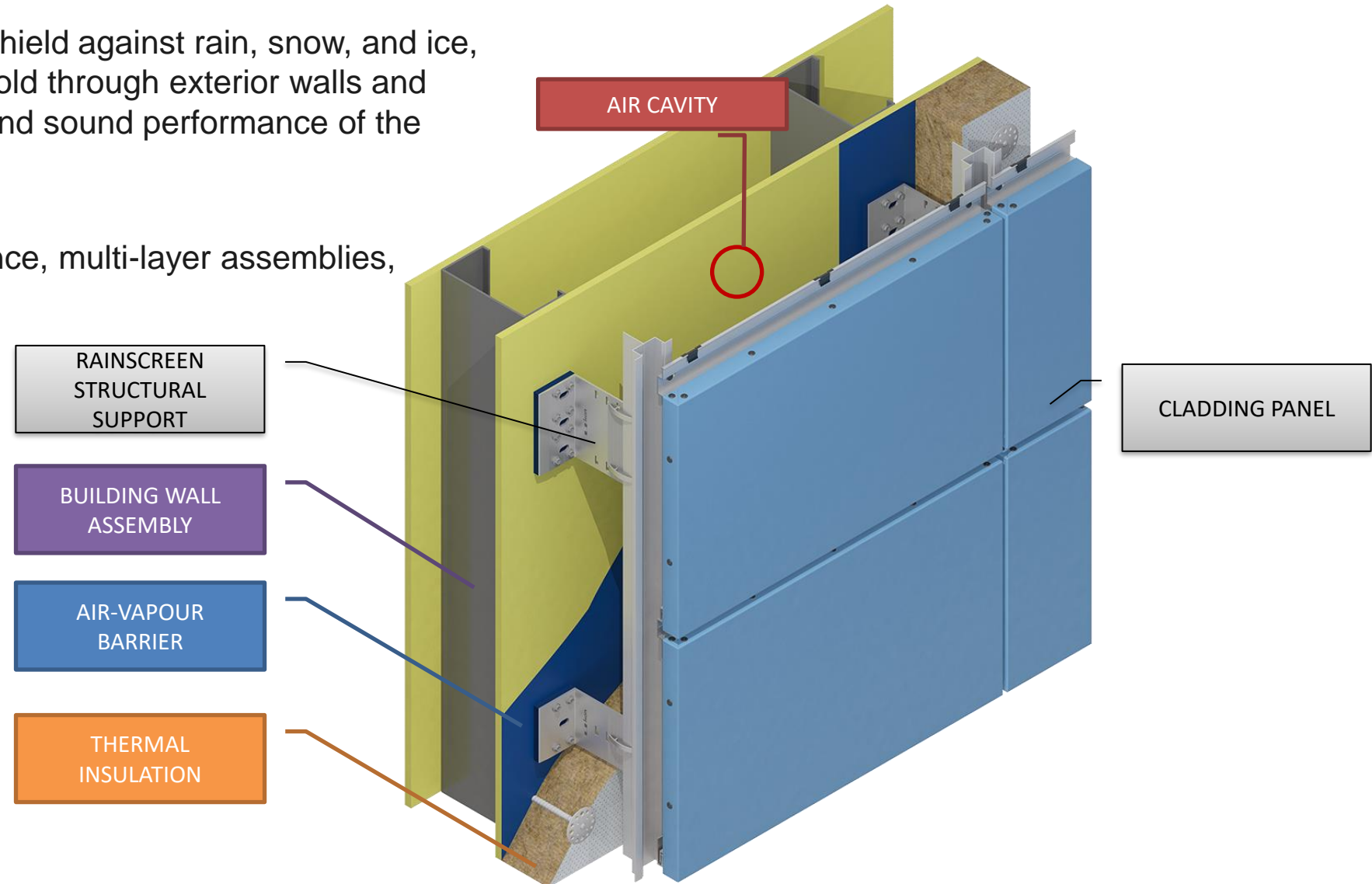
RAINSCREEN PRINCIPLE



# RAINSCREEN PRINCIPLE

Rainscreen systems provide a shield against rain, snow, and ice, preventing penetration water, mold through exterior walls and providing an excellent thermal and sound performance of the building.

Rainscreens are high-performance, multi-layer assemblies, typically featuring:

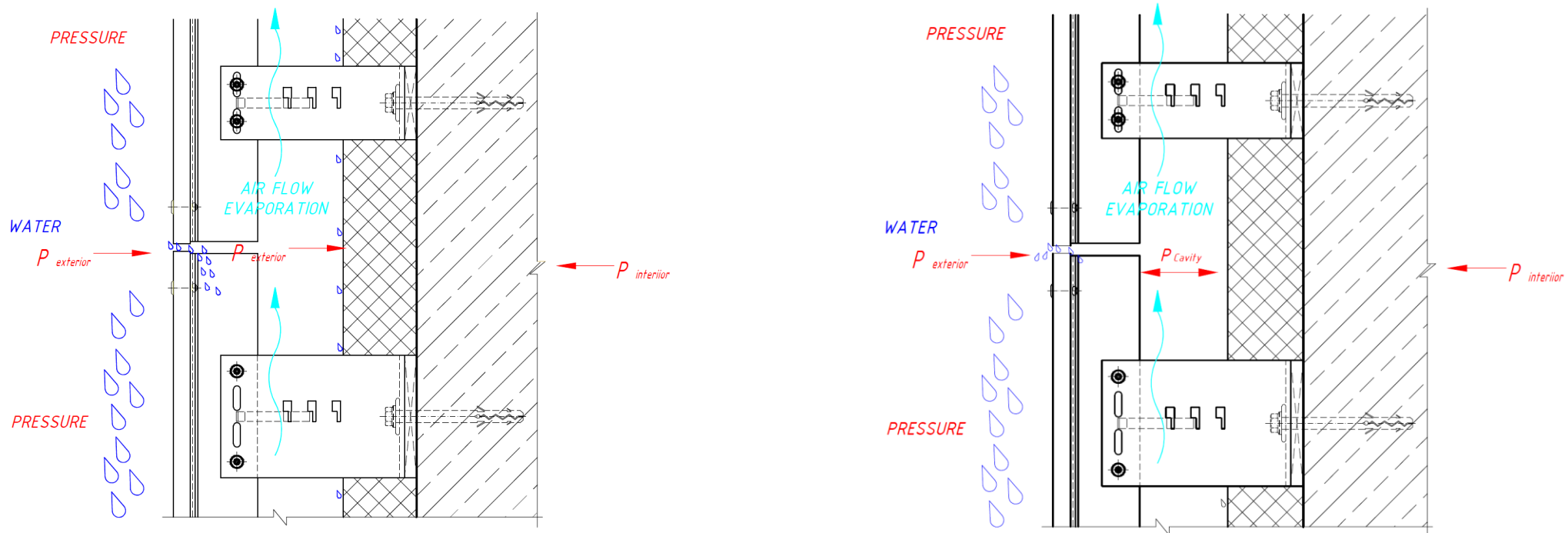


# RAINSCREEN PRINCIPLE

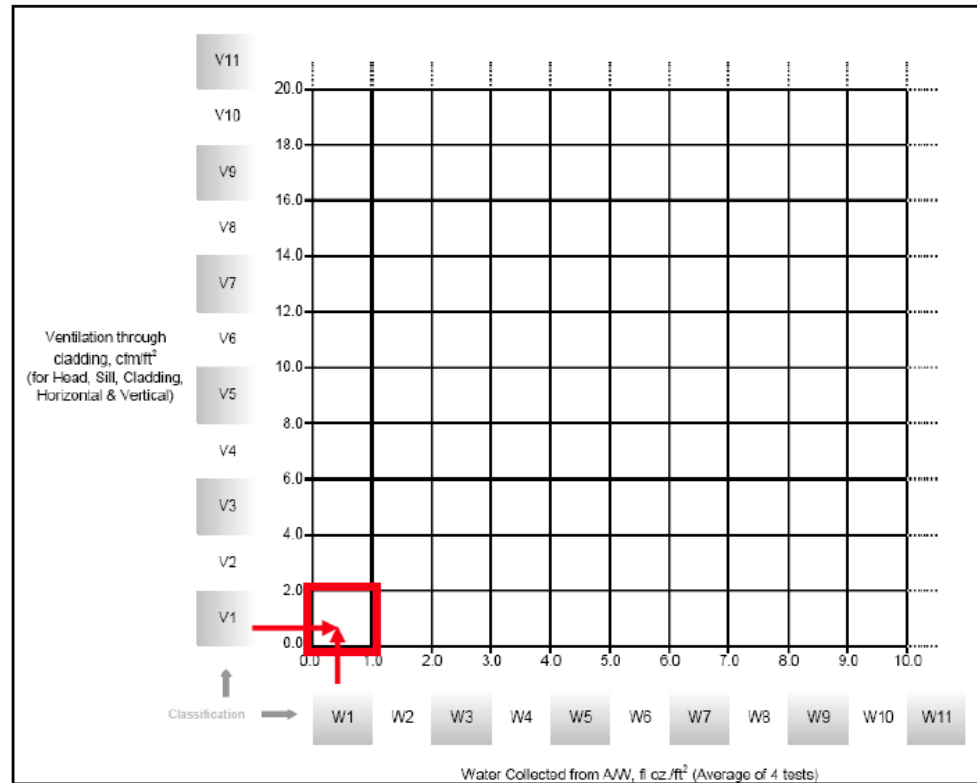
There are two basic types of rainscreen systems, as classified by the American Architectural Manufacturers Association (AAMA):

- Drained, back-ventilated (AAMA 509-09)
- Pressure-equalized (AAMA 508-07)

There is much confusion in the design and construction community about how these inter-related components should be specified, contracted and constructed. Below we will explain the main difference and features.



- Drained, back-ventilated (AAMA 509-09)



# Back-ventilated rainscreen substructure system

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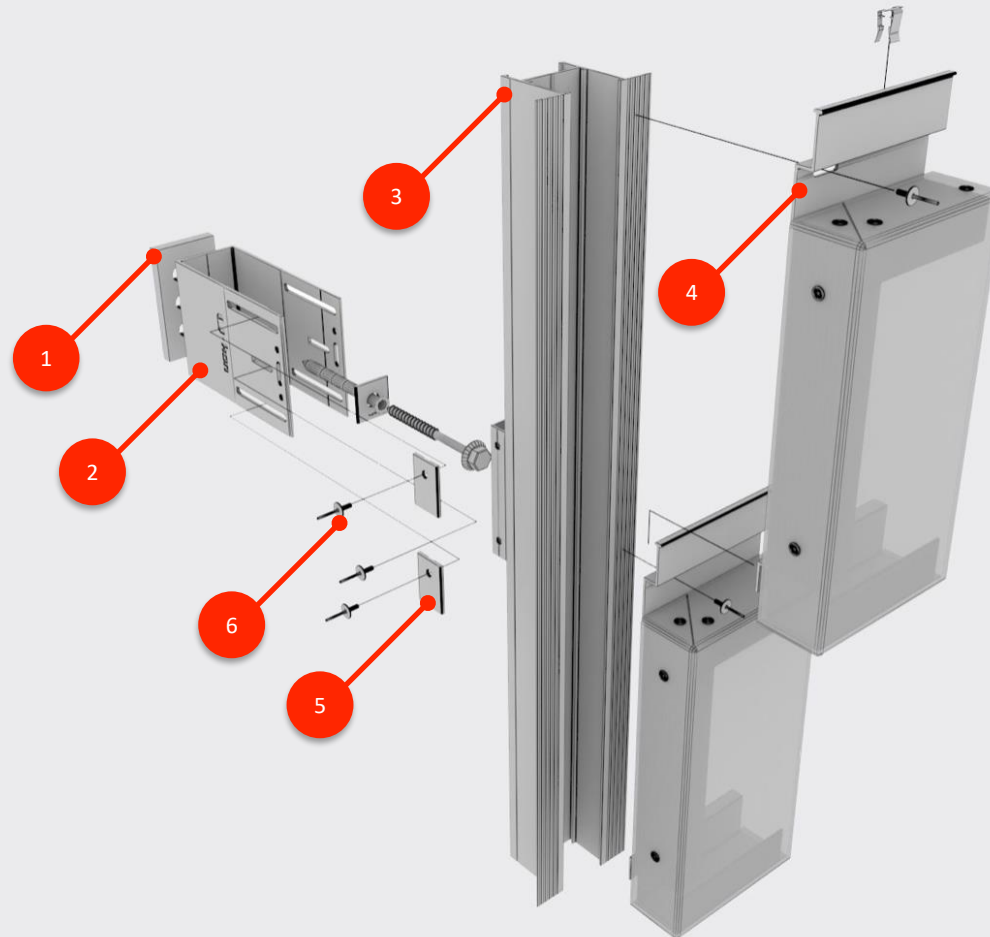


# Back-ventilated rainscreen substructure system

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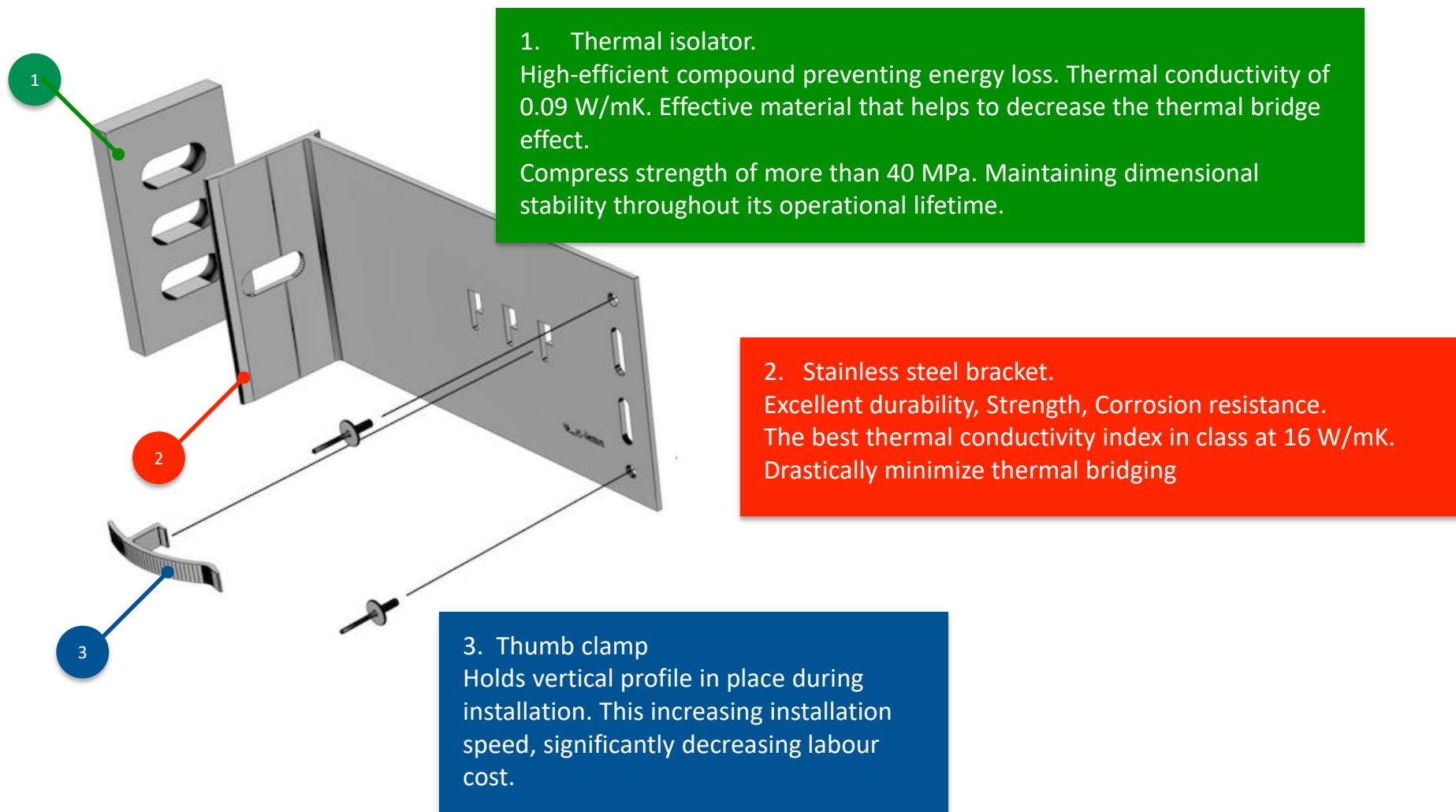
The focus of today's discussion is on engineered drain, back-ventilated support systems

- 1 - Thermal isolator
- 2 - Support bracket
- 3 - Main vertical profile
- 4 - Additional profile
- 5 - Attachment elements
- 6 - Fasteners



# Back-ventilated rainscreen substructure system

## Basic components





# Back-ventilated rainscreen substructure system

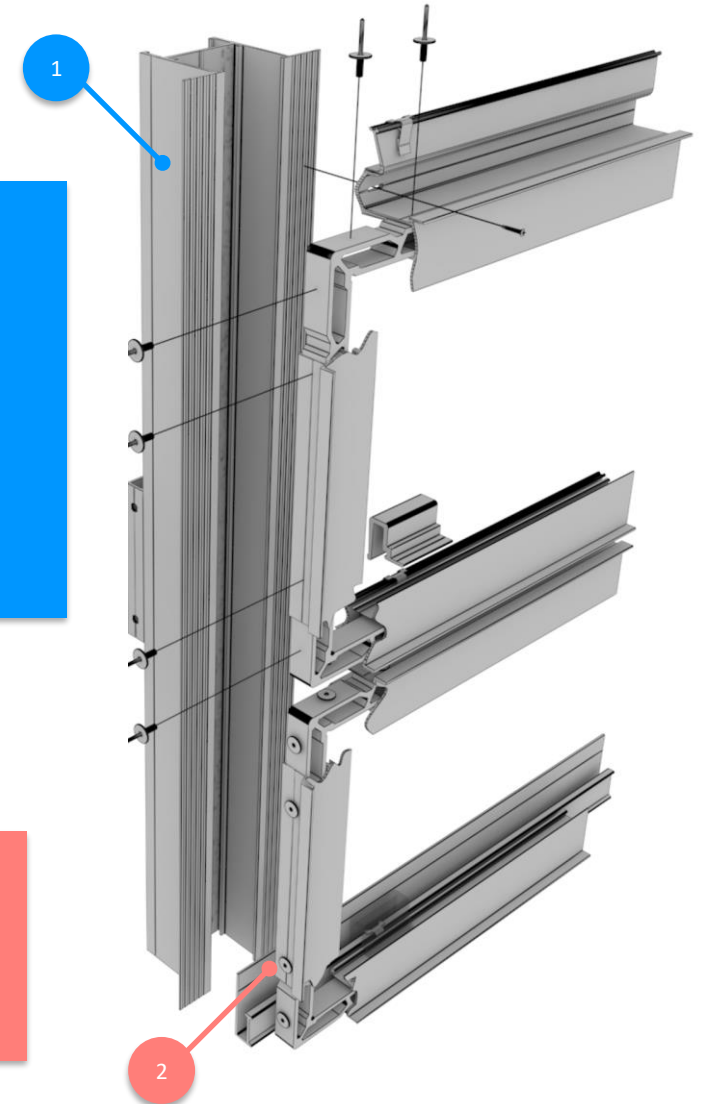
## Basic components

### 1. Main vertical profile.

- Wide variety of profiles, to meet the most stringent structural requirements
- Facilitates the installation of heavy cladding in extreme environments
  - Wind speed up to 200 km/h
  - Earthquake resistance up to a magnitude of 9.0 of the Richter scale.

### 2. Additional profiles

May be used to satisfying requirements imposed by architectural design or cladding material



# MAIN STRUCTURAL MATERIAL – EXTRUDED ALUMINUM

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Few facts about aluminum:

## **Lightweight**

- Aluminum is lightweight (lower density) yet is one of the strongest construction materials available.
- Aluminum's high strength-to-weight ratio means that less of a building's structure is spent supporting its own weight.
- Aluminum offers undiminished structural integrity over a long service life.
- Buildings in seismic zones benefit even more from reduced weight, since seismic forces are proportional to the structure's weight.



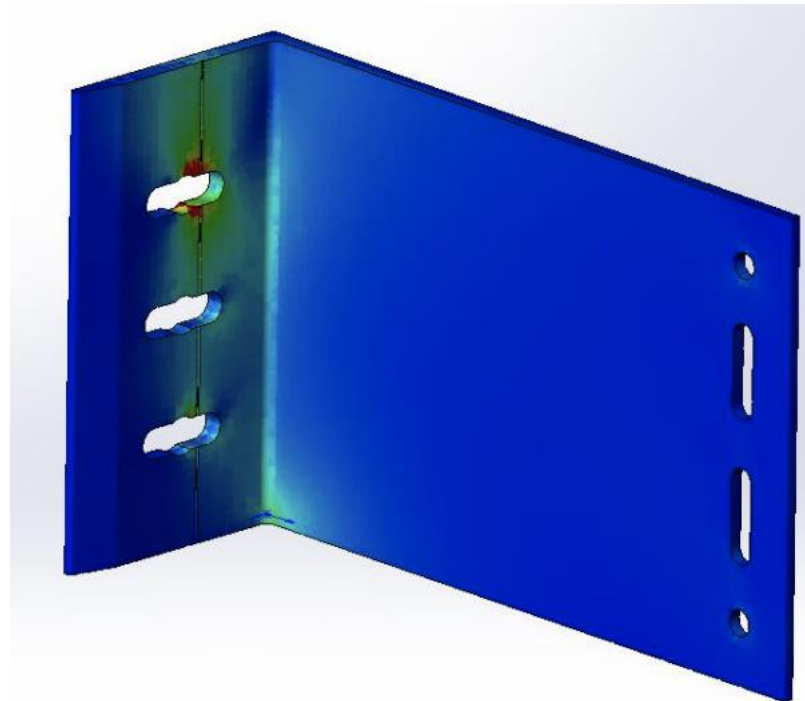
# MAIN STRUCTURAL MATERIAL – EXTRUDED ALUMINUM

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Few facts about aluminum:

## **Structural Strength**

Aluminum's structural strength and stability is consistently strong, even under extreme conditions and temperature changes, in terms of elastic modulus/stiffness. Where plastics may become brittle at low temperatures, aluminum actually becomes even stronger at extremely cold temperatures, which is why NASA chooses it for many aerospace applications.



# MAIN STRUCTURAL MATERIAL – EXTRUDED ALUMINUM

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Few facts about aluminum:

## **Tensile Strength**

Aluminum's tensile strength and structural stability and rigidity mean that extruded aluminum building components are more resistant to deformation caused by climate changes and building movement over time. Aluminum's unique enduring properties guarantee long-term performance with minimal maintenance.

Structural integrity is judged based upon the ability of a material to withstand loads—i.e., its strength.

Tensile strength determines the maximum load a material can carry under tension (when stretched).

Structural stiffness and strength combine with lightweight and ease of fabrication to form the ideal building material



# MAIN STRUCTURAL MATERIAL – EXTRUDED ALUMINUM

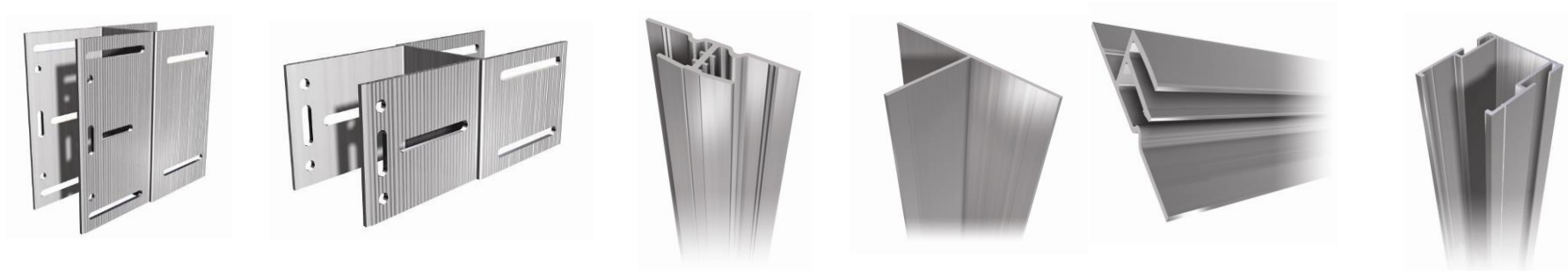
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Few facts about aluminum:

## **Formability**

Aluminum extrusions are versatile building material, especially when used in rainscreen applications.

Aluminum is plastic and easily formable and can be extruded into a vast array of shapes, including complex, multi-void hollows, and customized designs. Extrusions provide for the placement of metal precisely where it's needed. Tight tolerances, even on thin-walled extrusions, can be consistently maintained.



# MAIN STRUCTURAL MATERIAL – EXTRUDED ALUMINUM

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Few facts about aluminum:

## **Aluminum Is Sustainable**

Aluminum is recyclable:

- It is 100% recyclable with high scrap value.
- Aluminum can be repeatedly recycled, retaining the same material physical properties.
- 73% of all the aluminum ever produced is still in use today.

Recycled aluminum retains value:

- At the end of its life, aluminum is 100% reusable.



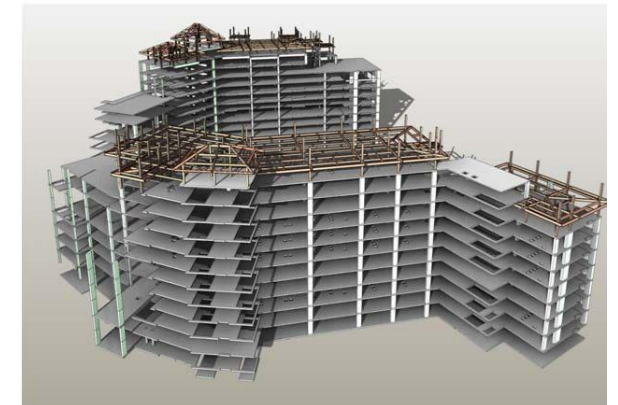
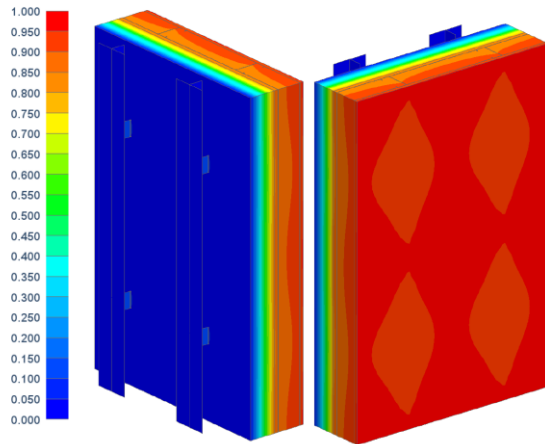


# DESIGN REQUIREMENTS

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**Rainscreen substructure should be properly design and meet the following requirements and performance:**

- Structural requirements
- Thermal performance
- Fire protection
- Corrosion resistance
- Maintenance and installation

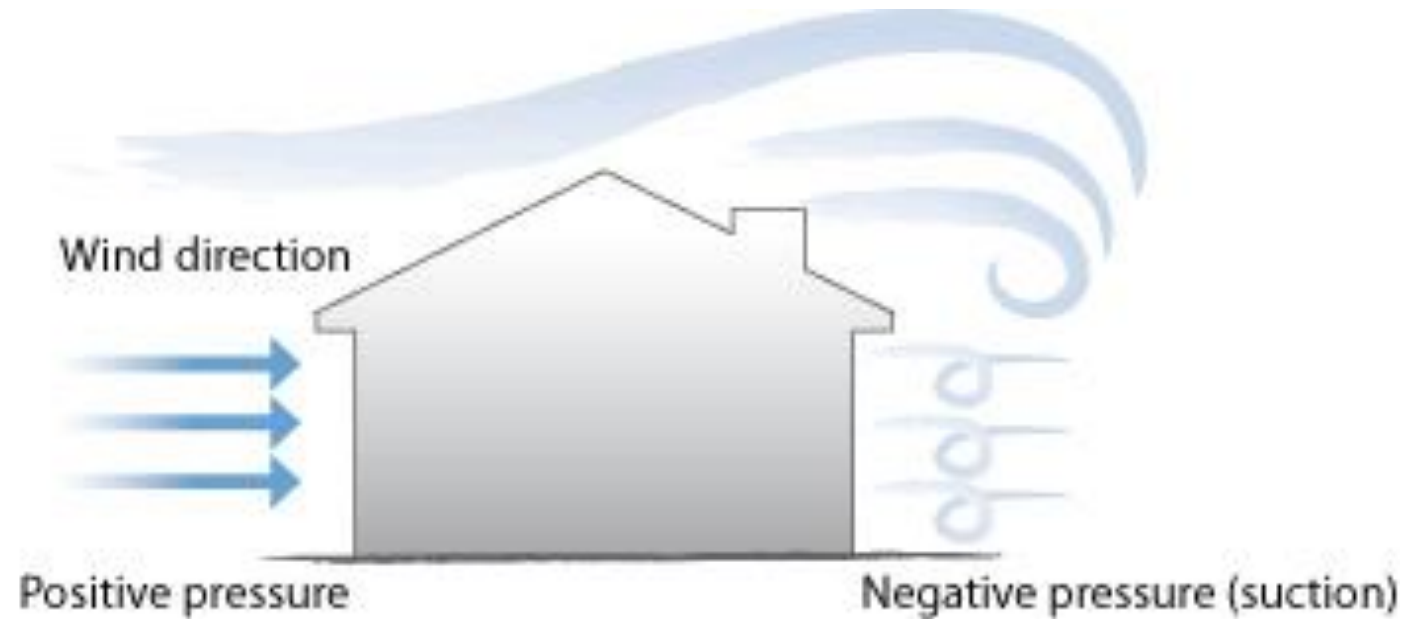


# DESIGN REQUIREMENTS

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Structural requirements:

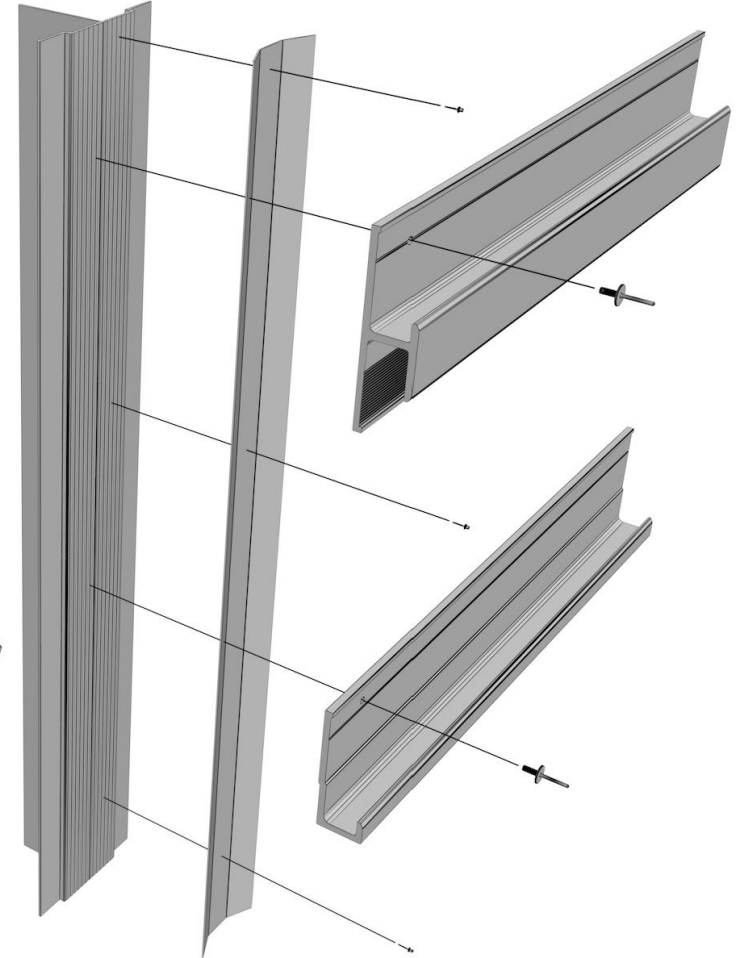
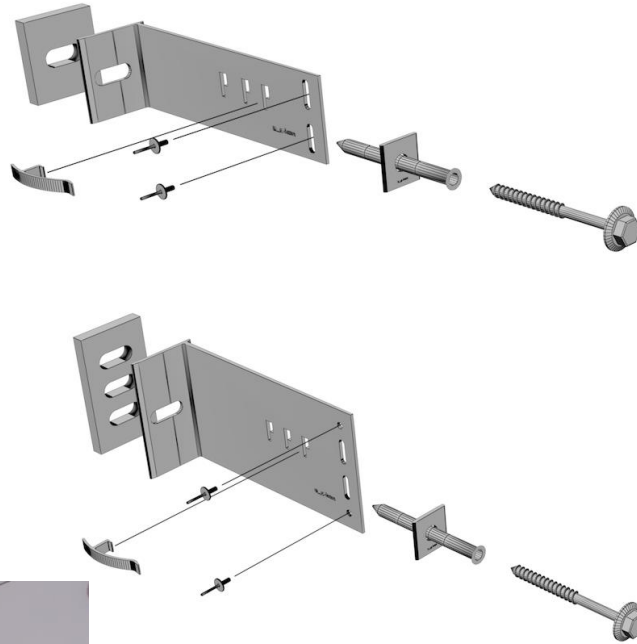
- Wind loads
- Deadloads
- Ice load
- Seismic
- Deflection
- Fasteners connection



# DESIGN REQUIREMENTS

## Structural requirements:

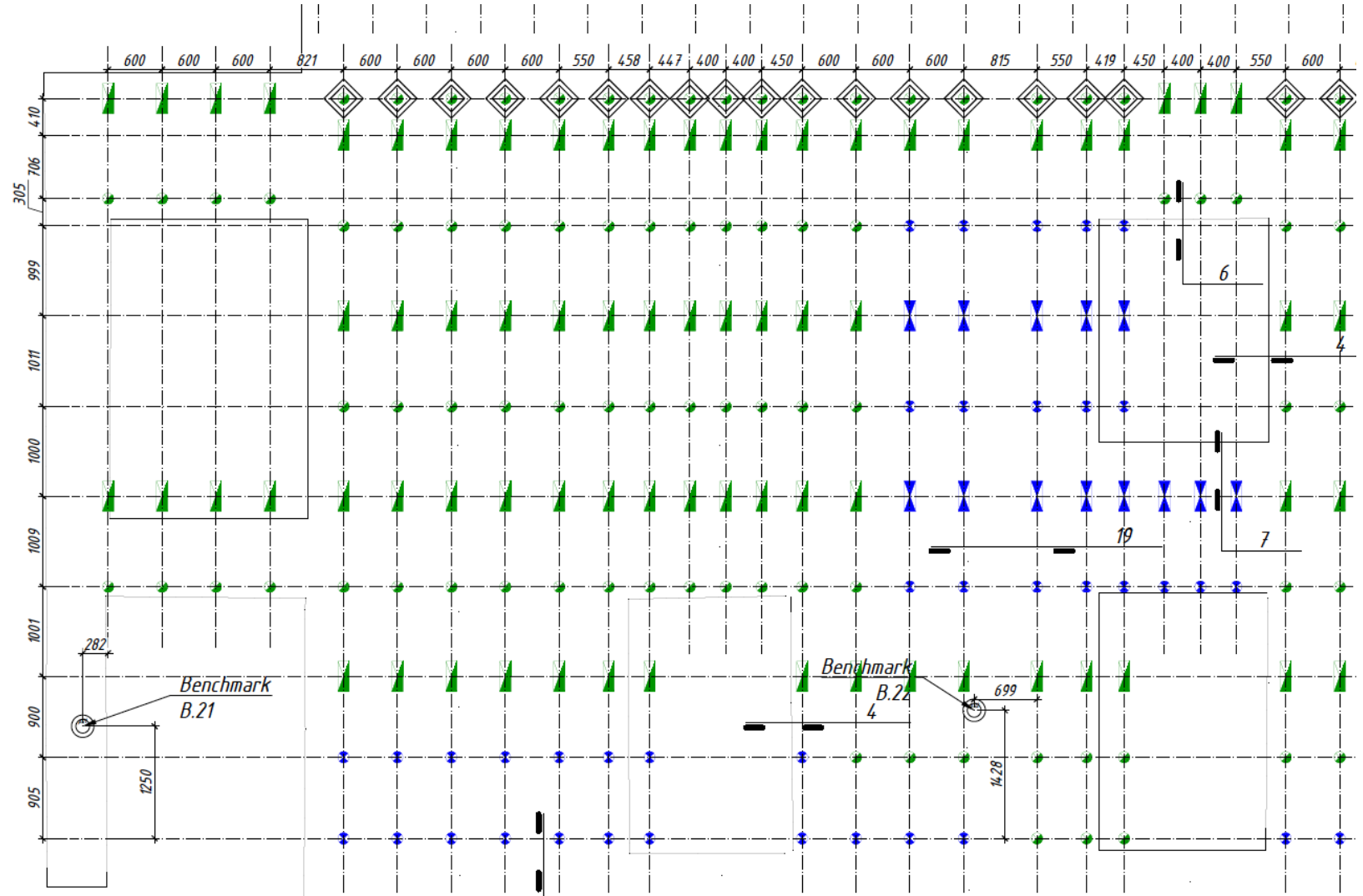
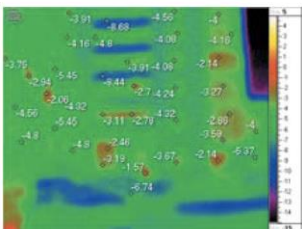
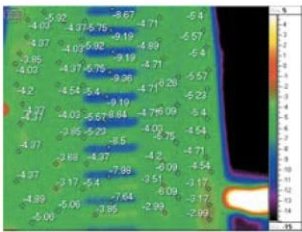
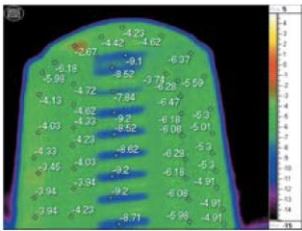
- Wind loads
- Deadloads
- Ice load
- Seismic
- Deflection
- Fasteners connection



# DESIGN REQUIREMENTS

Thermal performance.

Thermal performance should be calculated based on structural calculation for specific project.

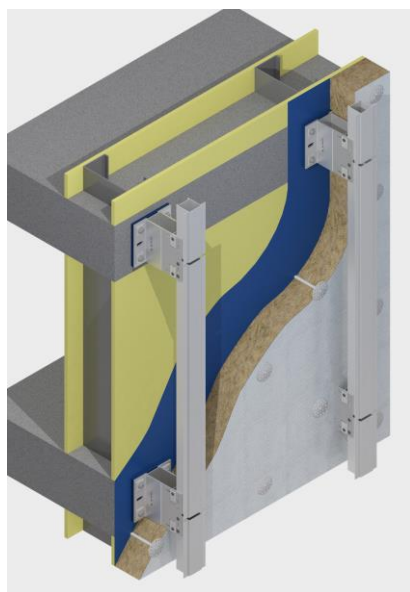


# DESIGN REQUIREMENTS

Thermal performance.

STANDARD OR COMBI SOLUTION.

- ALUMINUM BRACKETS
- STAINLESS STEEL BRACKETS



Vertical Spacing in	Exterior Insulation Thickness in	Exterior Insulation Nominal R-Value	Assembly Effective R-Value (Aluminum Bracket Standard/Combi)	Assembly Effective R-Value (Stainless steel Bracket Standard/Combi)	Assembly Effective R-Value (Stainless steel Bracket HIGH)*
24	4	R-16.8	R-14.3	R-17.7 (20%)	
24	5	R-21.0	R-16.0	R-21.1 (25%)	
24	6	R-25.2	R-17.7	R-24.8 (29%)	
36	4	R-16.8	R-15.8	R-18.3 (14%)	
36	5	R-21.0	R-18.0	R-21.9 (18%)	
36	6	R-25.2	R-20.2	R-25.8 (22%)	
48	4	R-16.8	R-16.7	R-18.7 (11%)	
48	5	R-21.0	R-19.3	R-22.4 (14%)	
48	6	R-25.2	R-21.8	R-26.3 (18%)	
120	4	R-16.8			18.2*
120	5	R-21.0			21.9*
120	6	R-25.2			25.8*

THERMAL ANALYSIS PERFORMED BY MORRISON & HERSHFELD

\* - Bracket is mounted to the intermediate floor slab, thermal bridging of the concrete slab must be included in the analysis. As a result, a linear transmittance value,  $\Psi$ , is provided to account for the thermal bridging effect of the intermediate floor.



# DESIGN REQUIREMENTS

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Fire protection.

The rainscreen substructure system should design to withstand fire and prevent falling cladding panels during the fire and developing fire on the building.



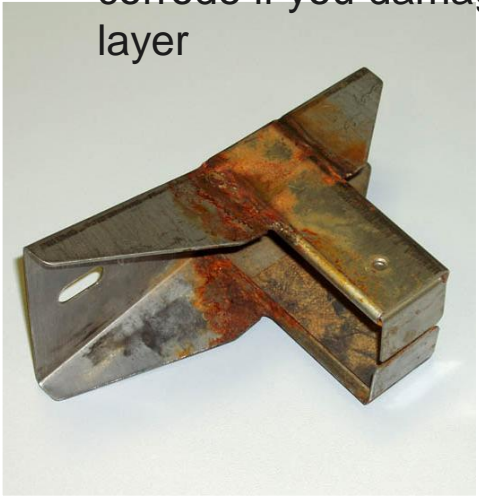


# DESIGN REQUIREMENTS

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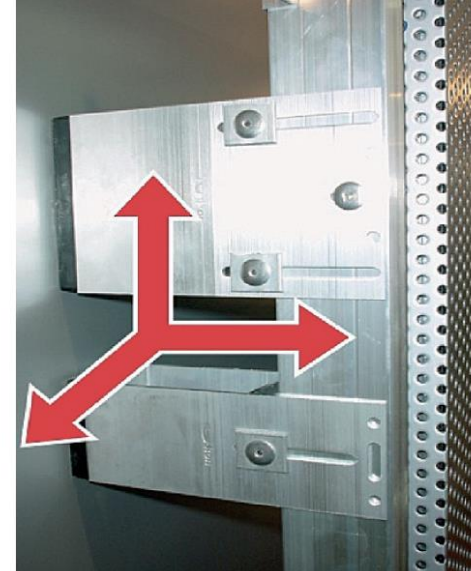
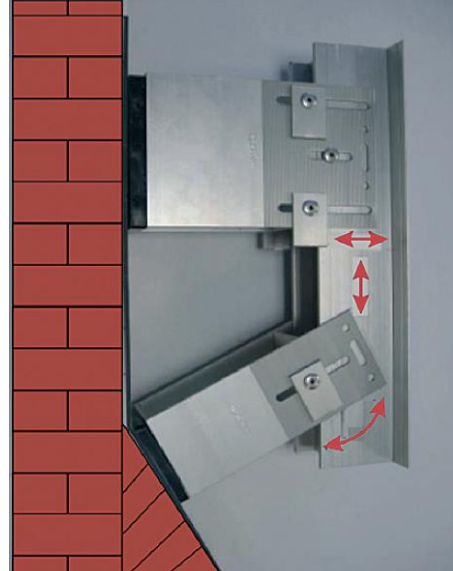
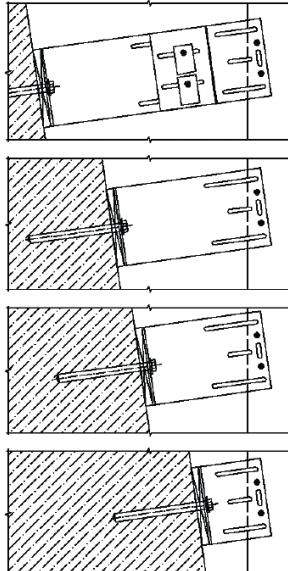
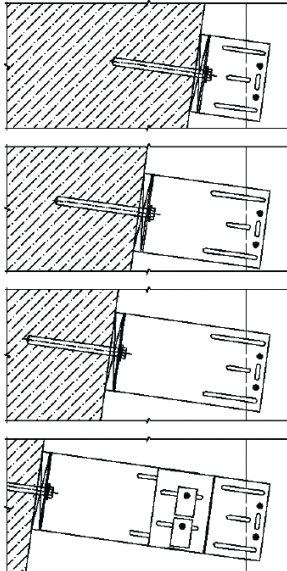
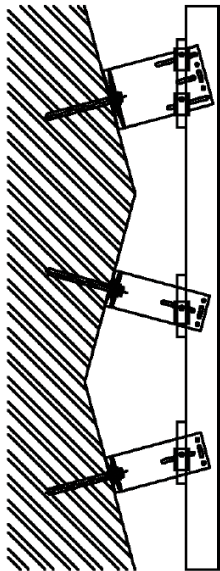
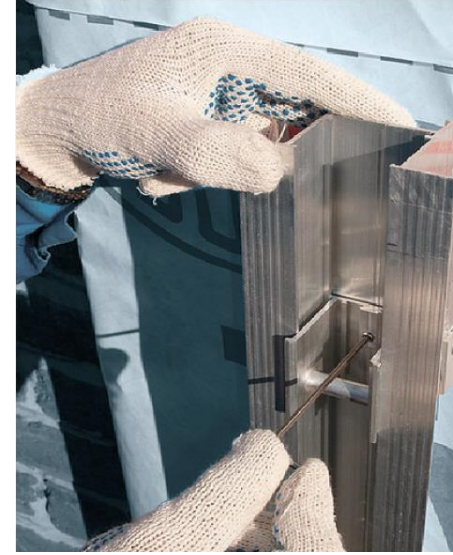
Corrosion resistance.

Even stainless steel AISI 430 can start corrode if you damage the protection layer



# DESIGN REQUIREMENTS

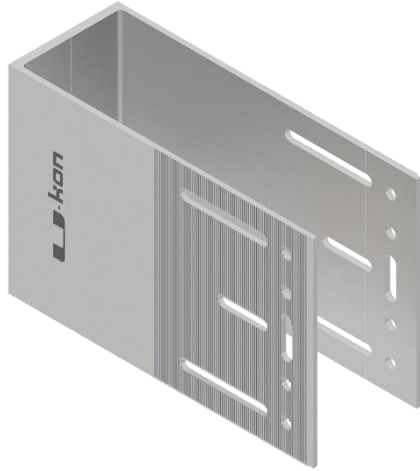
Design of the rainscreen system should be a simple and easy install, and have low maintenance



# MAIN COMPONENTS – WALL BRACKETS

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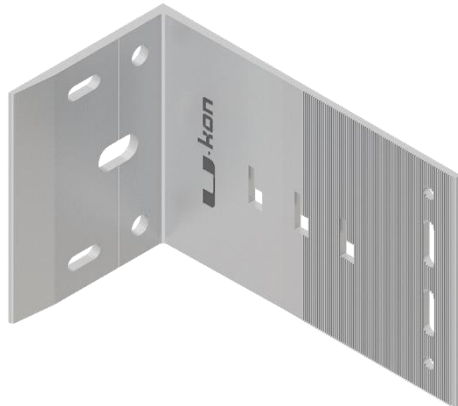
WALL BRACKETS “U” SHAPE



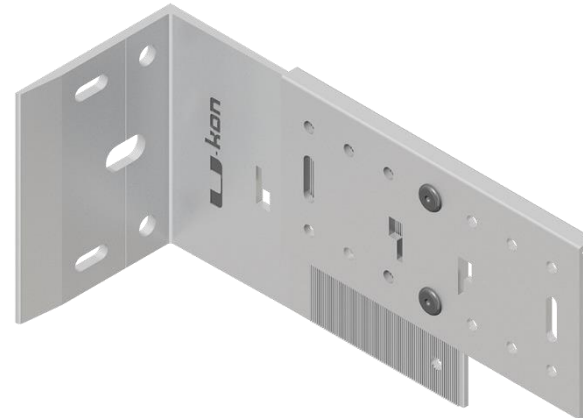
WALL BRACKETS “U” SHAPE WITH EXTENSION



WALL BRACKETS “L” SHAPE



WALL BRACKETS “L” SHAPE WITH EXTENSION





# TYPE OF THE WALL ASSEMBLIES

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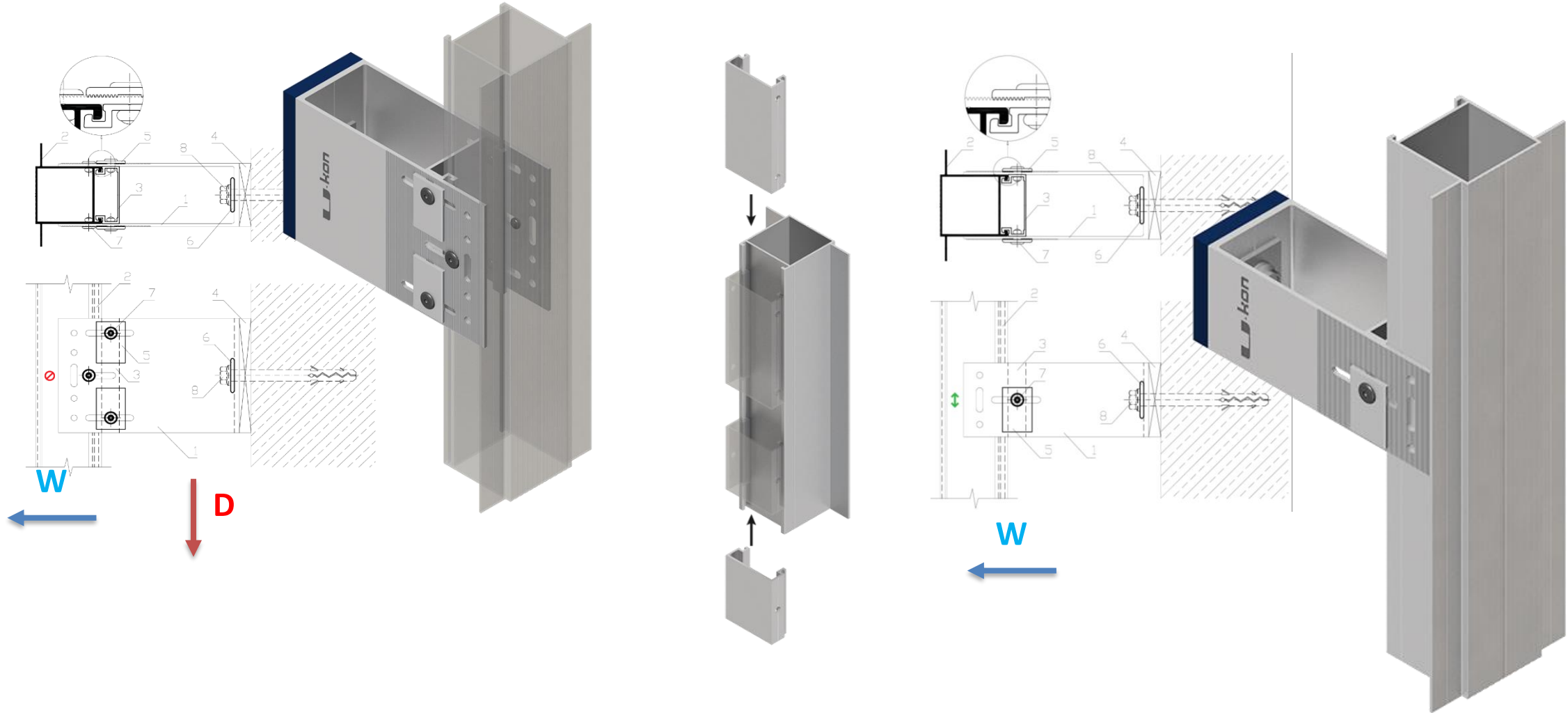
WALL BRACKETS “U” SHAPE  
ASSEMBLY - STANDARD



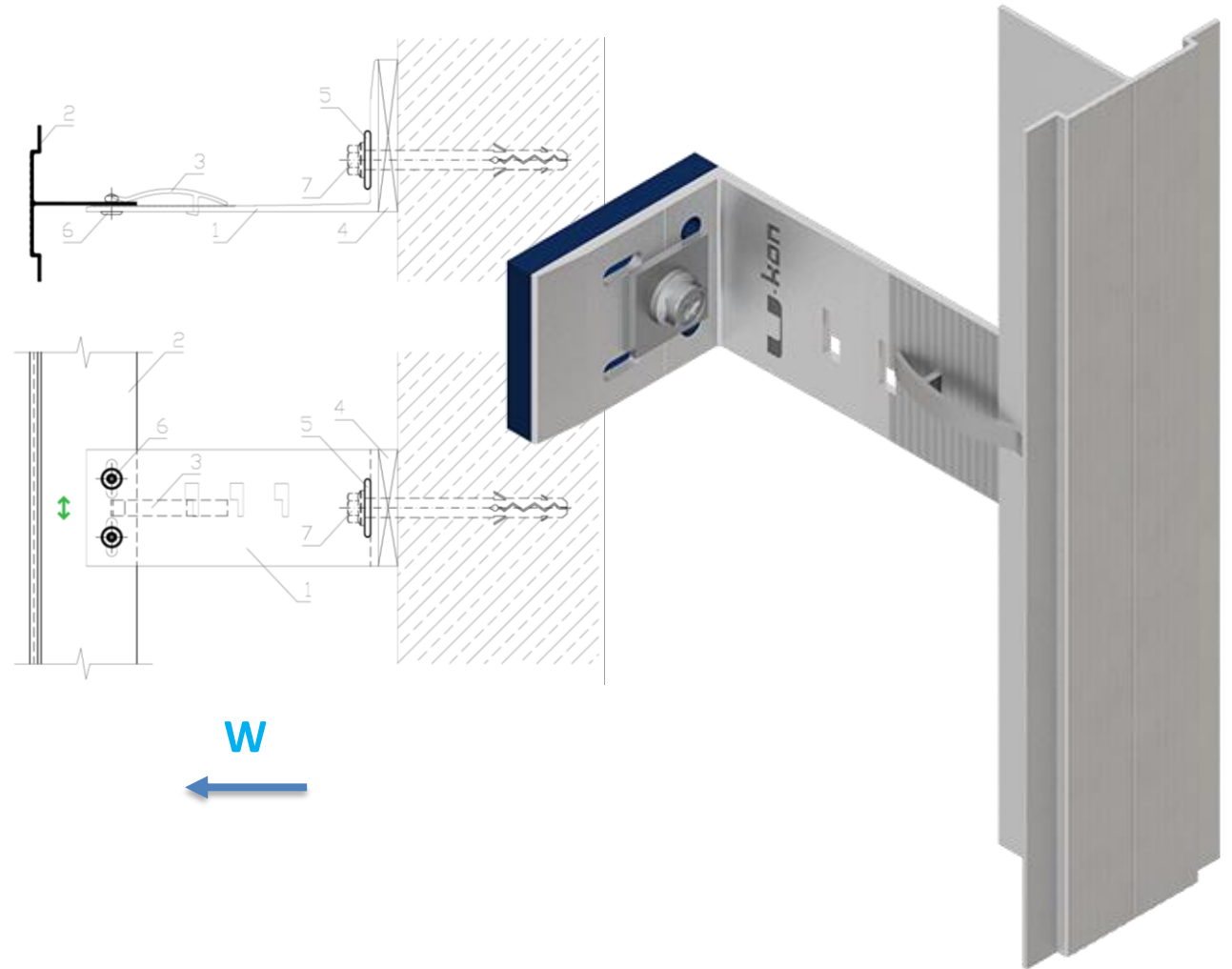
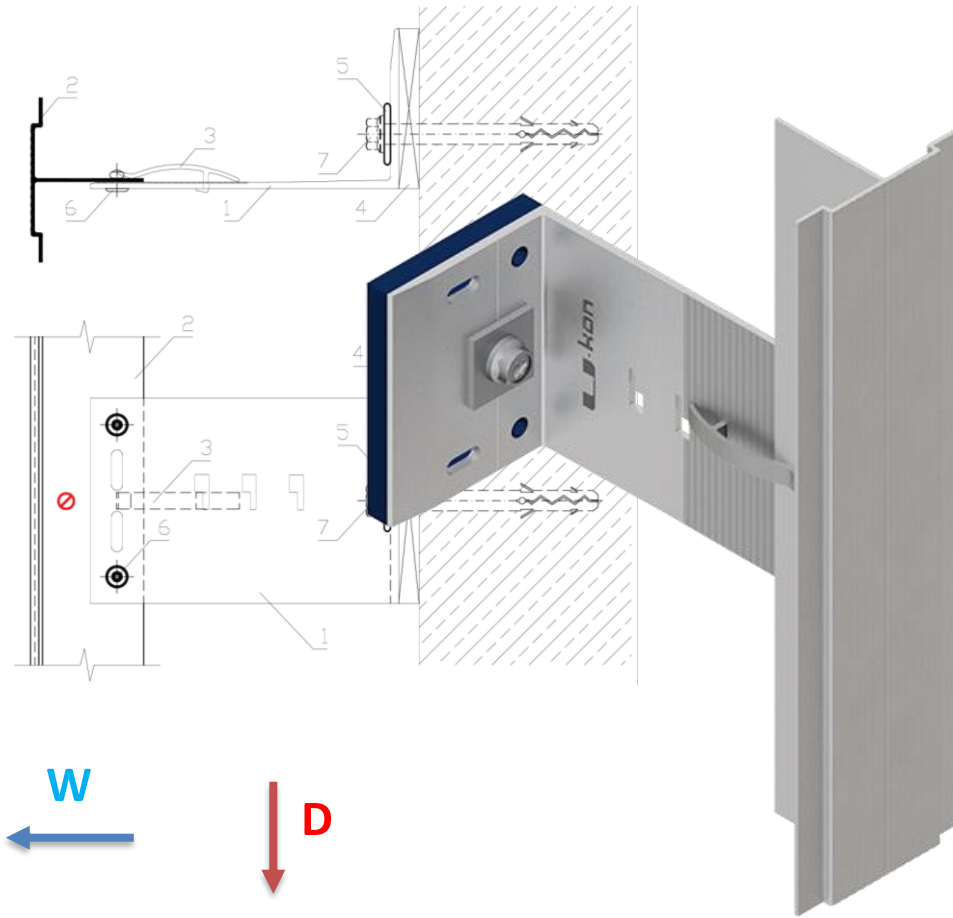
WALL BRACKETS “L” SHAPE  
ASSEMBLY - STANDARD



# TYPE OF THE WALL ASSEMBLIES - STANDARD



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# TYPE OF THE WALL ASSEMBLIES

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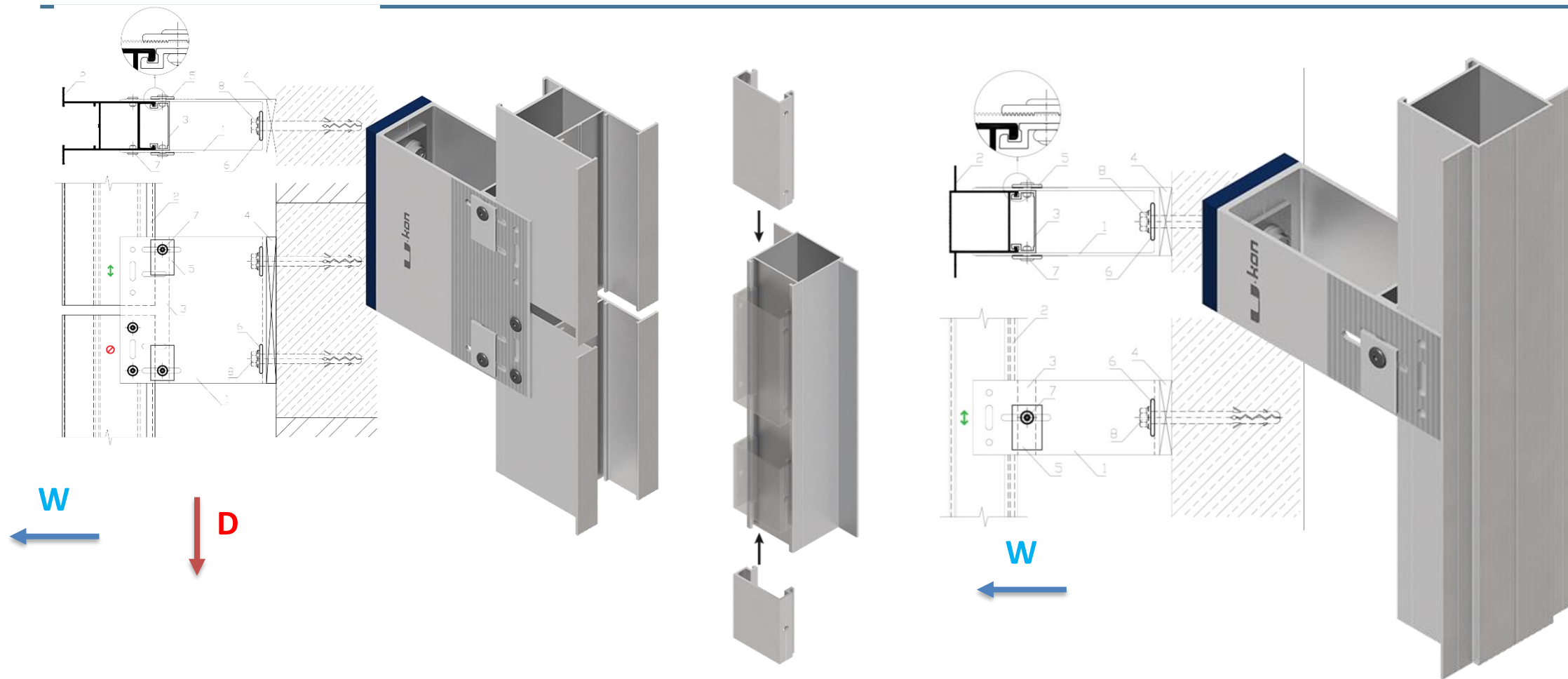
WALL BRACKETS “U” SHAPE  
ASSEMBLY - COMBI



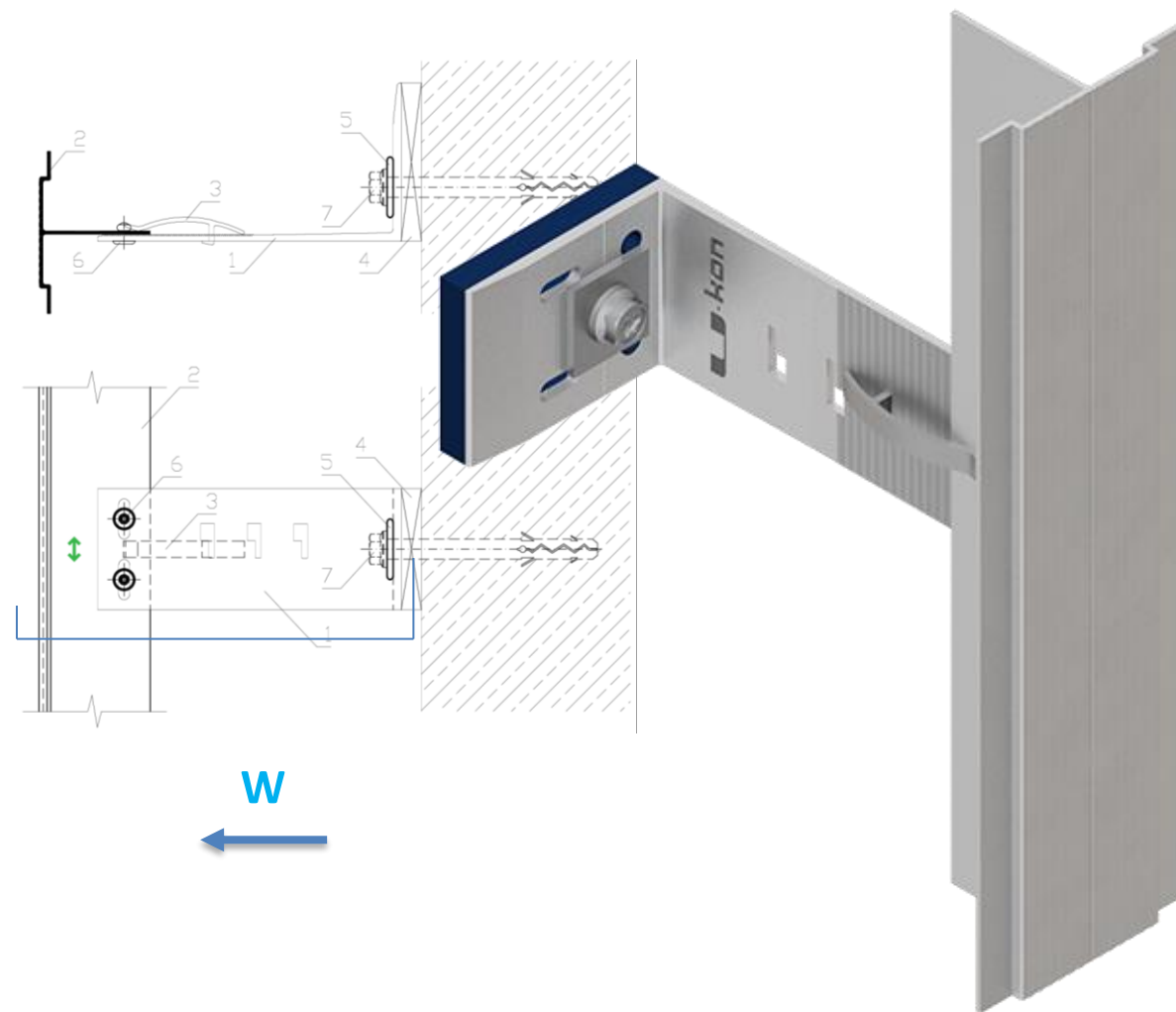
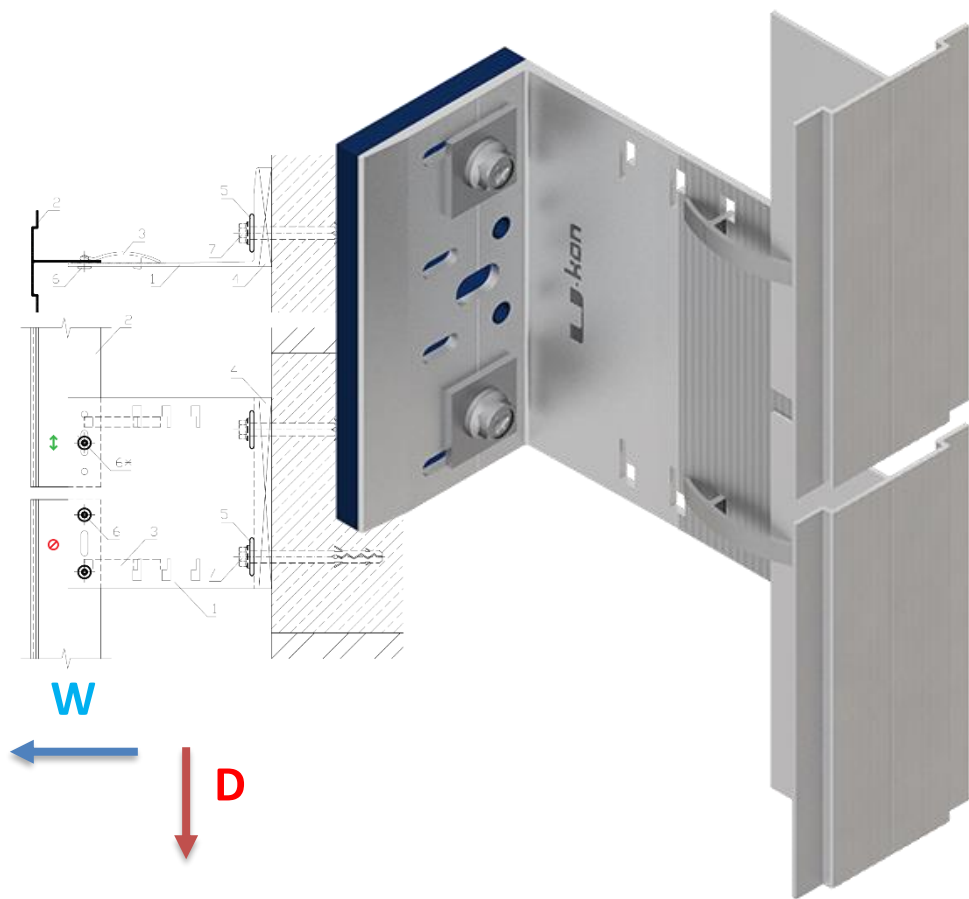
WALL BRACKETS “L” SHAPE  
ASSEMBLY - COMBI



# TYPE OF THE WALL ASSEMBLIES - COMBI



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# TYPE OF THE WALL ASSEMBLIES

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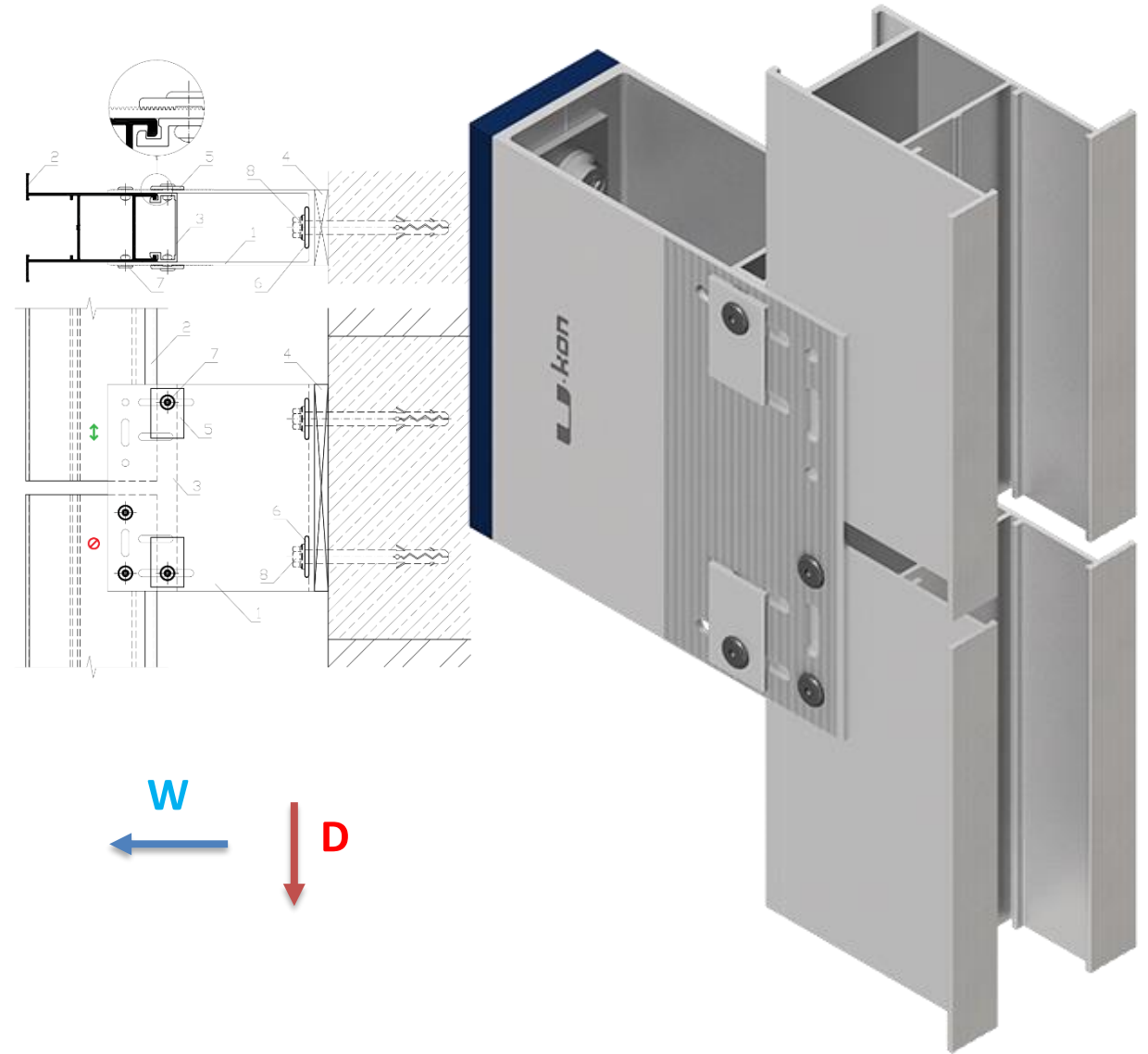
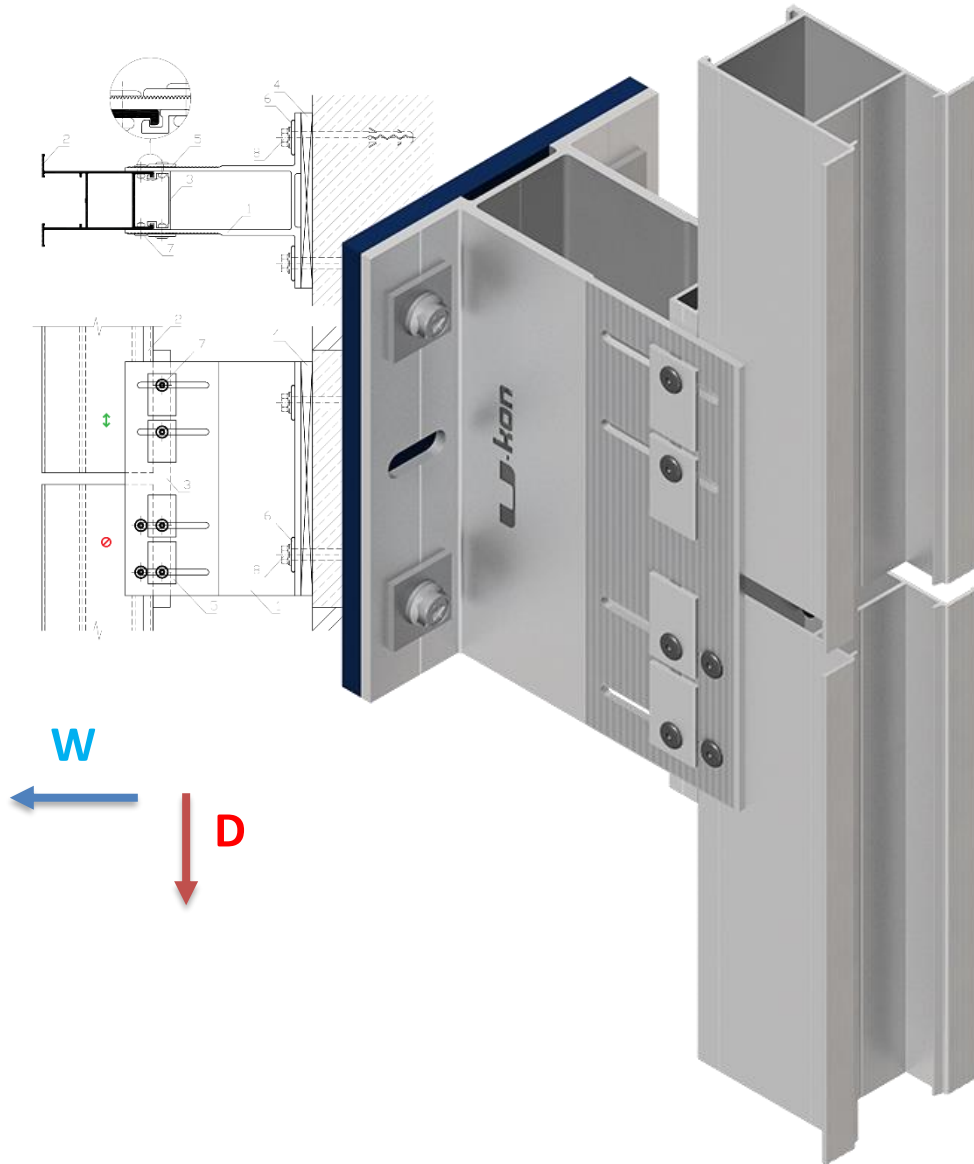
WALL BRACKETS "U" SHAPE  
ASSEMBLY - HIGH



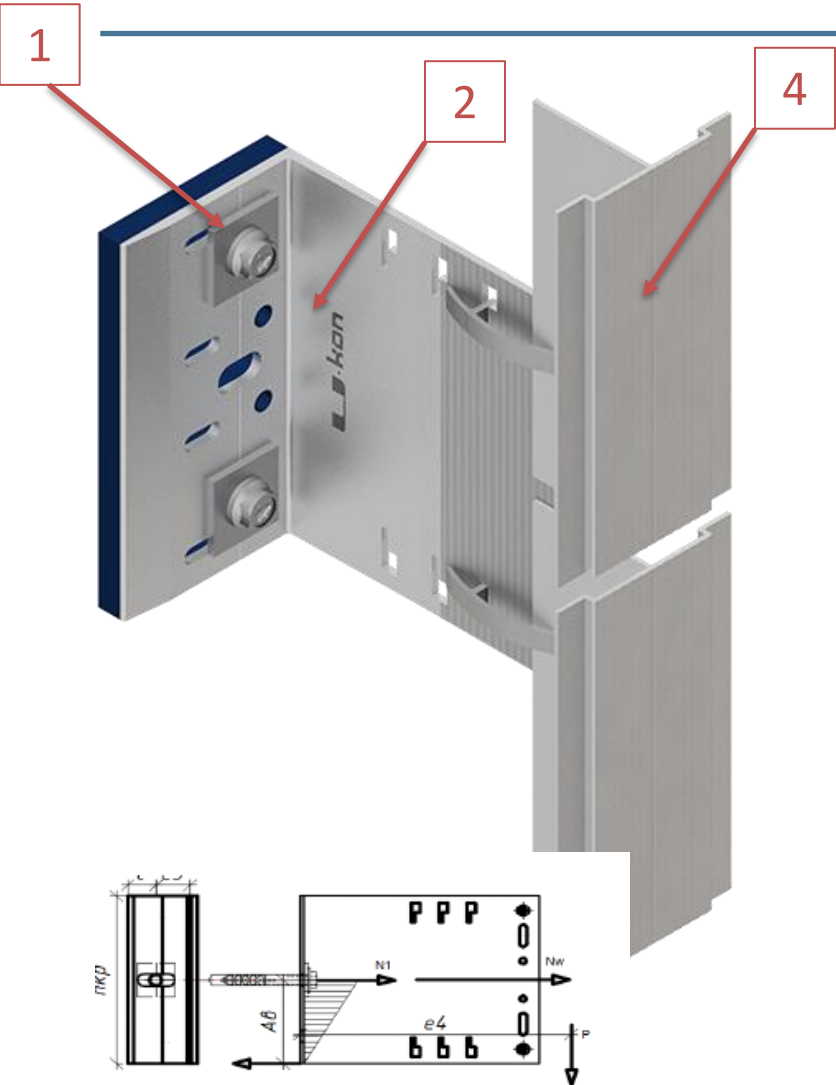
WALL BRACKETS "U" SHAPE  
ASSEMBLY – HIGH M



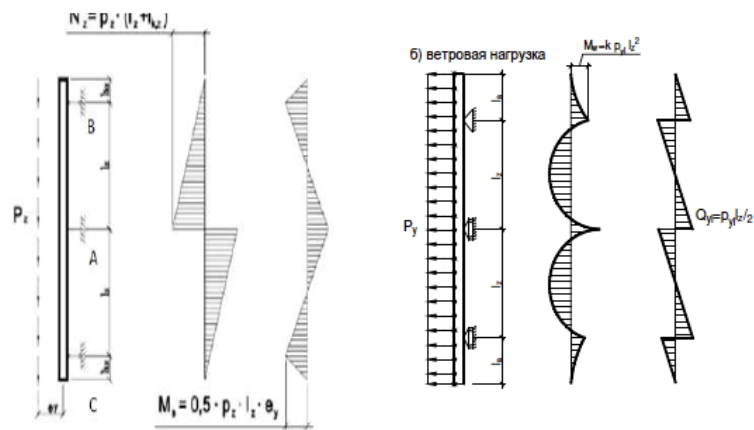
# TYPE OF THE WALL ASSEMBLIES - COMBI



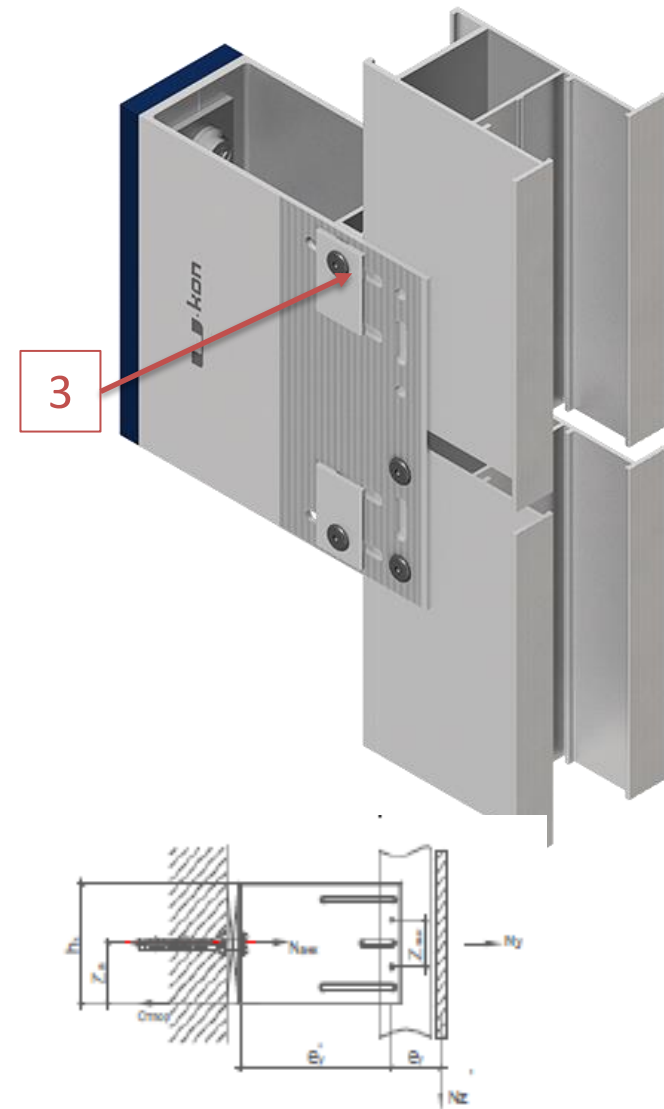
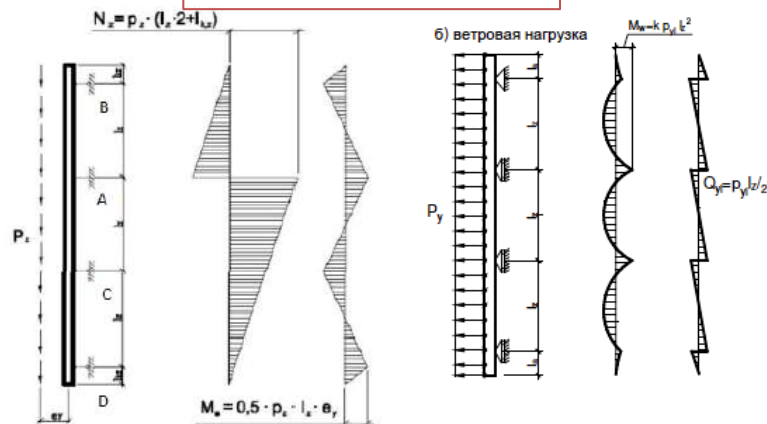
# STRUCTURAL ELEMENTS THAT MUST BE CHECKED



ONE SPAN



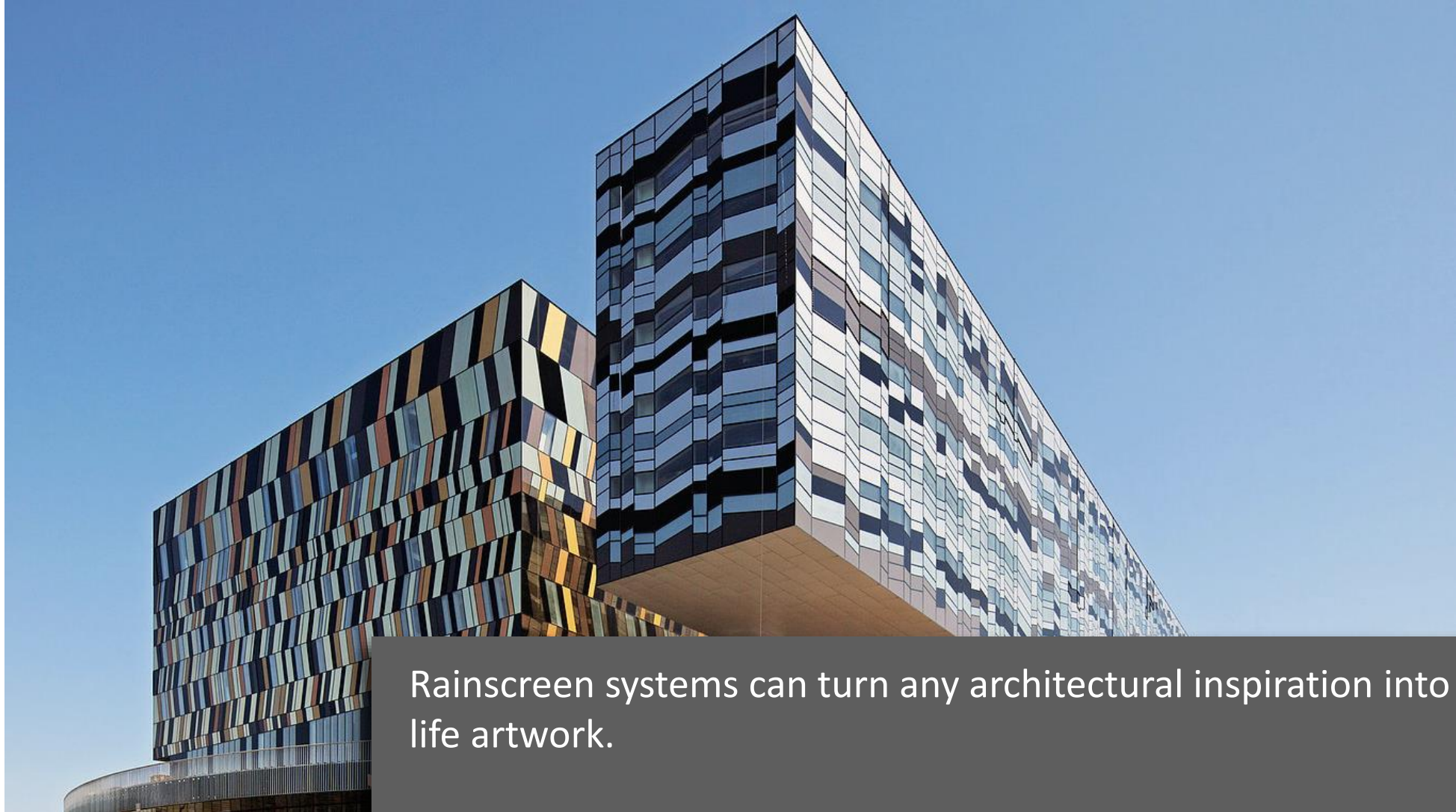
MULTI SPAN





# Engineered rainscreen attachment system

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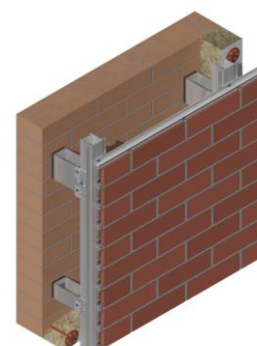
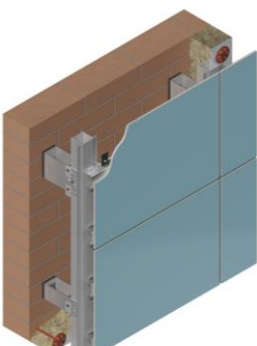
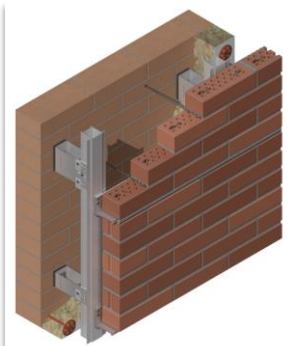
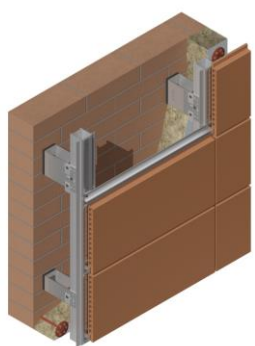
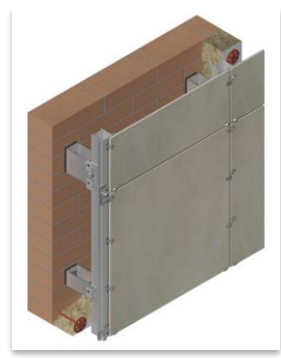
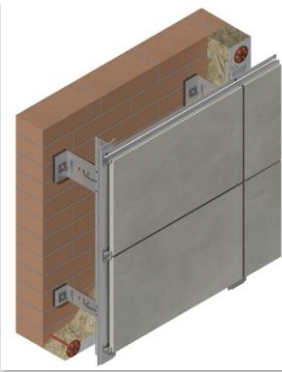
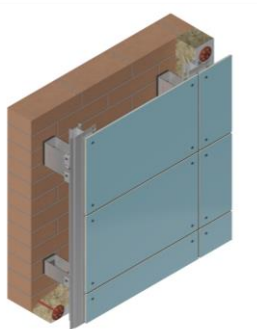
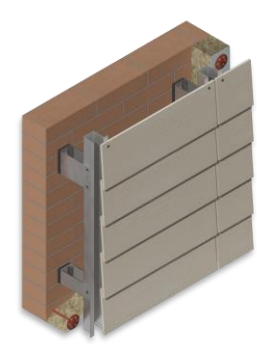
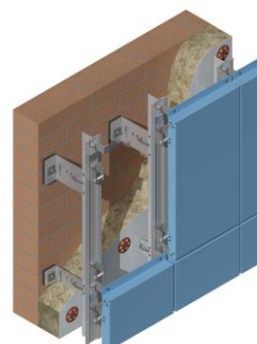
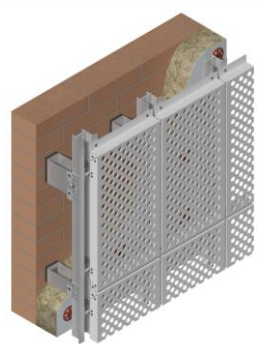
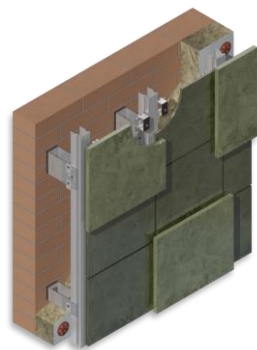


Rainscreen systems can turn any architectural inspiration into real life artwork.

# Engineered rainscreen attachment system

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The wide variety of pre-engineered rainscreen substructure systems guarantee simple installation and design that will meet all requirements.



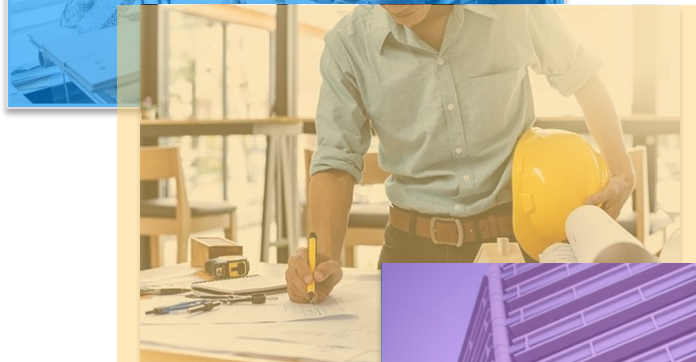
# Engineered rainscreen attachment system - Benefits

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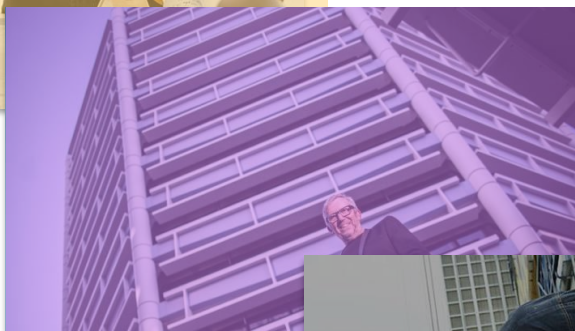
## Architect

One system for all types of design ideas



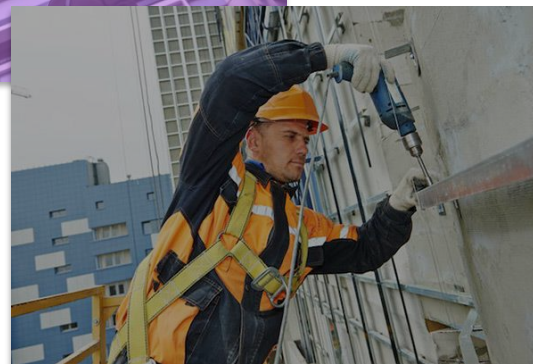
## General Contractor

Reducing installation time



## Owner

Reliable and durable solution  
Energy efficiency



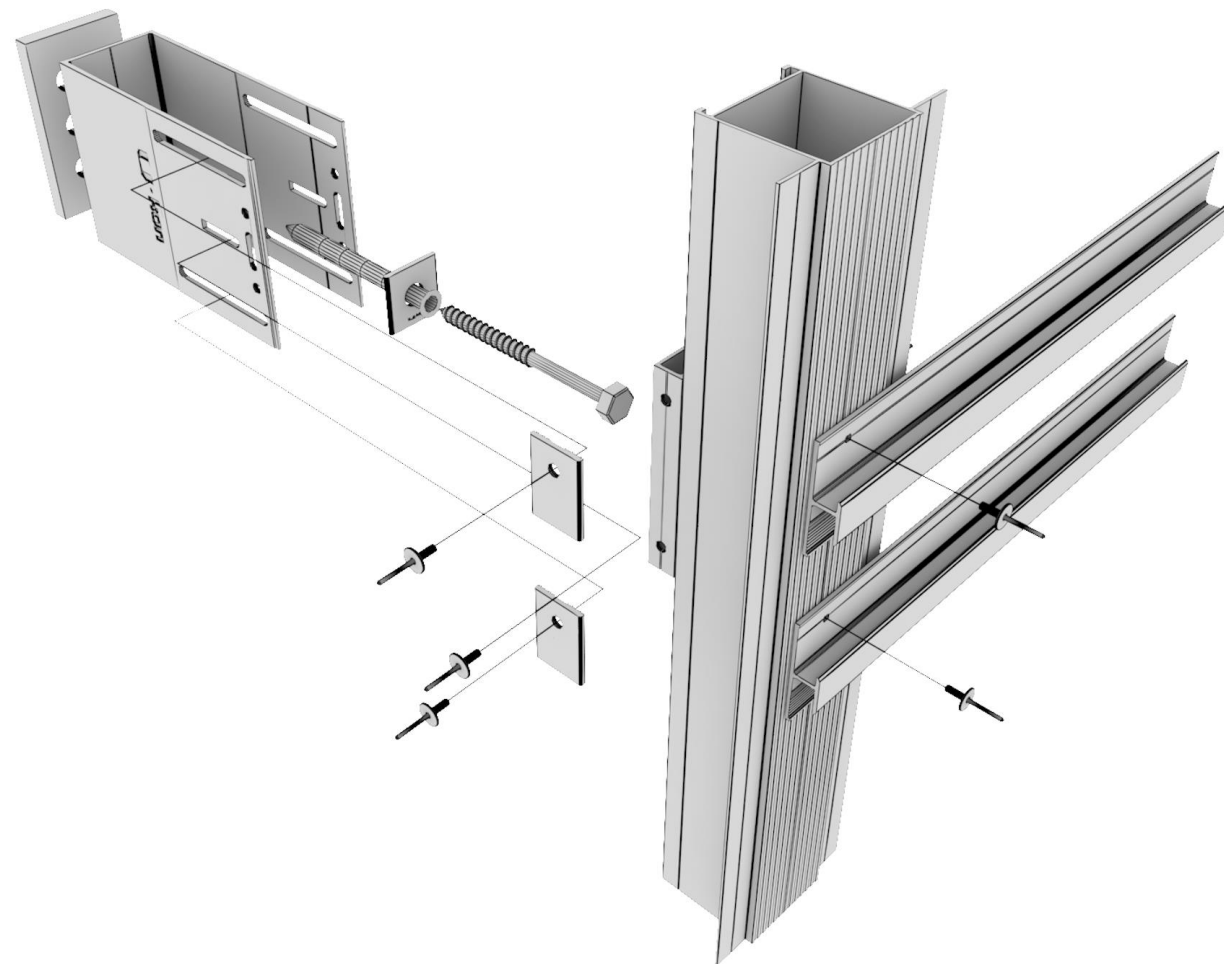
## Cladding installer

Simple and fast to install the system.  
Light-weight of the system. Technical support



# Engineered rainscreen attachment system with kerf

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The system is designed for an invisible way of fastening the natural stone. The cladding is fixed to the system of vertical and horizontal profiles. Stone panels are installed on horizontal girts, for which in the lower and upper ends of the panel the cut is made, where installing special horizontal profiles is set.



# Engineered rainscreen attachment system with kerf

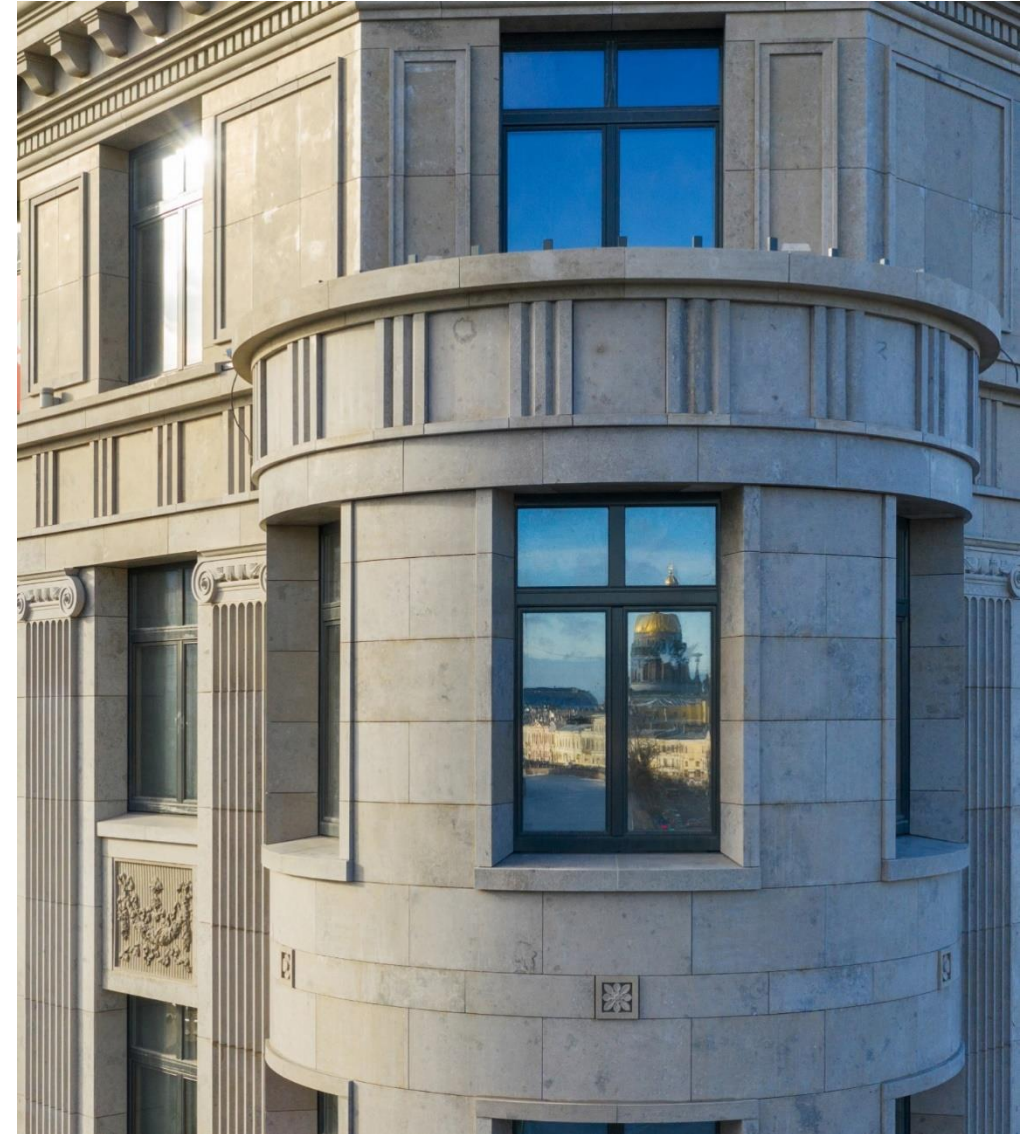
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# Engineered rainscreen attachment system with kerf

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# Engineered rainscreen attachment system with kerf

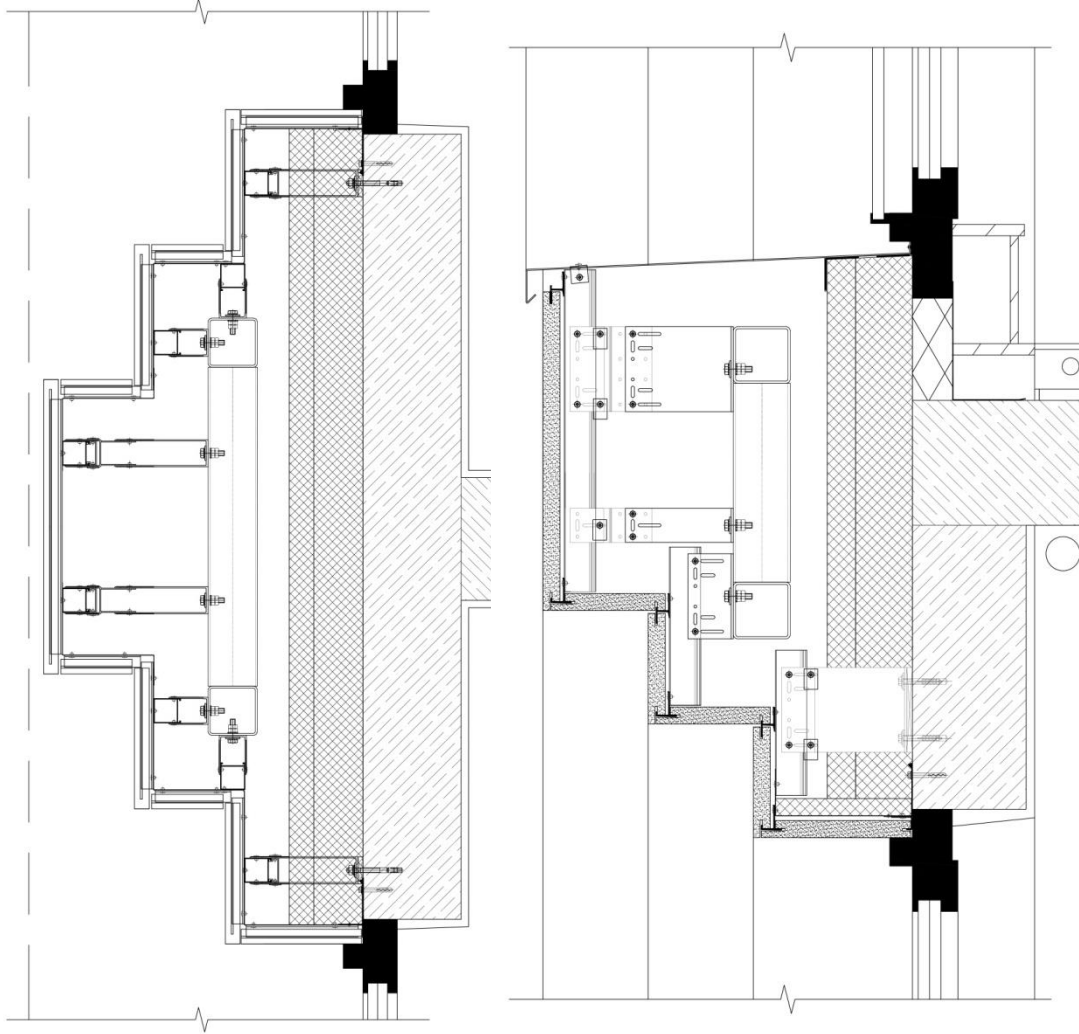
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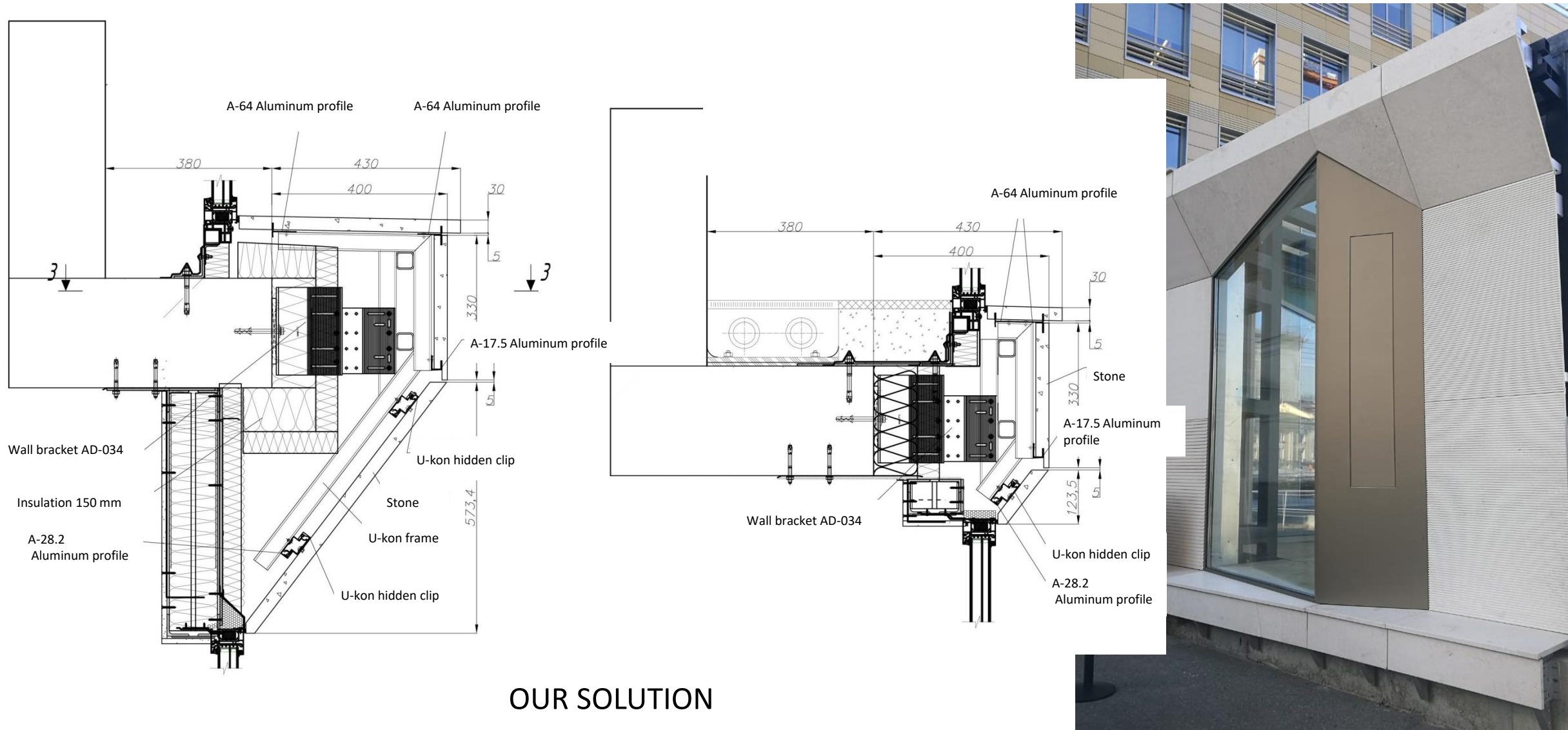


# Engineered rainscreen attachment system with kerf

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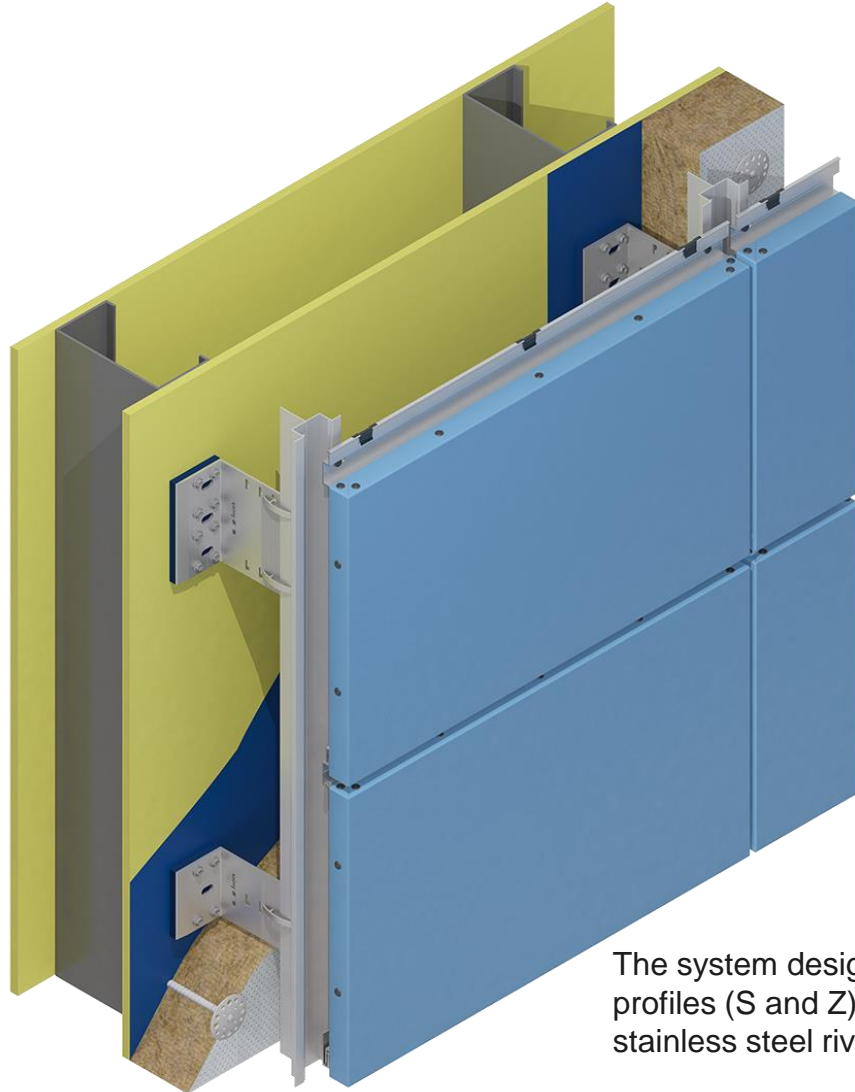
# Engineered rainscreen attachment system with kerf



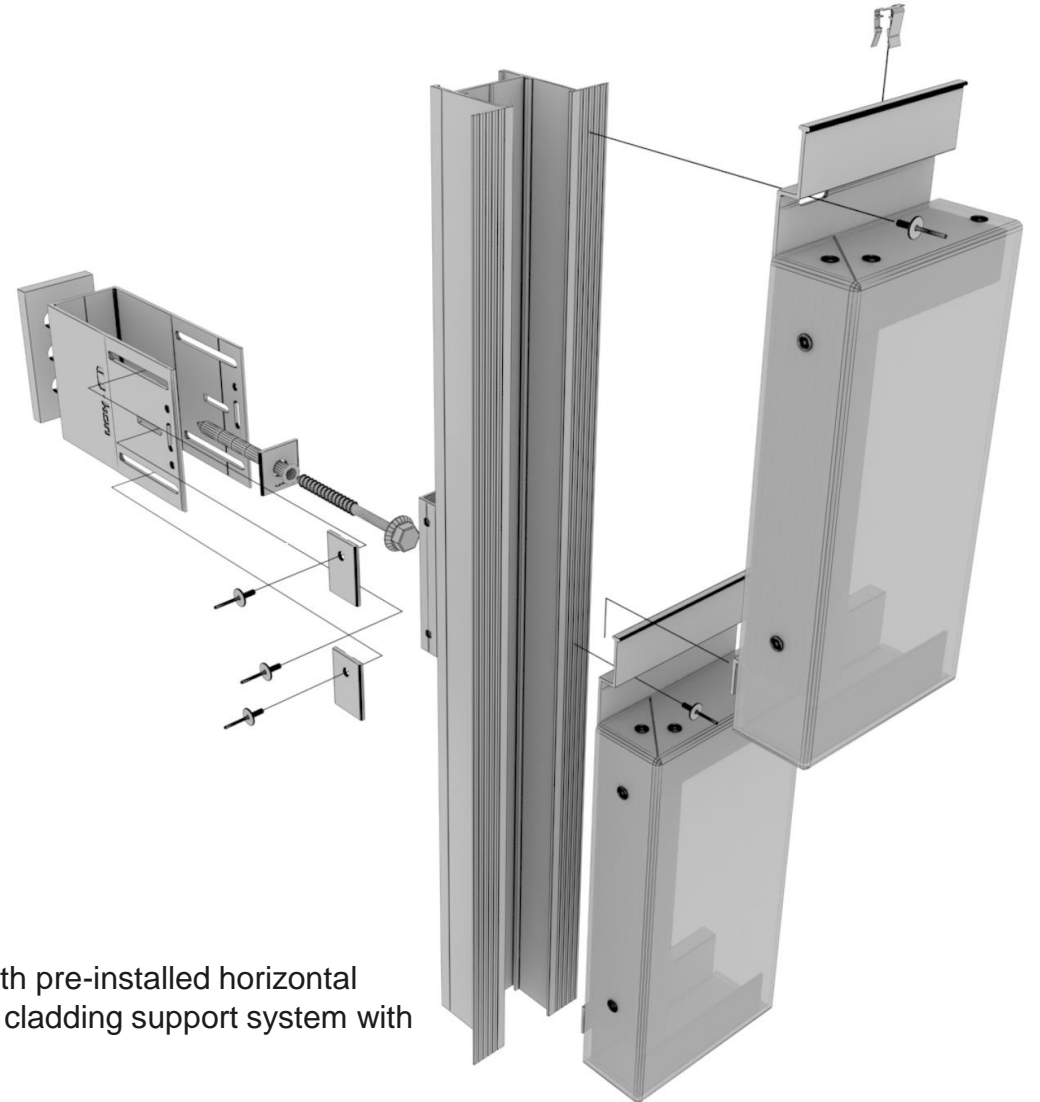
OUR SOLUTION

# Engineered rainscreen attachment system for ACM

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The system designed for cassettes with pre-installed horizontal profiles (S and Z) that fastened to the cladding support system with stainless steel rivets or screws.





# Engineered rainscreen attachment system for ACM

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# Engineered rainscreen attachment system for ACM

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# Engineered rainscreen attachment system for ACM

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# Engineered rainscreen attachment system for ACM

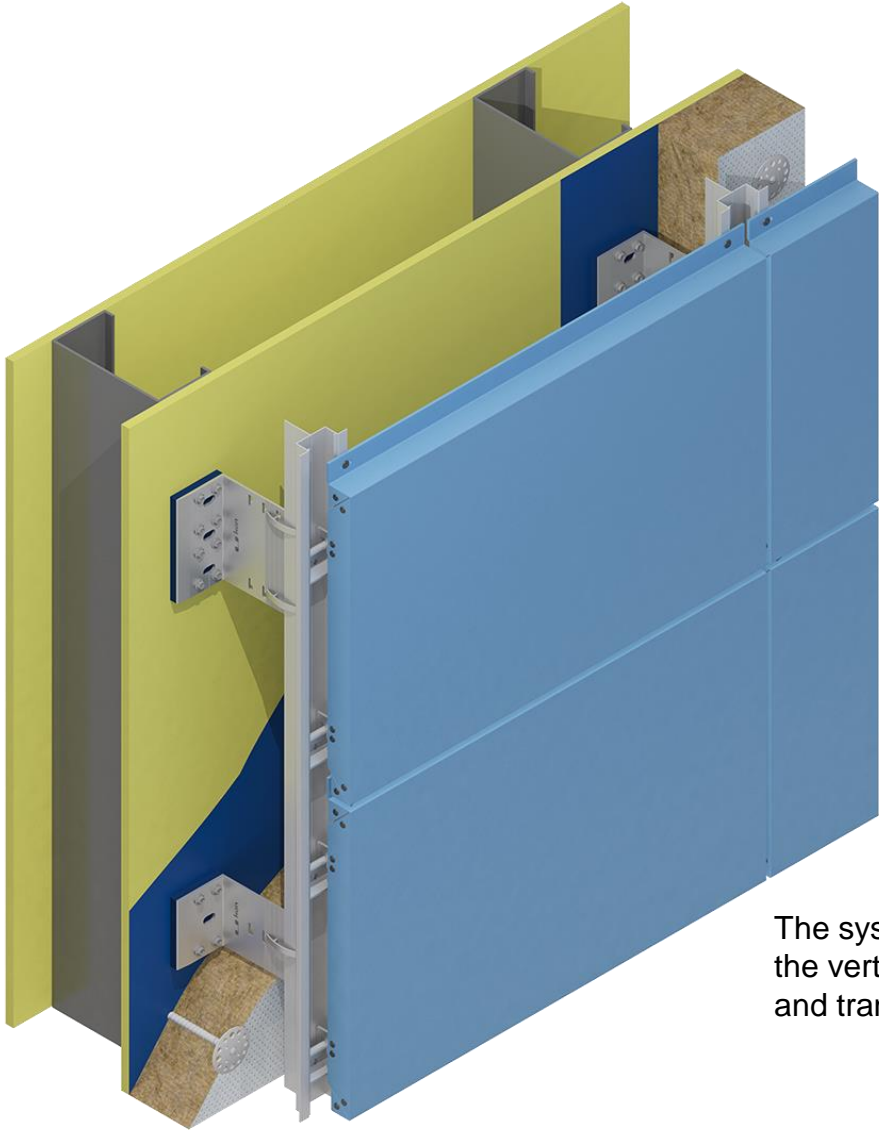
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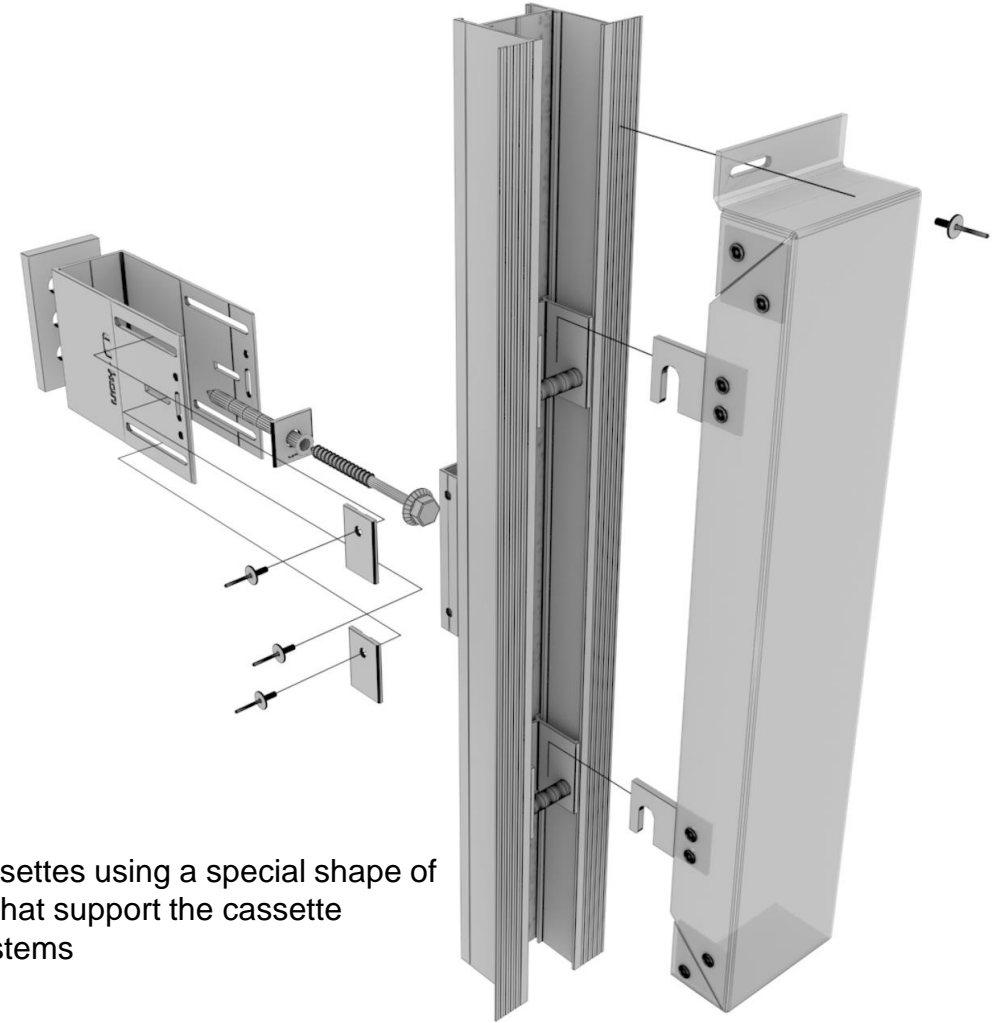


# Engineered rainscreen attachment system for ACM

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The system is designed for secret fix cassettes using a special shape of the vertical profile and a sliding bolt and that support the cassette and transfers the load to the cladding systems





# Engineered rainscreen attachment system for ACM

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# Engineered rainscreen attachment system for ACM

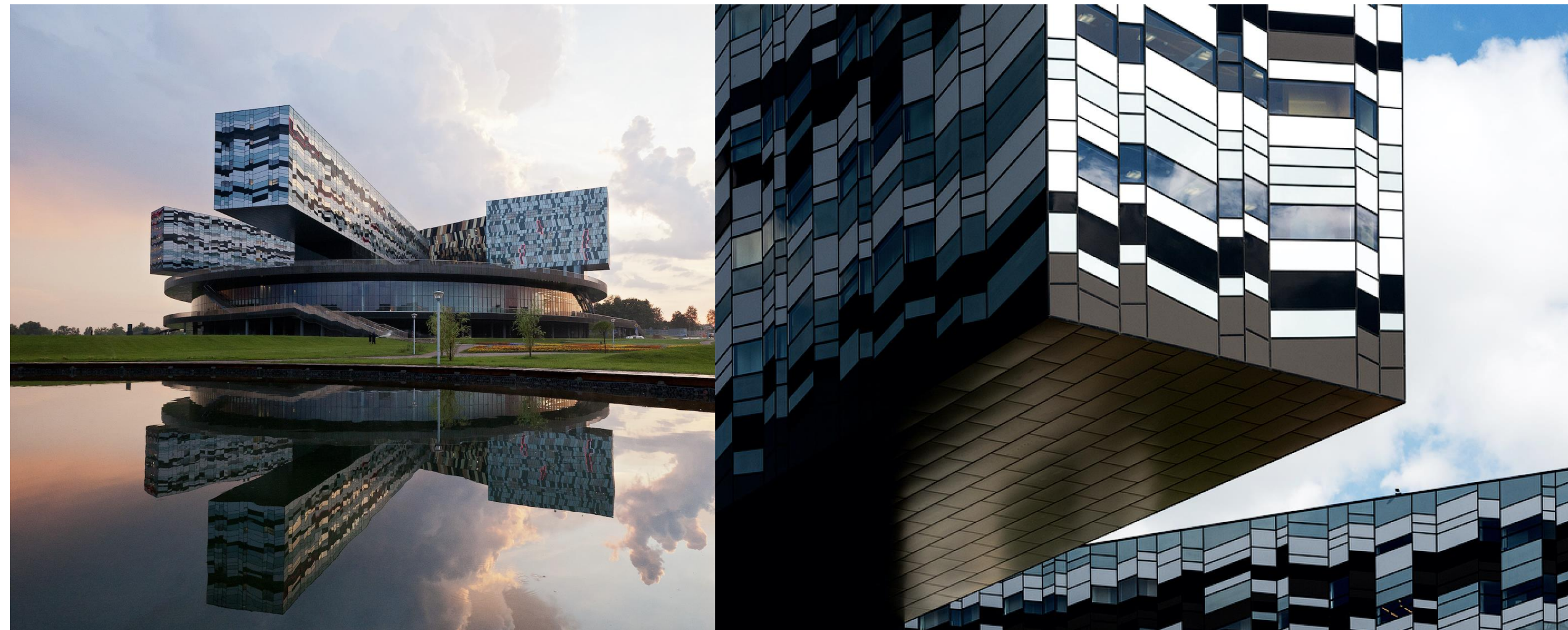
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# Engineered rainscreen attachment system for ACM

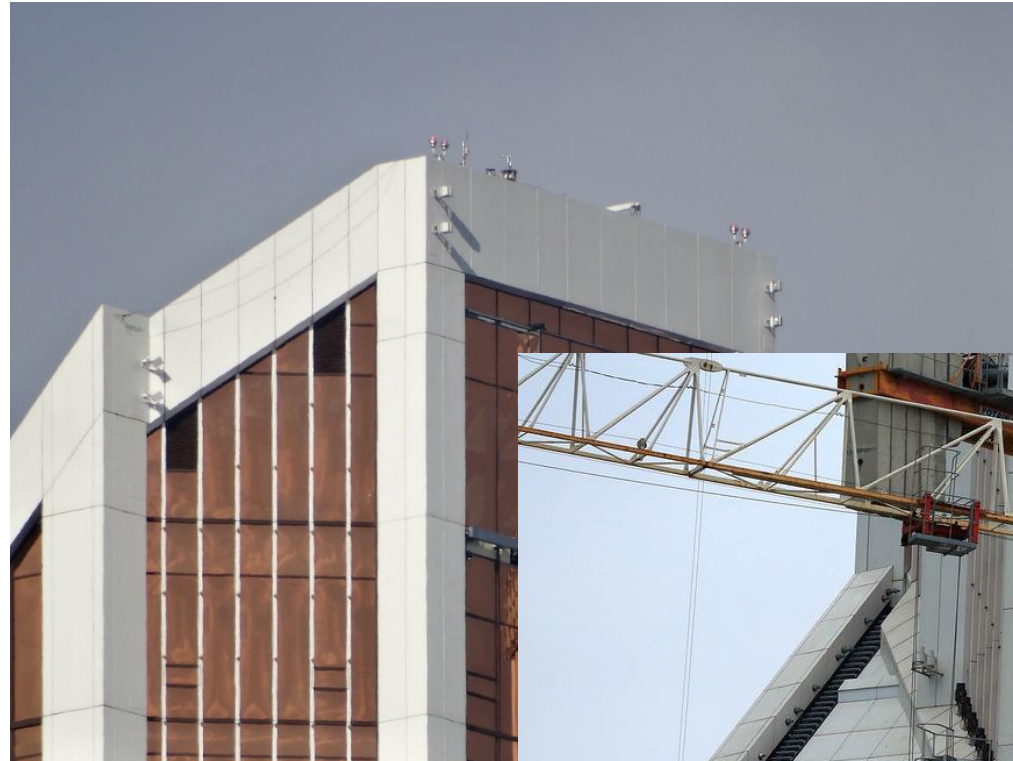
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# Engineered rainscreen attachment system for ACM

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# Engineered rainscreen attachment system for stone with pins

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The system is designed for the concealed way of fastening the natural stone. The cladding is fixed to the vertical profile with special stainless steel elements, which is installed into pre drilled holes in the stone. Preliminary, the hole is filled with sealant and a bushing is mounted in it to ensure the thermal deformations of the profiles.



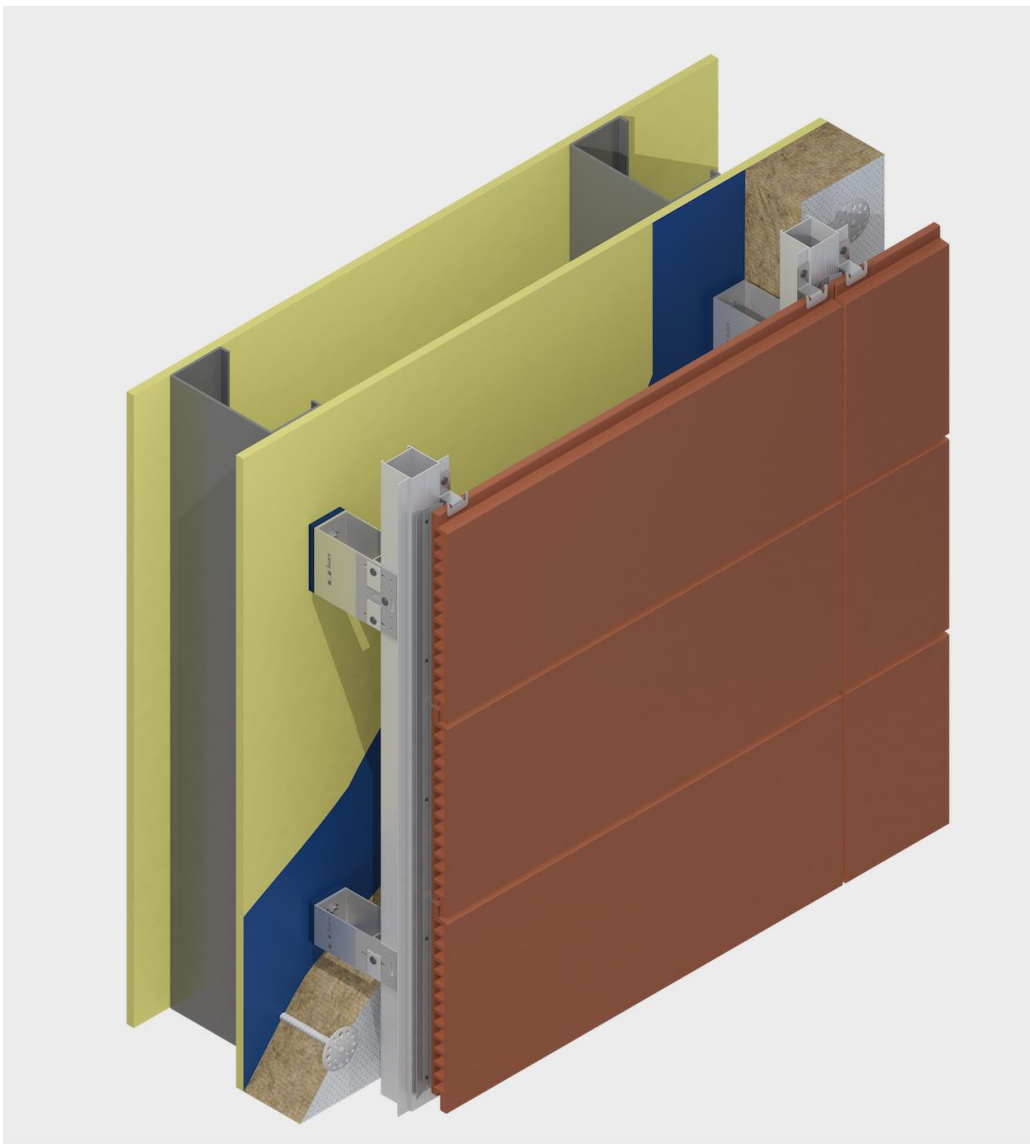


# Engineered rainscreen attachment system for stone with pins

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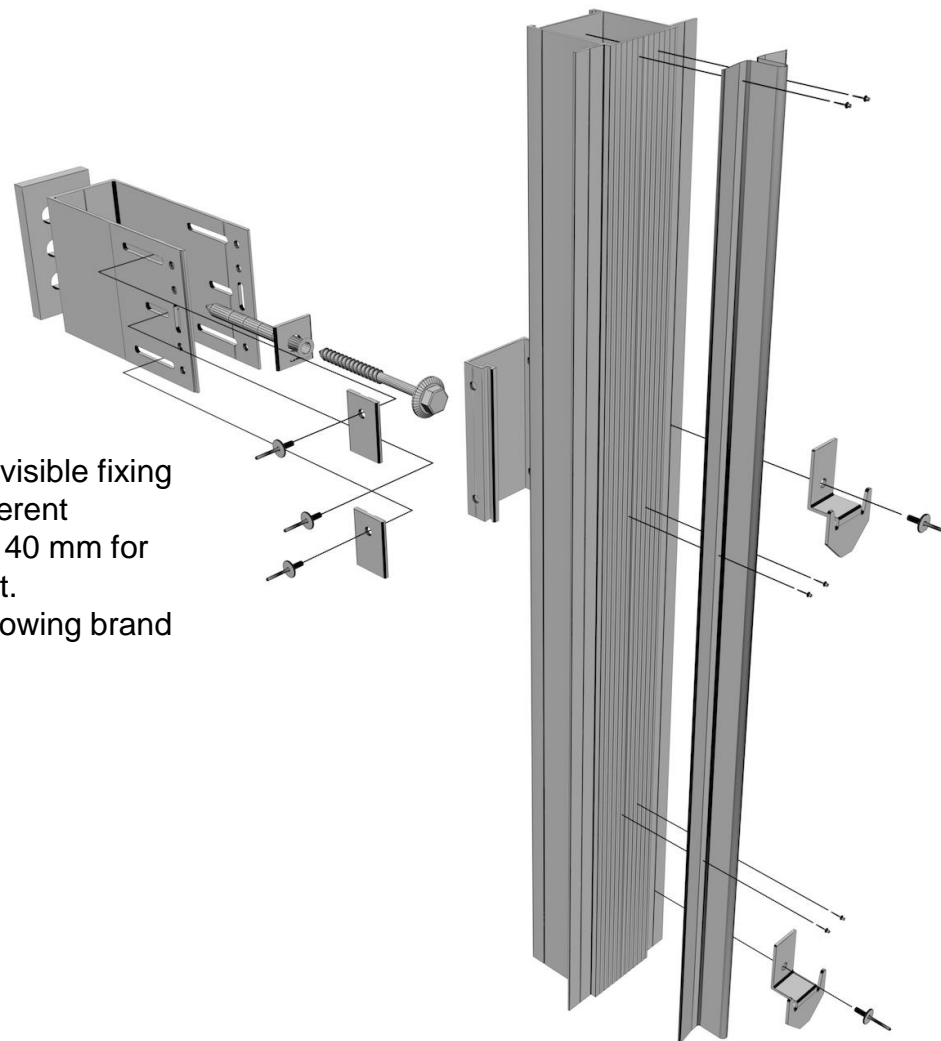
# Engineered rainscreen attachment system for terracotta



Systems are designed for invisible fixing of terracotta panels with different thicknesses from 8,5 mm to 40 mm for vertical and horizontal layout.

We provide a system for following brand of terracotta panels:

- AgGeTon
- Agrob Buchtal
- Ceramics Terracotta
- CN-ceramic
- Faveton
- Frontek
- Moeding
- NBK
- Tempio
- Terreal





# Engineered rainscreen attachment system for terracotta

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# Engineered rainscreen attachment system for terracotta

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# Engineered rainscreen attachment system for terracotta

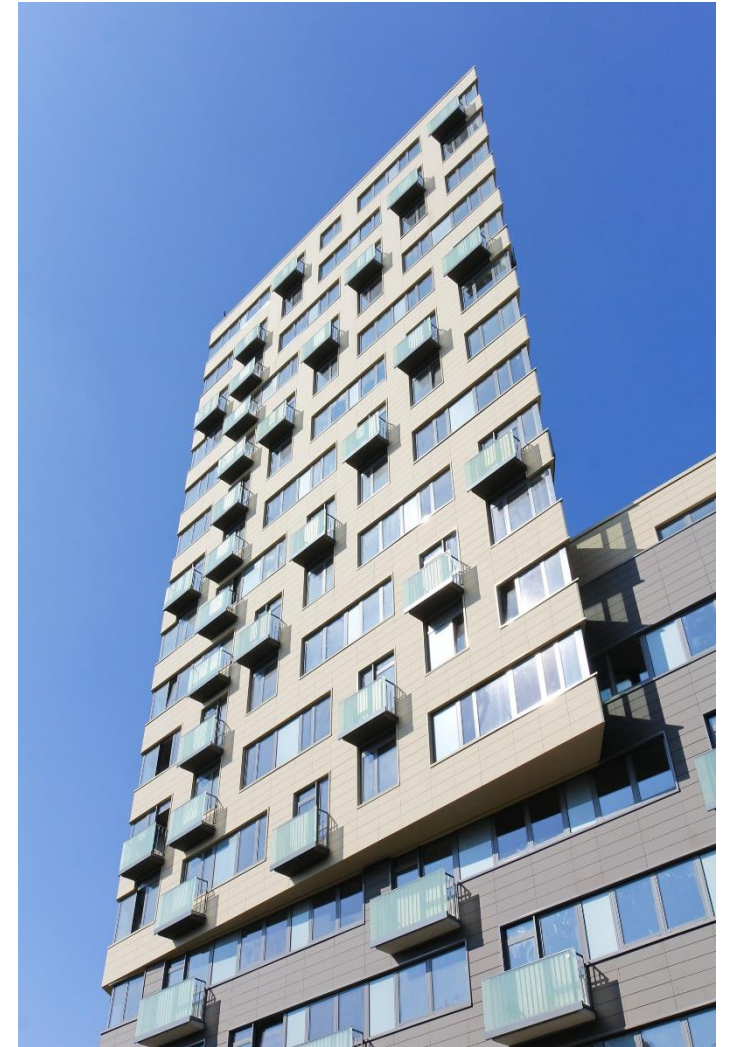
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# Engineered rainscreen attachment system for terracotta

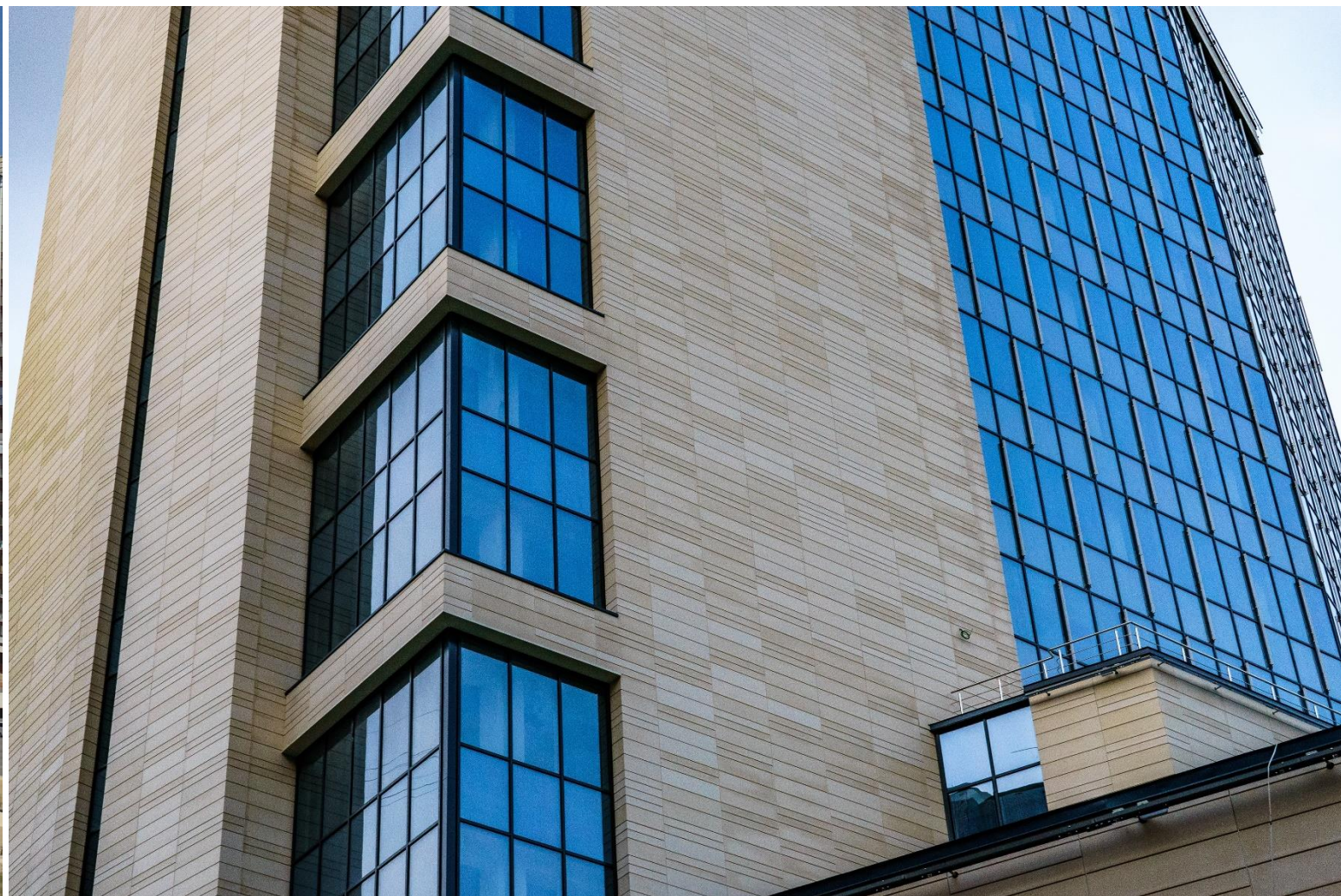
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# Engineered rainscreen attachment system for terracotta

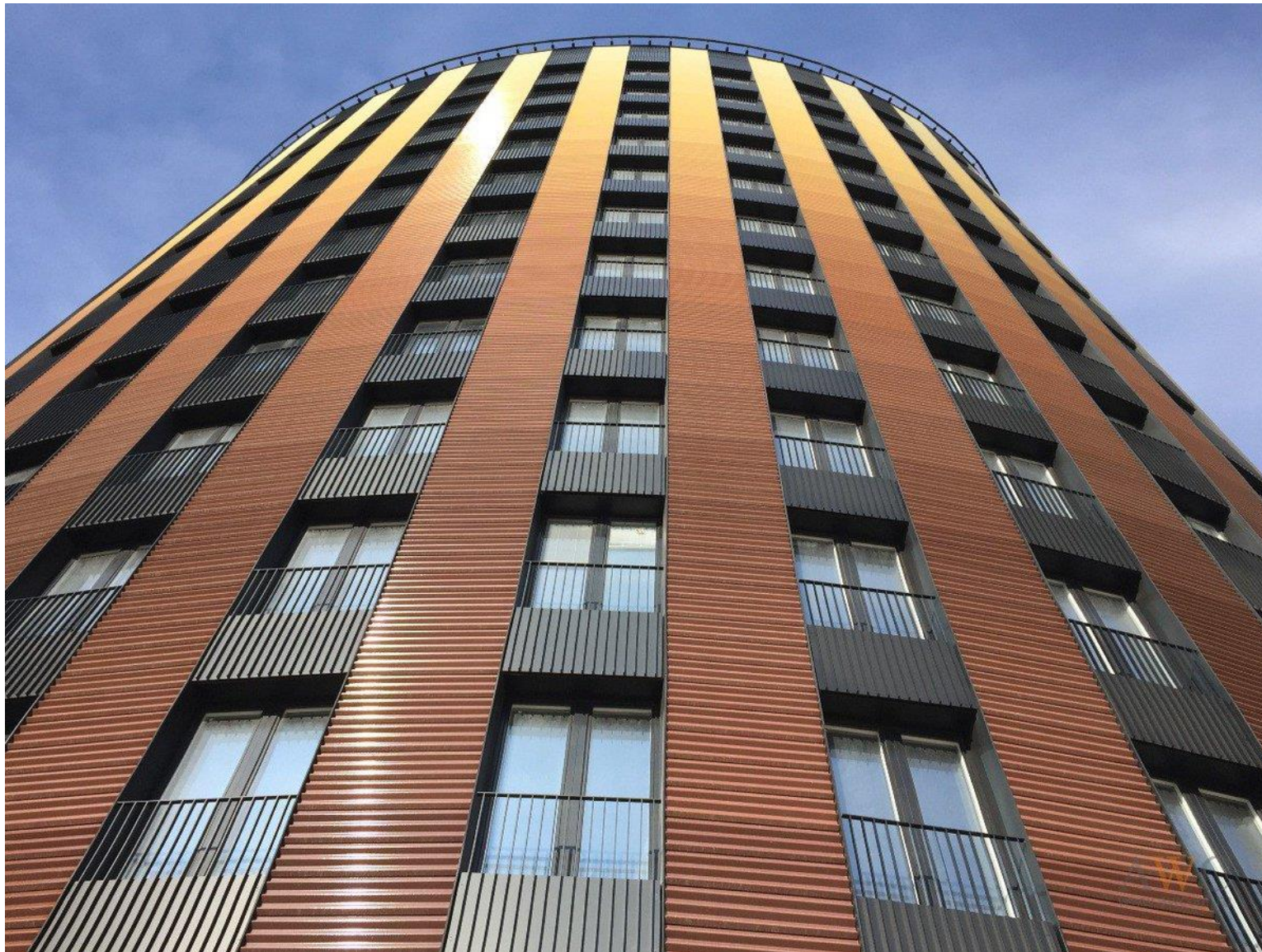
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# Engineered rainscreen attachment system for terracotta

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# Engineered rainscreen attachment system for terracotta

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# Engineered rainscreen attachment system for terracotta

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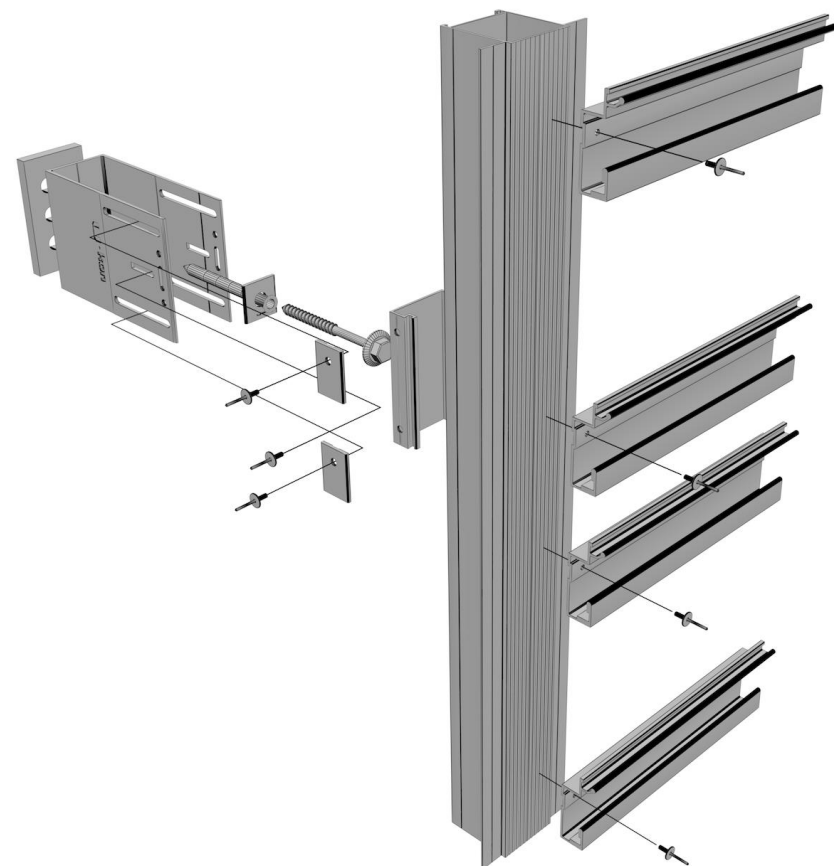
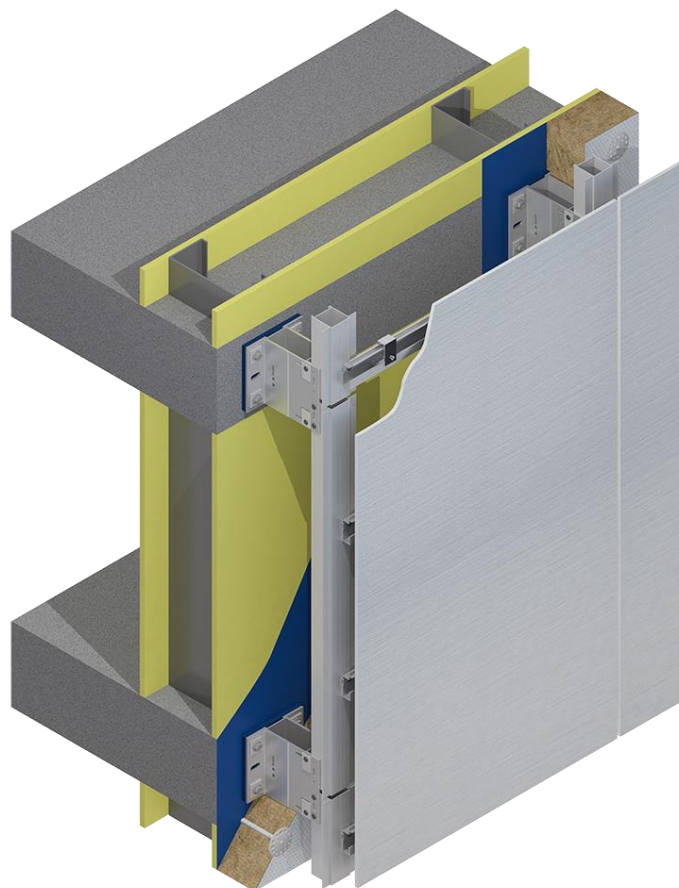
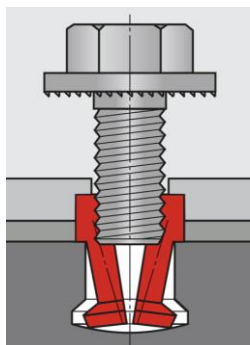
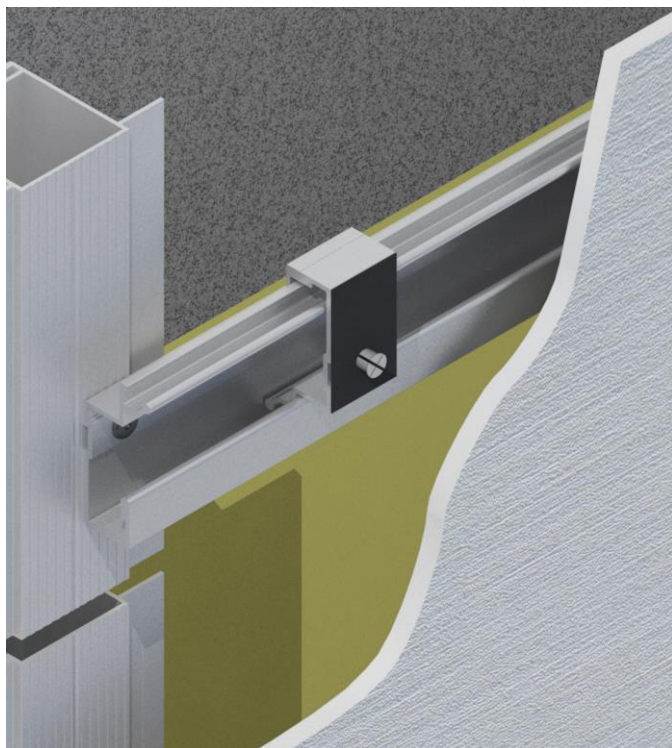
# Engineered rainscreen attachment system for terracotta

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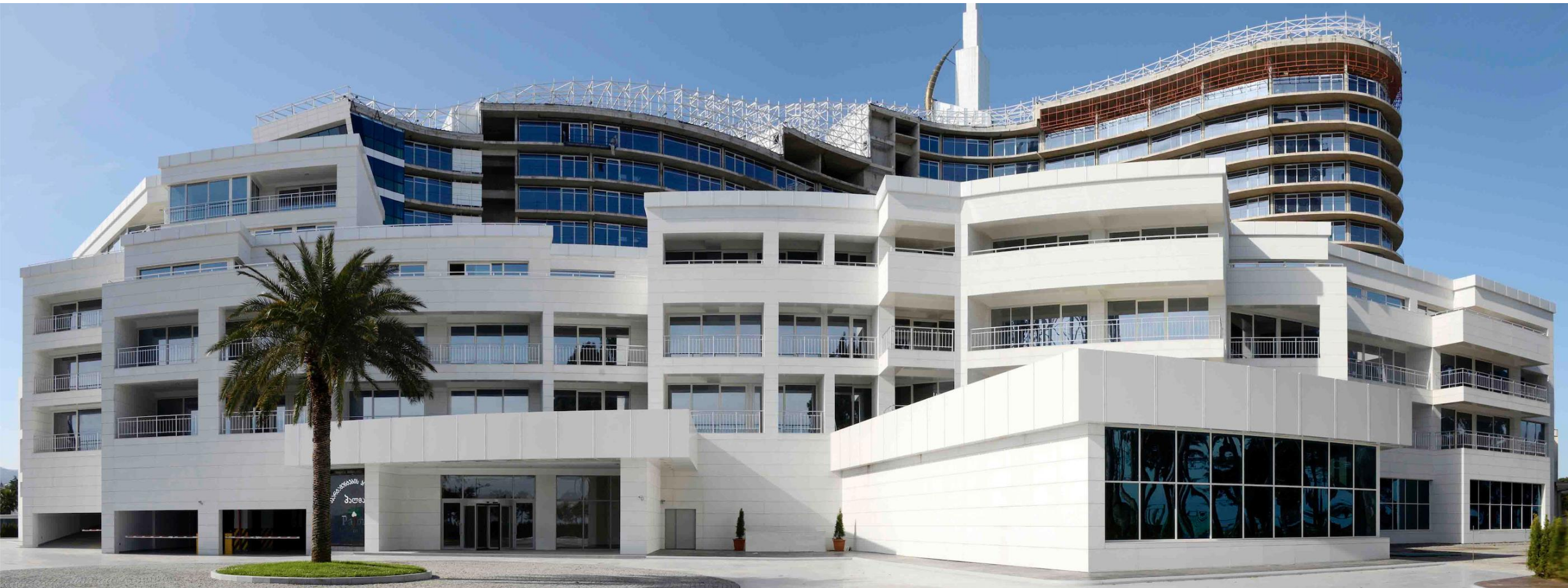
# Engineered rainscreen attachment system with undercut anchors



The system is designed for invisible fixing of ceramic, porcelain, HPL and fiber cement panels using special undercut technology. The hangers are fastened with an undercut anchor on the backside of the panel. These are mounted on a horizontal profile, which also has been specially developed for this type of method.

# Engineered rainscreen attachment system with undercut anchors

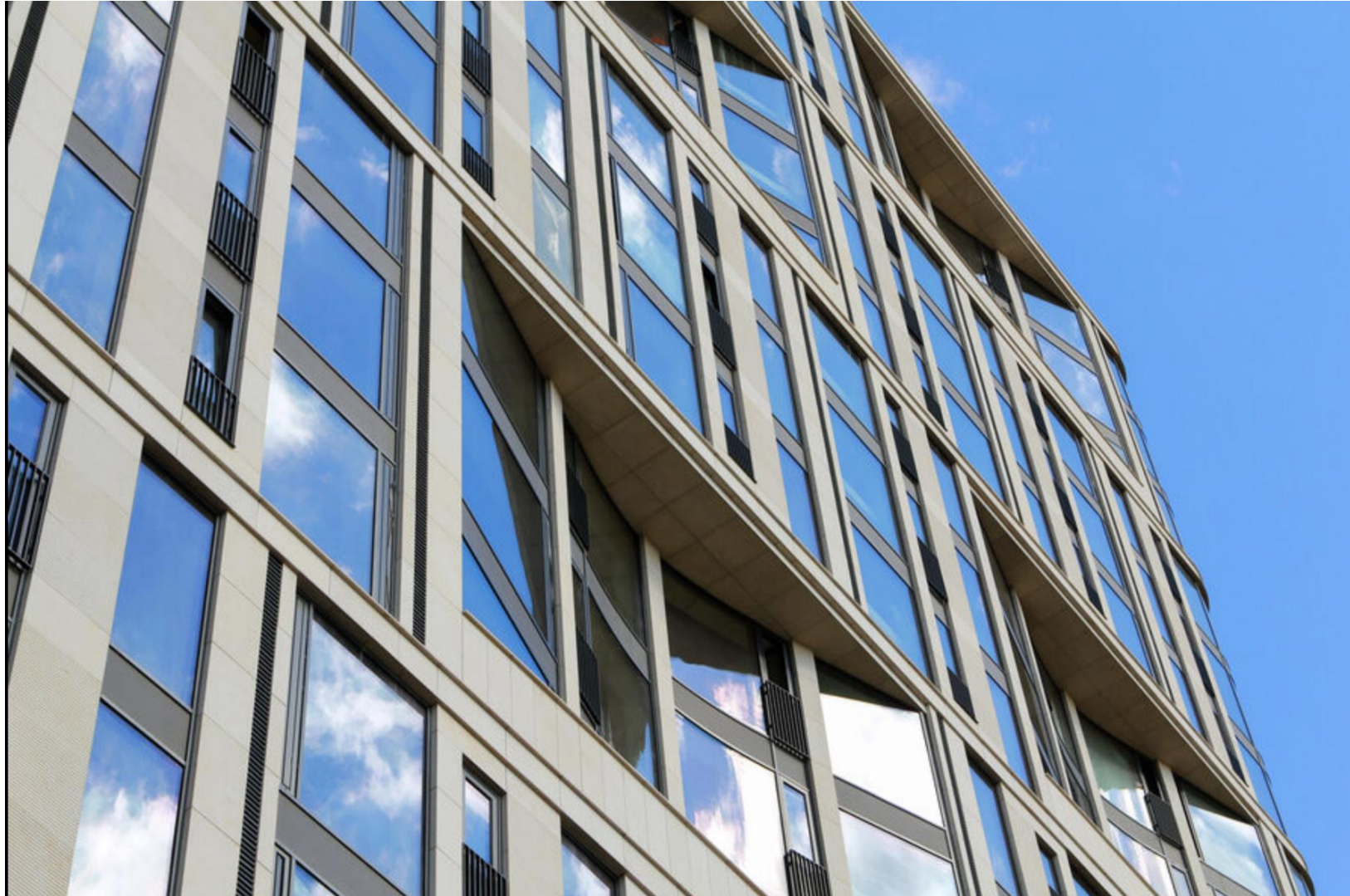
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# Engineered rainscreen attachment system with undercut anchors

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# Engineered rainscreen attachment system with undercut anchors

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# Engineered rainscreen attachment system with undercut anchors

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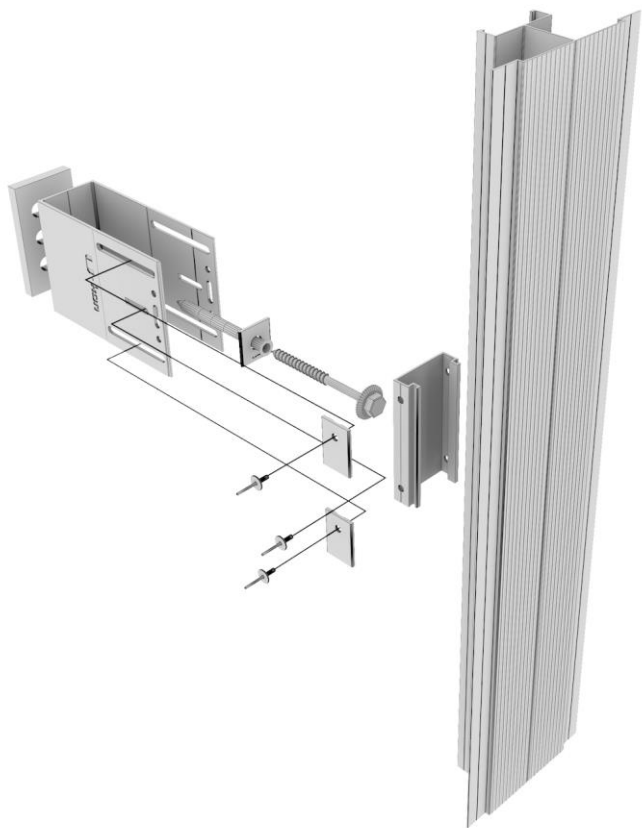
# Engineered rainscreen attachment system with undercut anchors

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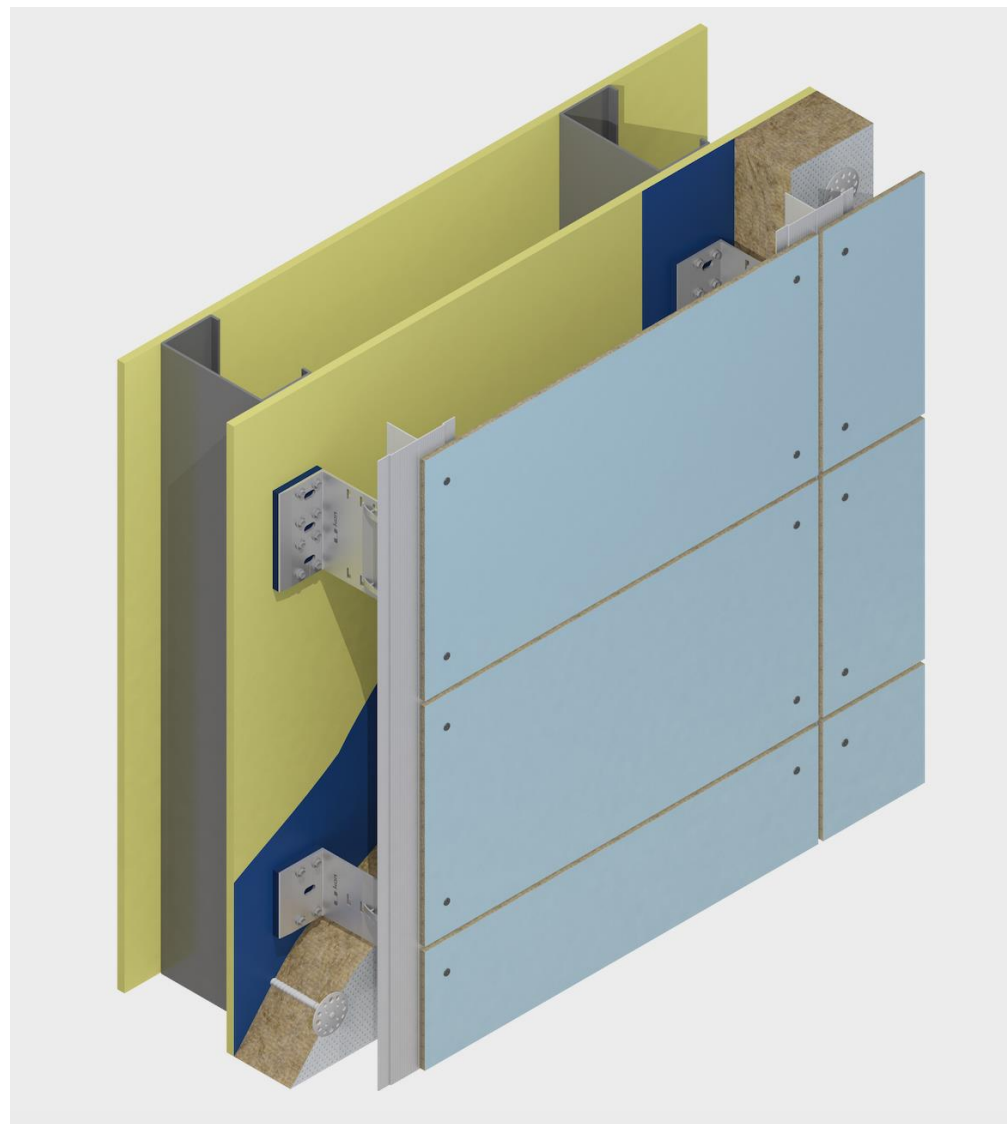


# Engineered rainscreen attachment system with visual fasteners

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The system is a simple, economical and frequently used system for visible fixing of flat facade material like aluminum composite panels, sheets, HPL, fiber cement corrugated and standing seam metal panels. The material is attached with rivets or screws to vertical holding aluminum profiles. The visible profile surfaces are available in matching color upon request.





# Engineered rainscreen attachment system with visual fasteners

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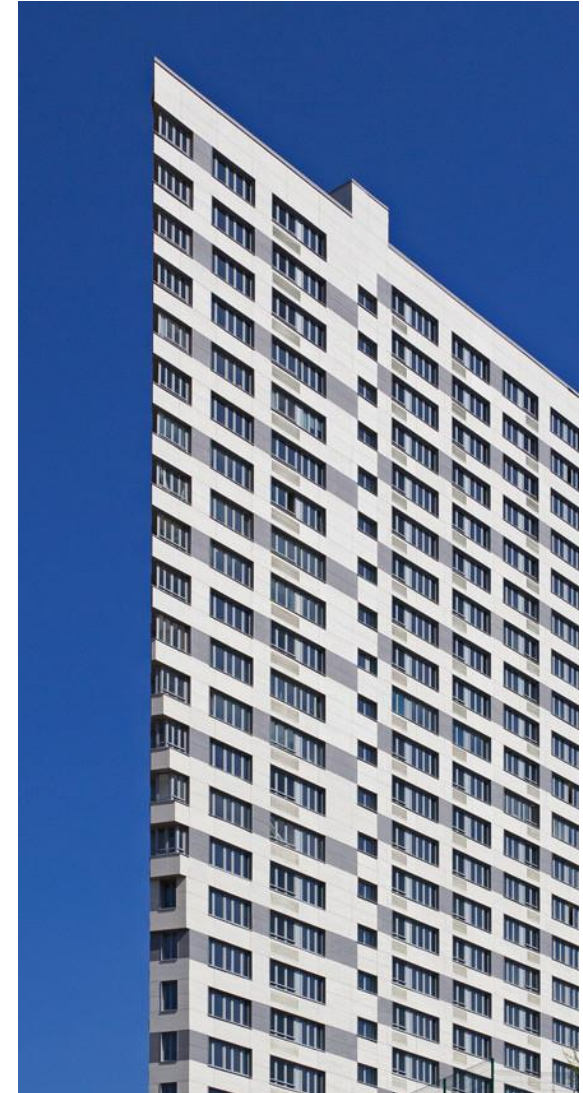
# Engineered rainscreen attachment system with visual fasteners

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# Engineered rainscreen attachment system with visual fasteners

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# Engineered rainscreen attachment system with visual fasteners

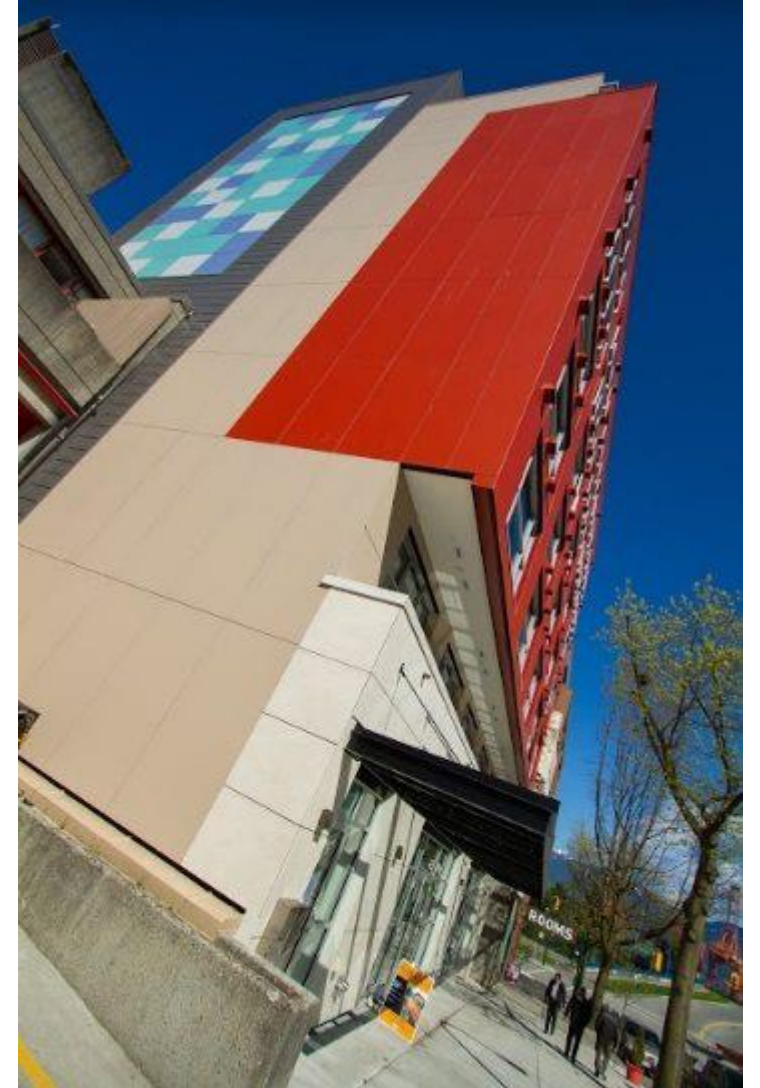
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# Engineered rainscreen attachment system with visual fasteners

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# Engineered rainscreen attachment system with visual fasteners

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# Engineered rainscreen attachment system with visual fasteners

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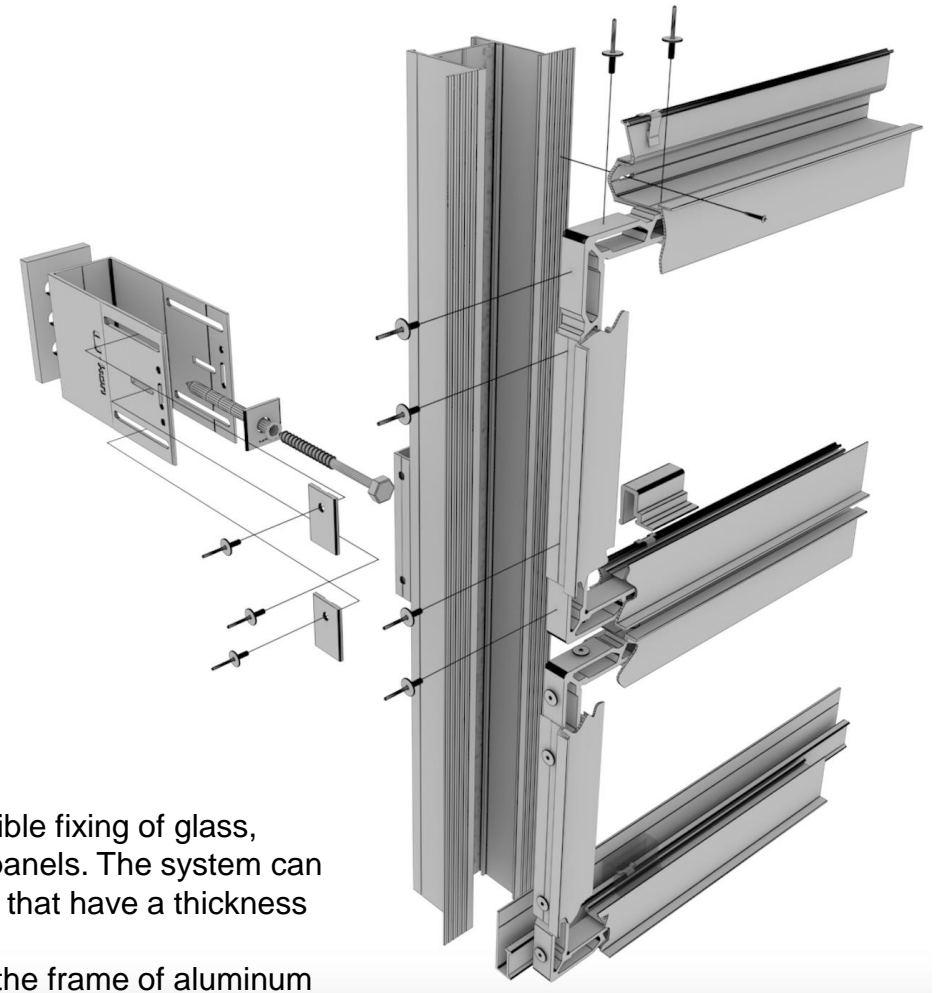
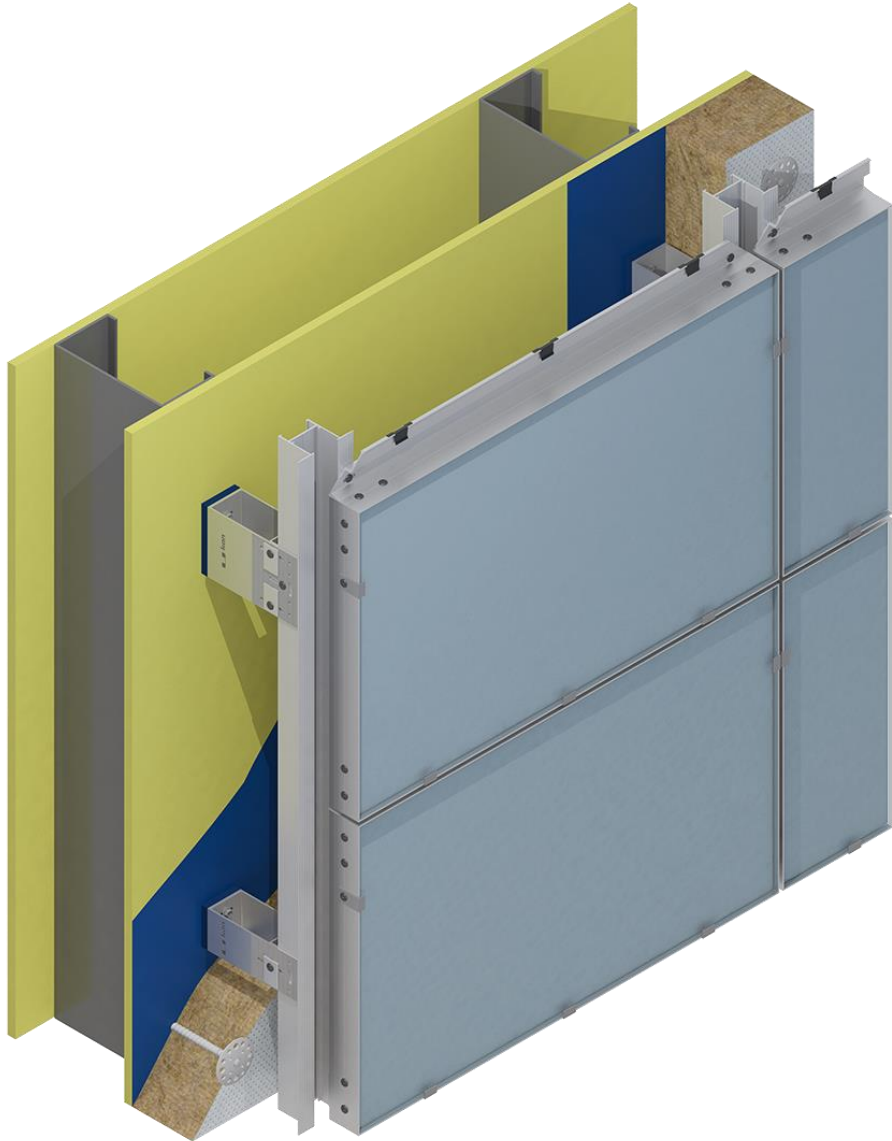
# Engineered rainscreen attachment system with visual fasteners

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# Engineered rainscreen attachment system with support aluminum frame

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This system is designed for invisible fixing of glass, ceramic, and photovoltaic solar panels. The system can withhold a large format of panels that have a thickness between 3.5 mm to 8 mm. The cladding panel is glued into the frame of aluminum profiles. Special stainless steel safety clips are installed around the perimeter of the cladding panel.



# Engineered rainscreen attachment system with support aluminum frame

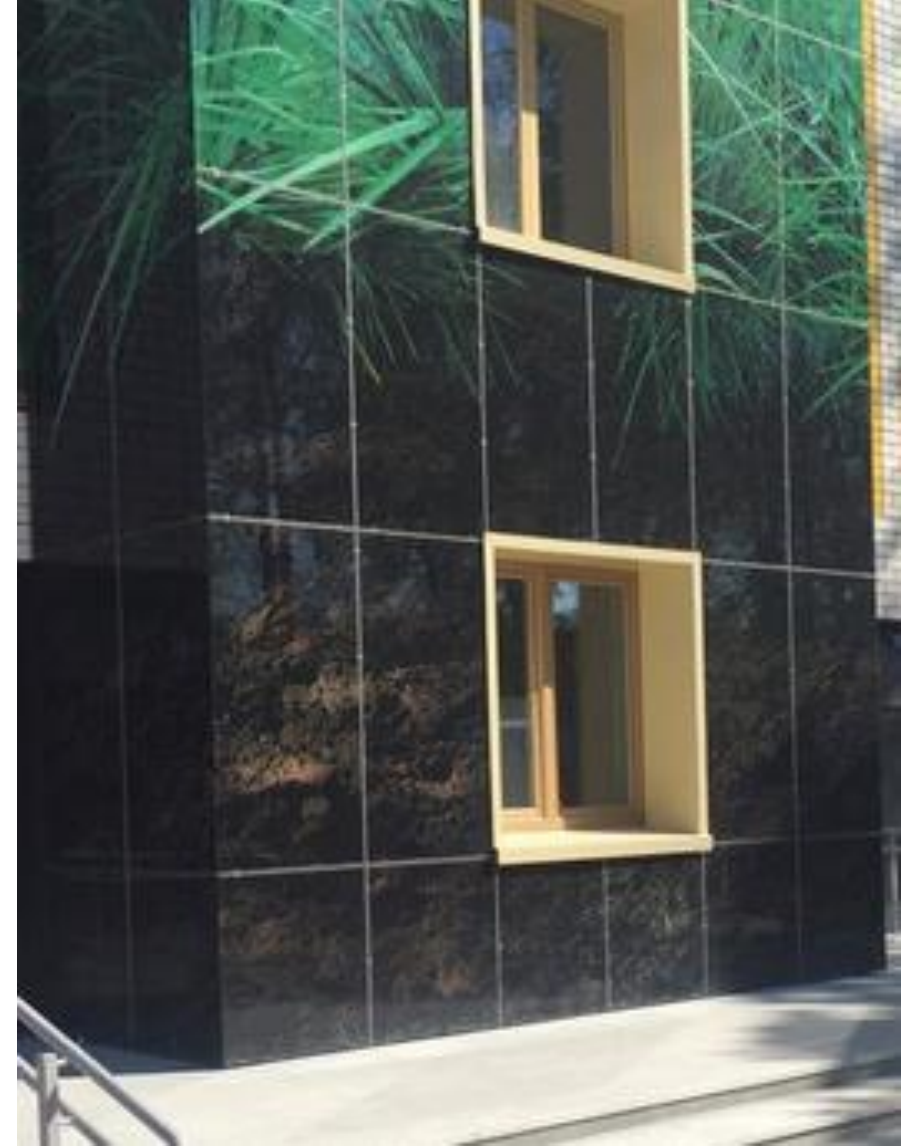
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# Engineered rainscreen attachment system with support aluminum frame

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# Engineered rainscreen attachment system with support aluminum frame

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# Engineered rainscreen attachment system with support aluminum frame

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# Engineered rainscreen attachment system with support aluminum frame

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# Engineered rainscreen attachment system with support aluminum frame

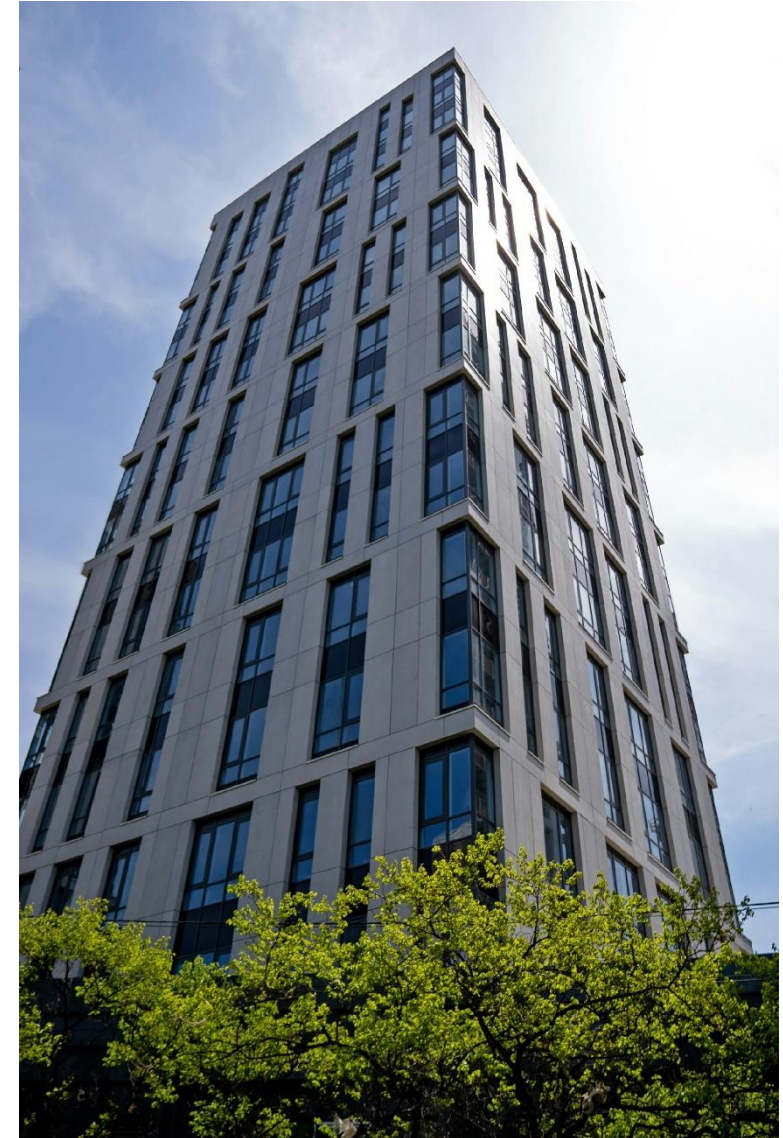
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# Engineered rainscreen attachment system with support aluminum frame

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# Engineered rainscreen attachment system with support aluminum frame

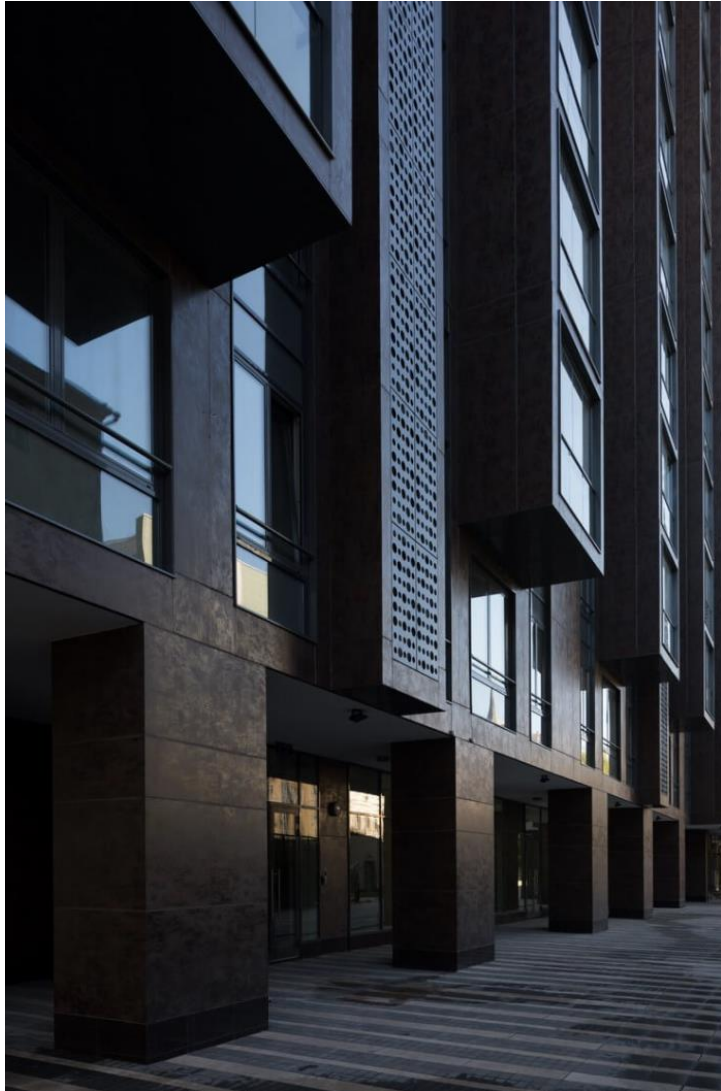
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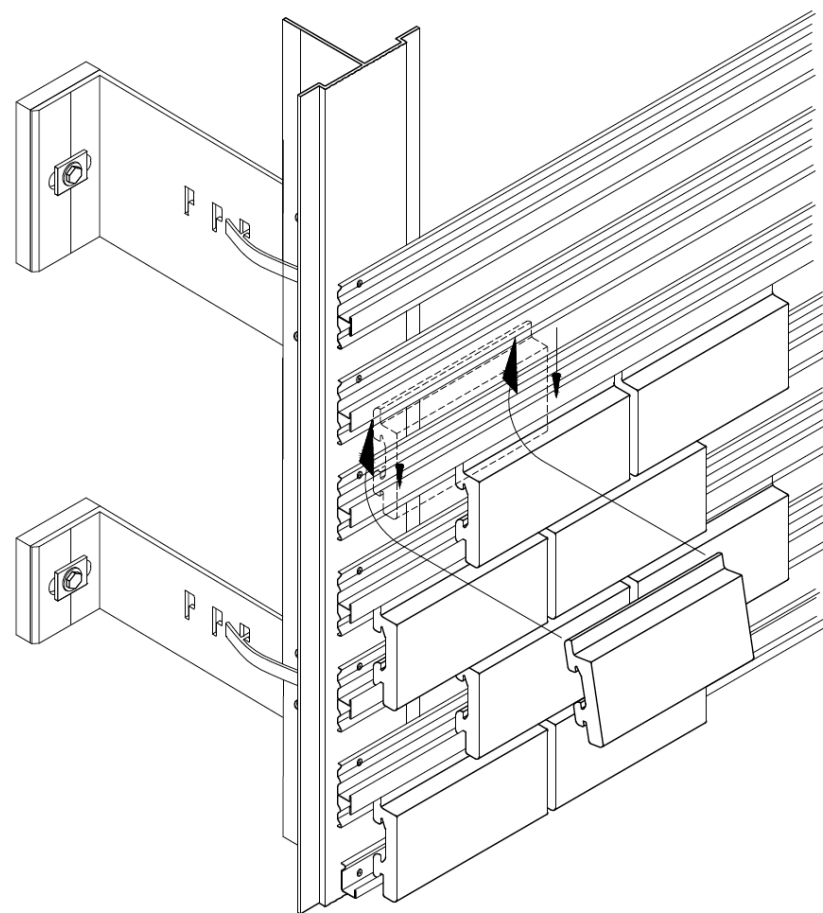
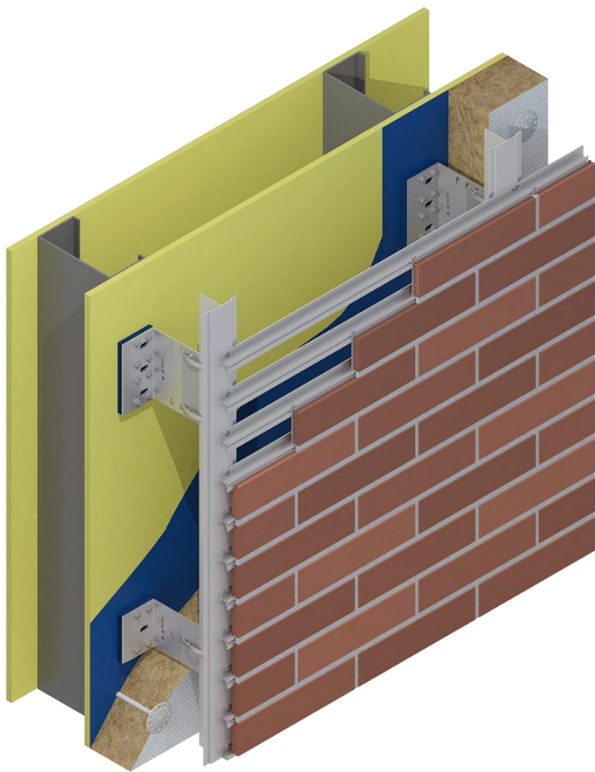
# Engineered rainscreen attachment system with support aluminum frame

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# Engineered rainscreen attachment system for clinker veneer

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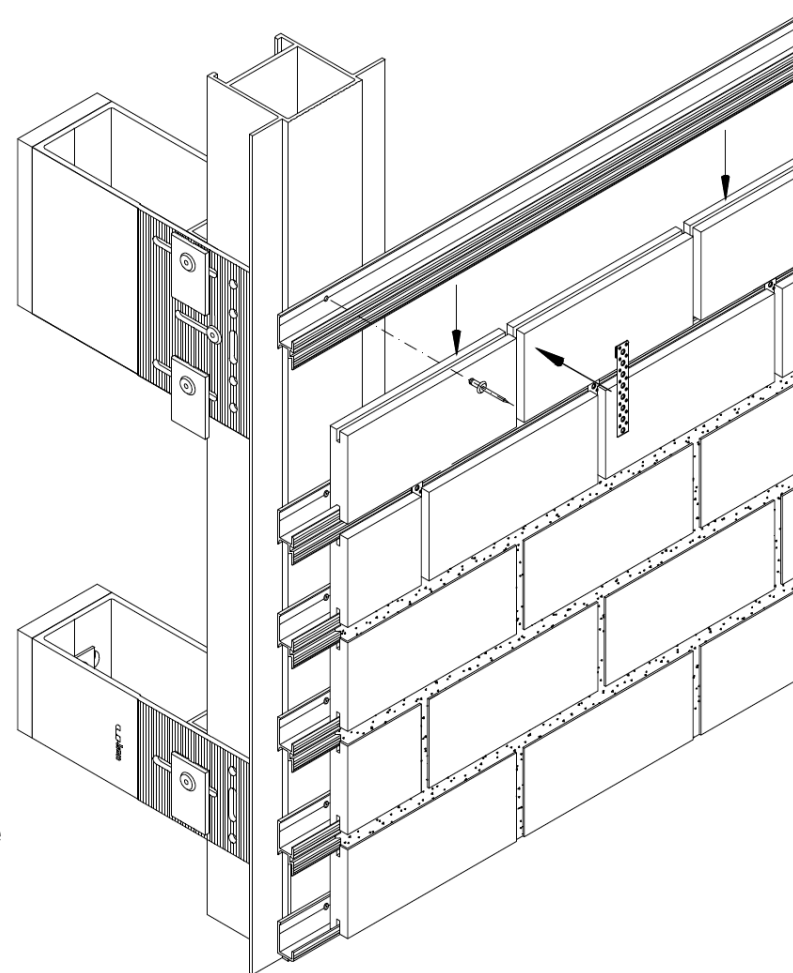
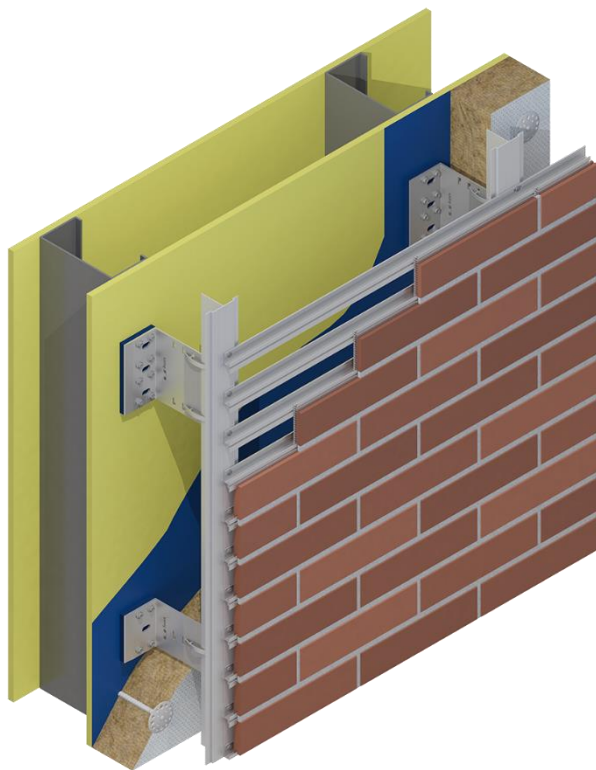
This system is designed for invisible fixing of thin brick. The brick veneer can be installed with or without grouting.

Brick veneer without grouting: Cladding panels are installed on horizontal rails, the shelves of which engage with grooves in the horizontal ends of the panels. Horizontal and vertical seams overlap shelves of plates.



# Engineered rainscreen attachment system for clinker veneer

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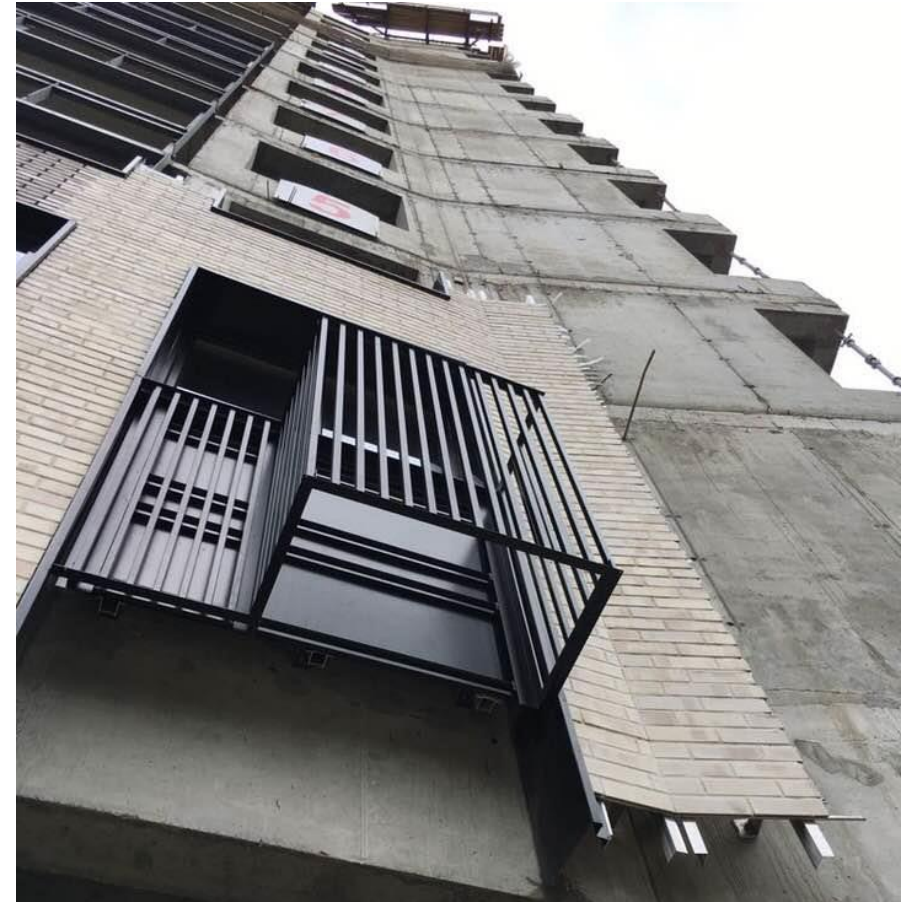


This system is designed for invisible fixing of thin brick. The brick veneer can be installed with or without grouting.

Brick veneer with grouting: Cladding panels are installed on horizontal girts, the shelves of which are engaged with grooves in the horizontal ends of the panels. At the same time, perforated tapes are installed in horizontal and vertical seams. Grouting is done with special mortar.

# Engineered rainscreen attachment system for clinker veneer

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# Engineered rainscreen attachment system for clinker veneer

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# Engineered rainscreen attachment system for clinker veneer

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# Engineered rainscreen attachment system for clinker veneer

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# Engineered rainscreen attachment system for clinker veneer

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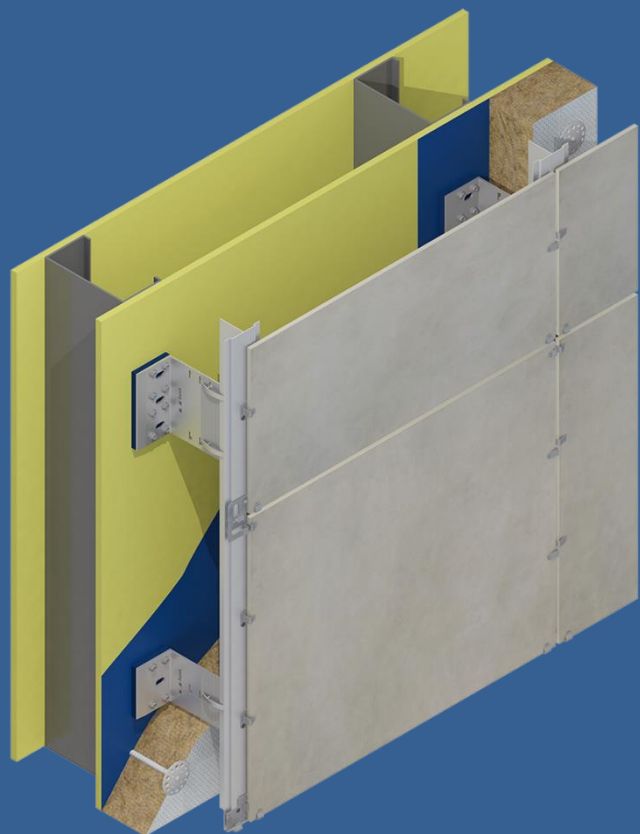




# Engineered rainscreen attachment system for clinker veneer

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SUMMARIZE



# DRAINED, BACK VENTILATED RAINSCREEN SYSTEMS - ADVANTAGES

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## **Esthetics:**

- A large variety of combinations of materials, surfaces, colours, shapes, joins.
- Possibilities to attach cladding panels in a visible or concealed manner



# DRAINED, BACK VENTILATED RAINSCREEN SYSTEMS - ADVANTAGES

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## **Sustainability /efficiency:**

- The rainscreen support systems are not very prone to damage
- The long service life of the façade
- Low cost of maintenance.
- Easy to disassemble
- Can be reused or recycled





# DRAINED, BACK VENTILATED RAINSCREEN SYSTEMS - ADVANTAGES

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## **Energy efficiency:**

- Protects building from heating in the summer, protects against cooling and loss of heat in the winter
- All energy-related building standards can be easily attained

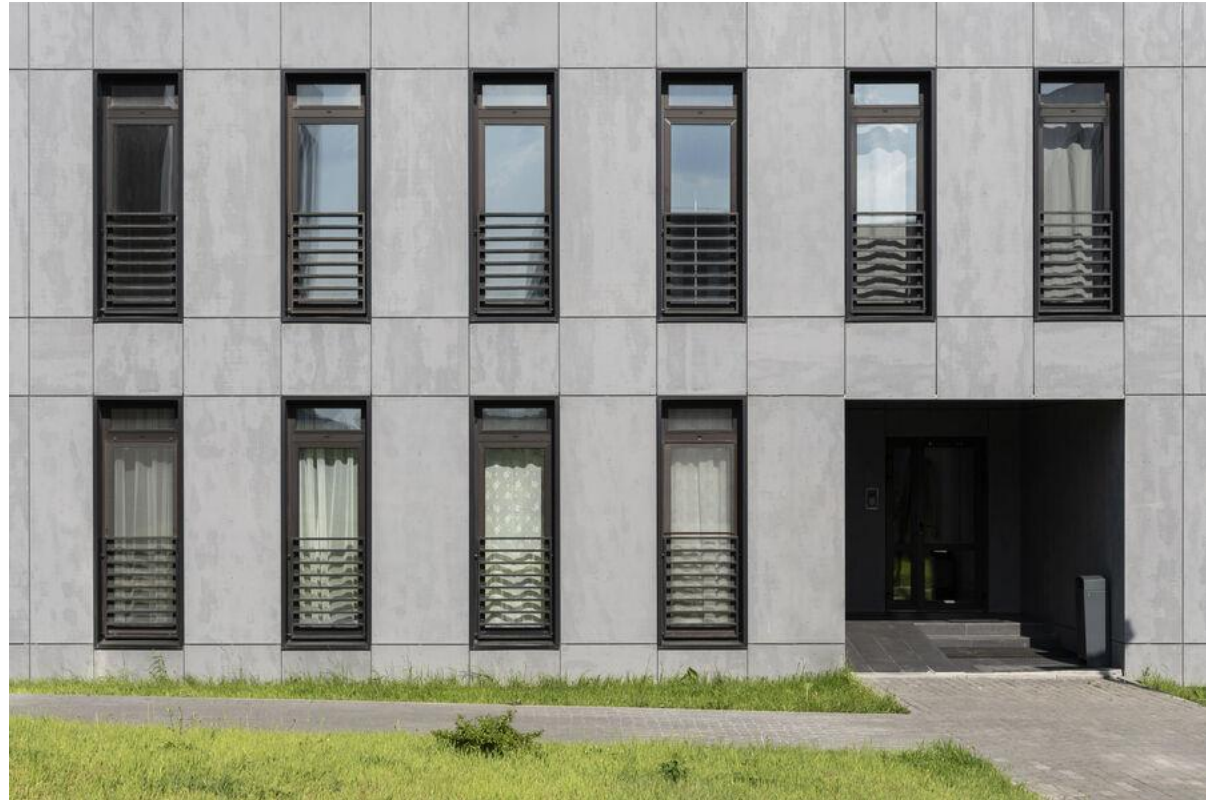


# DRAINED, BACK VENTILATED RAINSCREEN SYSTEMS - ADVANTAGES

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## **Design and structural benefits:**

- Simple tolerance compensation
- Possibilities to use any thickness of insulation materials. No limitation.
- Effective protection from rain and condensation
- Ability to use heavy cladding materials such as stone or concrete.





# Questions?

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Thank you for your  
attention!



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Questions or concerns about the content of this course should be directed to the program instructor.



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