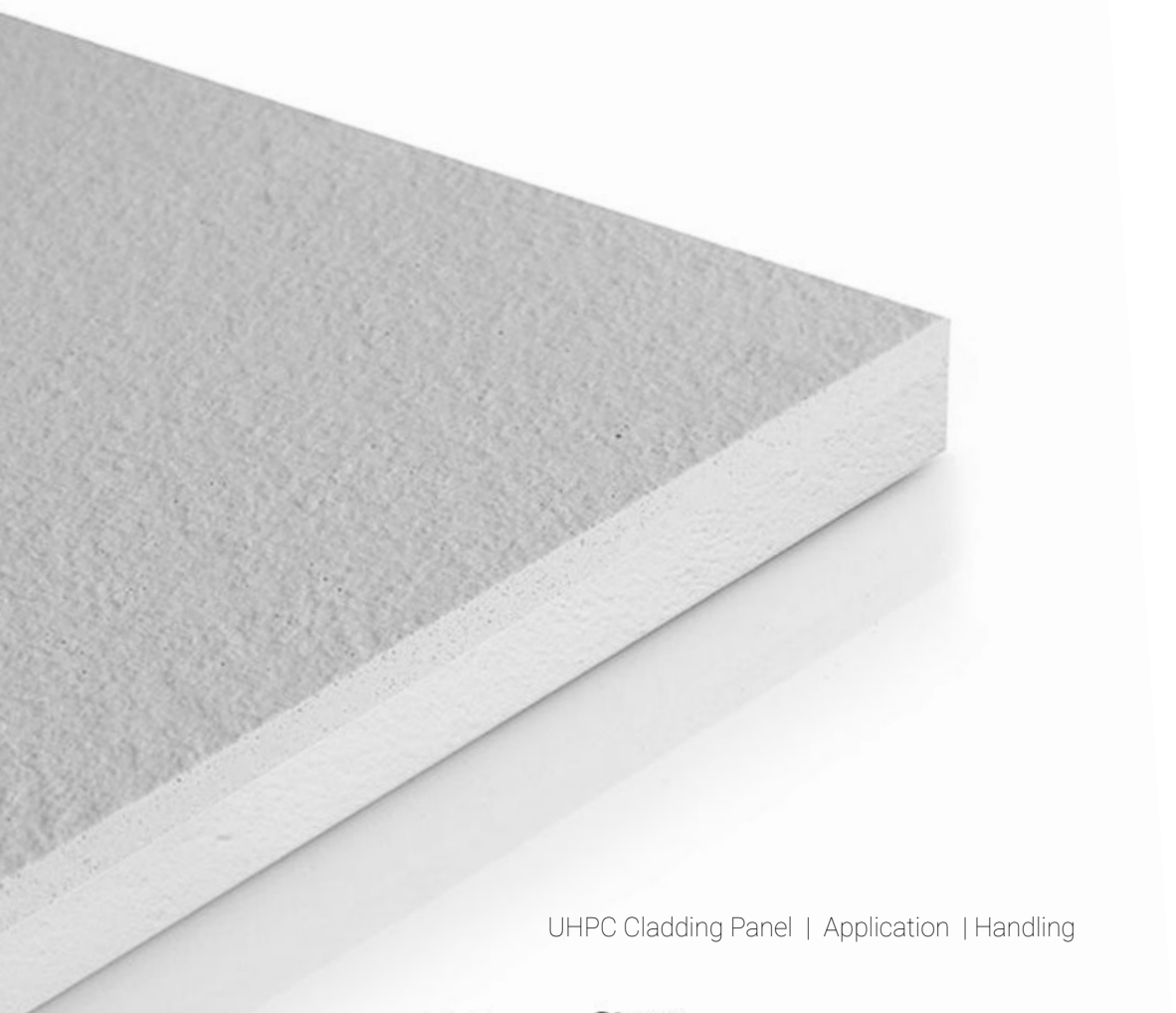
Petra Design Inc. Architectural Molded Composite

PETRA™

ARCHITECTURAL MOLDED COMPOSITES

UHPC Installation Manual



UHPC Cladding Panel | Application | Handling

CONTENT

Material

Fastenin g

Handling

Note

This Document Contains Basic descriptions and information on Ultra High performance reinforced concrete Panels.

The description of the product characteristics should not be considered as a guarantee. All information, including technical information and drawings, is up to date based on our own experience. The service provided by Petra Design inc. is extended to UHPC panel manufacturing but explicitly not to fastening materials or substructures. The applications described here are examples only and do not take account of the specific conditions associated with individual cases. The suitability of if the material for the intended use must be checked with respect to specific context and region.Despite careful quali, we can not accept liability for accuracy, completeness or actuality. This applies to print errors and subsequent changes to technical information .

01

1.1 About Us - Petra Design Inc. Overview

1.2 UHPC Product Description

1.3 Color & Finishes

1.4 Technical Specifications

Material

1.1 ABOUT US

Image | Ellie tower condominium

Petra Design, where architectural excellence meets a legacy of over 25 years in delivering premium GFRC, UHPC FRP and Precast architectural products. We take pride in supplying a diverse range of solutions to both commercial and residential projects across North America.

At Petra Design, our extensive product line includes but is not limited to exterior cladding solutions, columns, cornices, door surrounds, sills, porticos, domes, balustrades, and more. Whether you're an architect, interior designer, contractor, builder, or homeowner, we collaborate with you on new constructions and renovations, ensuring your project receives the highest quality and aesthetic appeal.

1.1.1 Engineering Excellence

Following an extensive and thorough research effort spanning the past few years, Petra Designs has successfully developed highly refined Ultra-High-Performance Concrete (UHPC) and Glass Fiber Reinforced Concrete (GFRC) mix designs, each branded differently. These formulations are crafted to be easily customizable, catering to the specific requirements outlined by architects and engineers.

1.1.2 Quality Assurance

Petra Design engineers benefit from a substantial database of material properties and comprehensive full-scale tests, offering a robust reference point for the creation of new systems. Our Petra team maintains ongoing communication with leading universities and researchers globally, integrating cutting-edge design knowledge into our projects. Many of our engineers have firsthand experience as shop or site engineers, ensuring that the designs not only showcase innovation but are also practical for efficient manufacturing and installation.

1.2 UHPC Product Description

Ultra-High-Performance Concrete (UHPC) redefines construction materials, boasting exceptional strength and durability. With compressive strengths surpassing **120 MPa** and low porosity, UHPC ensures unparalleled resistance to corrosion and wear. Its innovative composition allows for slender designs, making it a preferred choice for robust, long-lasting structures.

Ultra High Performance Concrete

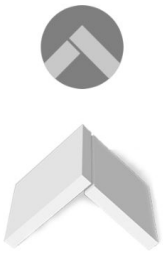
is a revolutionary material

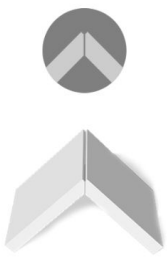
- Durability & Low Maintenance
- Reproducibility of Shapes
- Low Thermal Conductivity
- Fire resistance
- Environmentally friendly

Min. Dimensions	6″ x 48″ (152mm x 1,219mm)
Max. Dimensions	48″ x 144″ (1,220mm x 3,657mm)
Max. Custom Dimensions	60″ X 144″ (1,524mm x 3,657mm)
Standard Thickness	5/8″ (15.87mm)
Custom Thickness (Max.)	1 5/8″ (41.275mm)

Corner Options

Various closed and open corner possibilities exist for UHPC panels, achieved by accurately cutting finished panels to form straight or mitered edges. To explore tailored corner solutions, contact our Technical Support Team.


Square Corner Joint

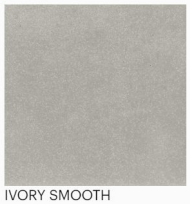

Miter Corner Joint

More Texture & Details

1.3 Color & Finishes

SHADES

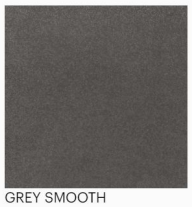
Products are manufactured in Gray color unless one of our colors are specifically requested. We can also custom match colors.


IVORY SMOOTH
STANDARD


IVORY SAND BLAST
STANDARD

POLAR WHITE
SMOOTH

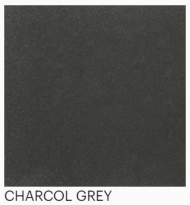

WHITE
SAND BLAST

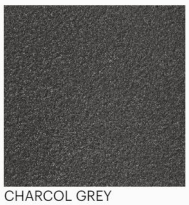

GREY SMOOTH


GREY SAND BLAST


BUFF SMOOTH


BUFF SAND BLAST


CHARCOL GREY
SMOOTH


CHARCOL GREY
SAND BLAST


OXIDE RED
SMOOTH


OXIDE RED
SAND BLAST

One of UHPC's defining qualities is its ability to enhance wide range of colors. We have developed ten standard shades for the construction industry with the ability to formulate customized colors as per requirements. The Platinum and White colors are formulated without any pigment. All other colors contain pigments that are UV-stable and specifically engineered for use in concrete. These pigments are added during the mixing Process.

FINISHES

Beyond texture and color, finishes are a way to accentuate the design of a custom facade by highlighting the surface properties of GFRC through clean lines, bright colors, or exposed aggregate.


CAST FINISH STANDARD


LIGHT SANDBLAST FINISH STANDARD


POLISHED COLORED PREMIUM


AGGREGATE FINISH PREMIUM

TRIMS

Products are manufactured in smooth precast finish unless the Acid Etched, Light Sandblasted or Polished finishes are specifically requested.

LIGHTING

Products are manufactured in smooth precast finish unless the Acid Etched, Light Sandblasted or Polished finishes are specifically requested.

DITTERRENTS

Products are manufactured in smooth precast finish unless the Acid Etched, Light Sandblasted or Polished finishes are specifically requested.

More Color & Finishes

1.4 UHPC Technical Specifications

Test	Results	Standard
Compressive strength(MPa) at 4 Days	[90 - 105]	CSA - A23.1, U.4.1.2.1
Compressive strength(MPa) at 28 Days, TN28	[120 - 140]	CSA - A23.1, U.4.1.2.1
Tensile strength(MPa) at 28 Days	[5 - 7]	CSA - A23.1, U.4.1.2.2.5 (1)
Hardening strength ratio in tension at 28 days	1.15	CSA A23.1, U4.1.2.2.5 (1)
Ultimate Tensile Strength (MPa)* at 28 Days	[9 - 12]	CSA A23.1, U4.1.2.2.5 (1)
Strain (%)* at 28 Days	0.29	CSA A23.1 U.4.2.2.2
Absorption (%)*	[1.2 - 2.1]	CSA A23.2-11C
Chloride Ion Penetration (coulombs), at 56 Days (TN56)	85(Without Fibers)	CSA A23.1, U.4.1.8.5
Shrinkage (%)	-0.019 (28 Days)	ASTM C157
Freeze-Thaw Cycle Resistance TN28	>95%	ASTM C1856
Water-Soluble Chloride Ion Content (% Mass of Cement)	-0.001% (28 Days)	CSA A23.2-4B
Slump Flow (Inches)	10-12	ASTM C1437
Setting time (Hours)	8	ASTM C191
Modulus of Elasticity (28 Days) KSI	7000	ASTM C469

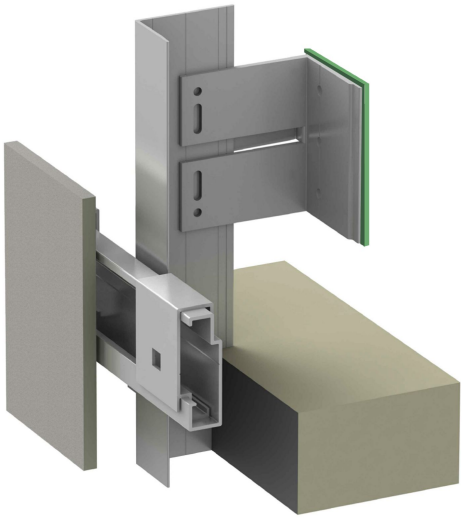
Fiber Reinforcement Note:

Performance values stated within this specification are based on UHPC (Ultra-High-Performance Concrete) mixes reinforced with PVA fibers at a volumetric dosage of 2.5% (approximately 32.5 kg/m³). Specifiers and clients should note that values associated with steel or glass fiber-reinforced UHPC may be slightly different when compared to PVA fibers.

02

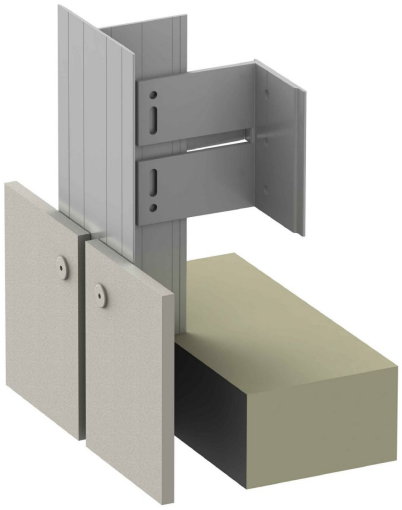
Fastening

2.1 Fastening Types



1. Concealed fastening with undercut anchor

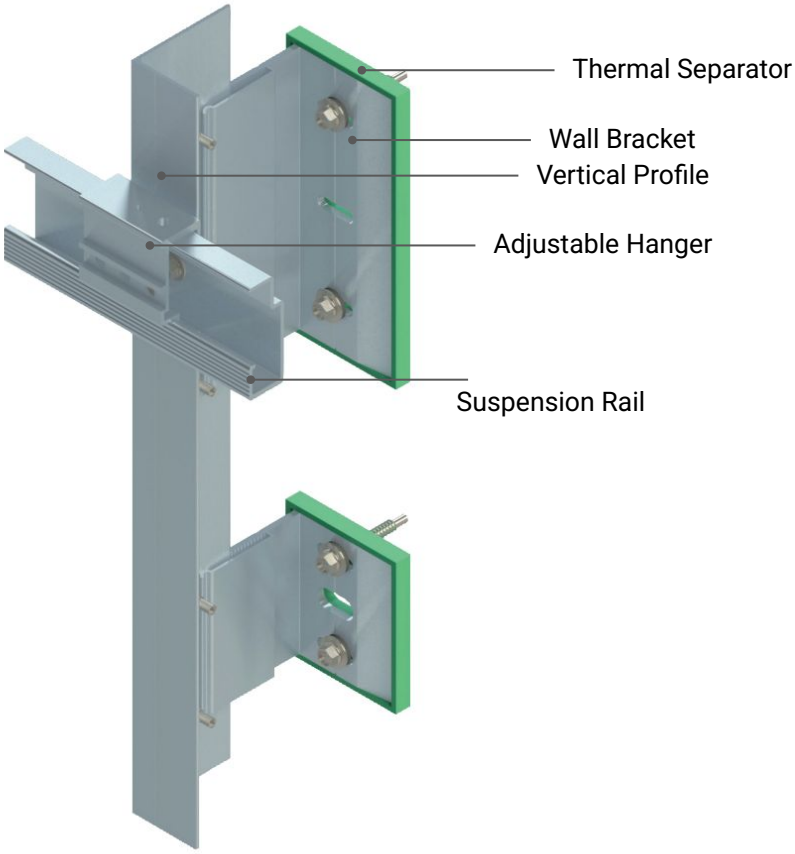
As an alternative to the visible fastening, UHPC Panels can be mechanically fastened concealed using embedded undercut anchors.



2. Face Fastened System

Fastening with Face means can be fitted quickly and permanently. The panels are fastened with floating- and fixed points to cancel out thermal length variations in the materials used.

2.2 Concealed Fastening with Undercut Anchor



Easy

- No complex undercut hole required simple standard hole sufficient
- No special tools to install required
- Holes can even be drilled on site Quick and easy installation with the battery riveting tool from GESIPA® PowerBird® Pro

Secure

No over torquing of the TUF-S
High pullout values with the installed thread
No unwinding
Removable possible via hex head
Can be used in soffit application
Approved for fastening system with the existing ETA assessment ETA-15/0476

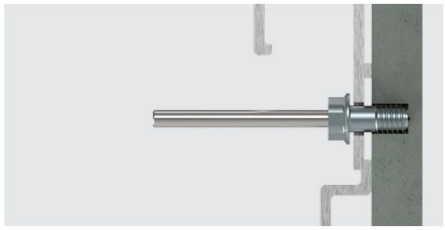
The TUF-S blind fastener from SFS is superior to previous approaches to the attachment of HPL or fiber cement cladding panels with regards to installation and long-term security.

TUF-S blind fastener

1.

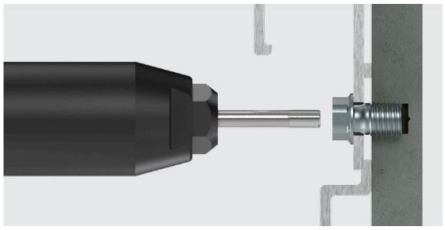
Pre-drill using a Ø 6 mm blind-hole drill with depth-stop – in HPL and fiber cement panel with VHM

2.

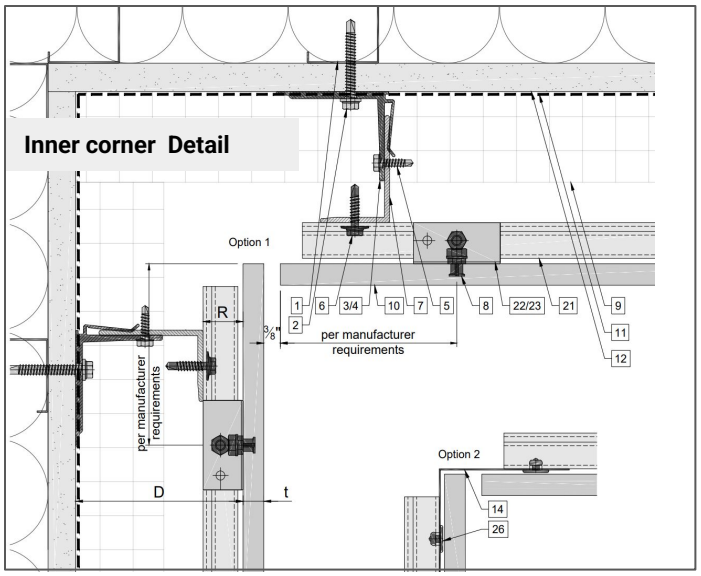


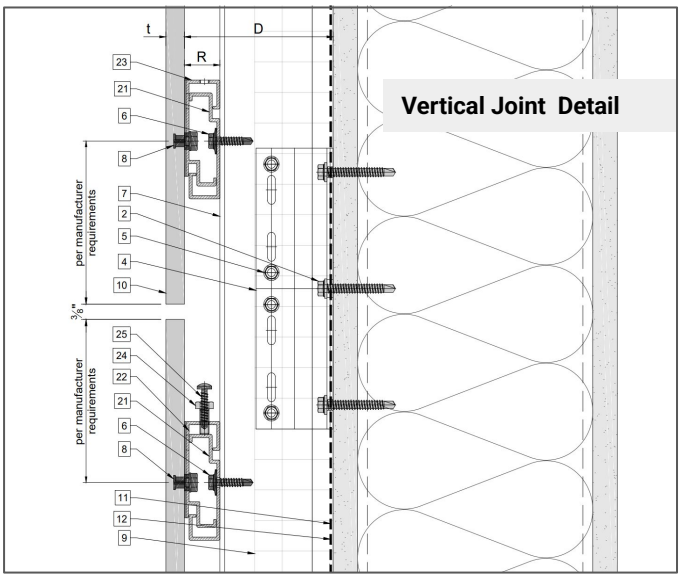
Position the pre-drilled hanger over the hole in the panel and push through the TUF-S blind fastener

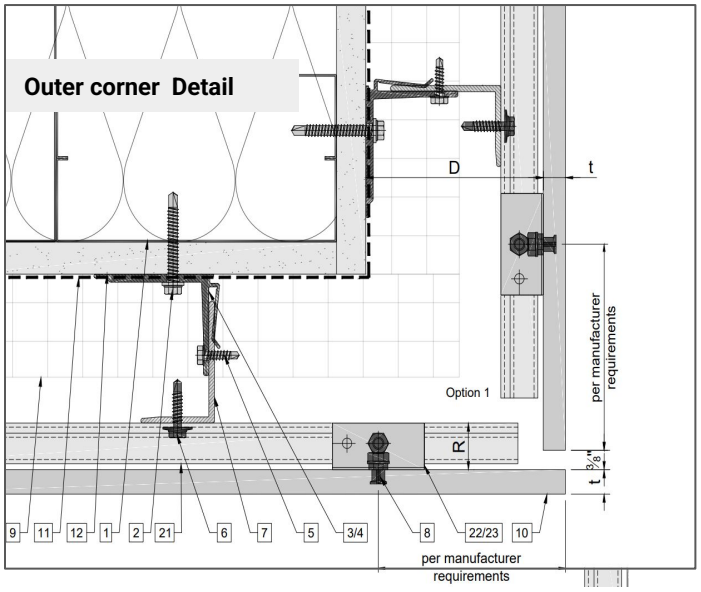
3.

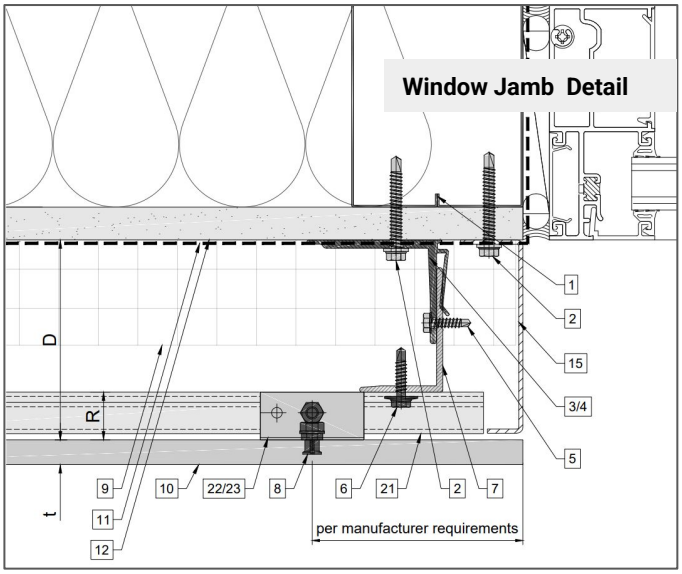


Remove the mandrel using a GESIPA® PowerBird® Pro battery riveting tool combined with nose piece 17/36 or 17/40



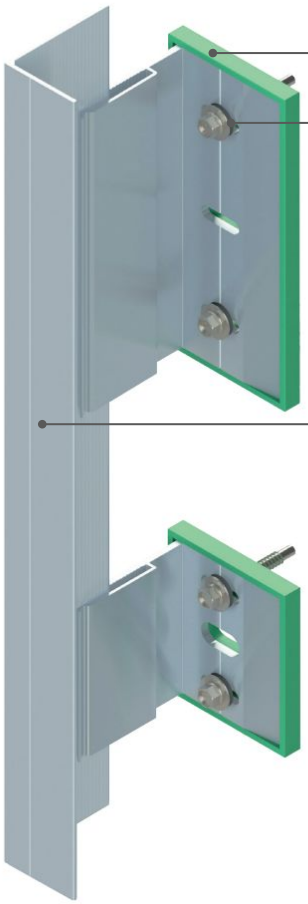




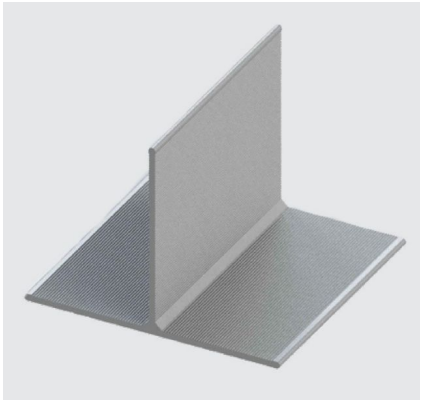


1.Steel stud (16 GA typical)
2.Perimeter anchor
3.Alpha V wall bracket
4.Alpha V+ wall bracket
5.st/st self-drilling screw
6.st/st self-drilling screw
7.Vertical L-profile
8.Undercut anchor
9.Insulation
10.Panel
11.A/V barrier
12.Exterior wall
13.Outer corner closure
14.Inner corner closure
15.Jamb closure
16.Horizontal L-profile
17.Coping
18.Perforated window head closure
19.Window sill
20.Perforated base closure
21.C-carrier rail
22.C-hanger, adjustable
23.C-hanger, non-adjustable
24.Leveling bolt M6
25.Fixing screw
26.Rivet
27.D - System depth
28.t - Panel thickness
29.R - C-carrier rail and C-hanger

2.4 Face Fastening System

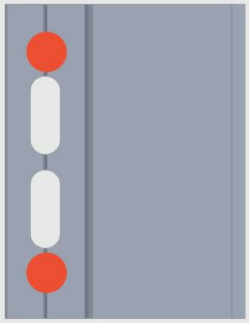


L - Vertical Profile

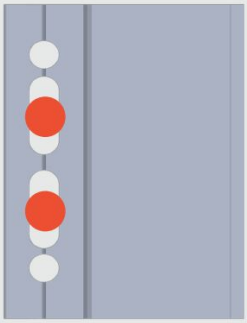


T - Vertical Profile

Generally, profiles are cut to lengths that reflect the height of the panels that are going to be attached to them. Typically storyheight profiles are cut so that the panels are located on one set of vertical profiles and do not 'bridge' the expansion gap between two profiles. These are secured to the bracket using a secondary fastener.



Fixed point: Absorbs dead loads

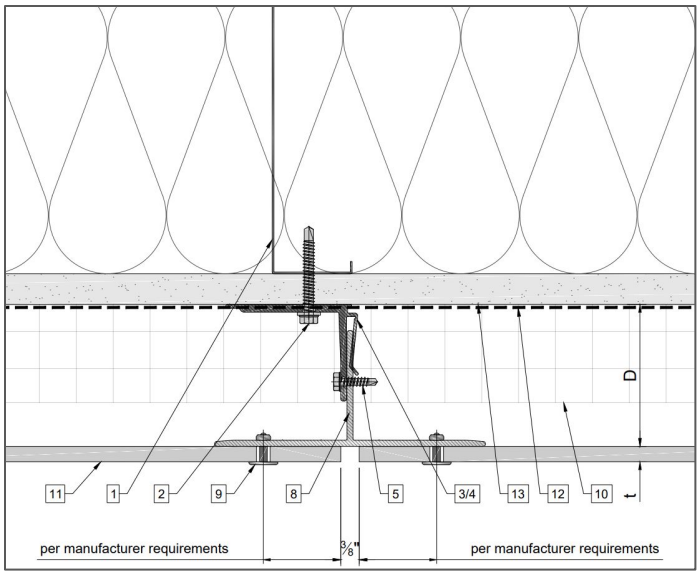


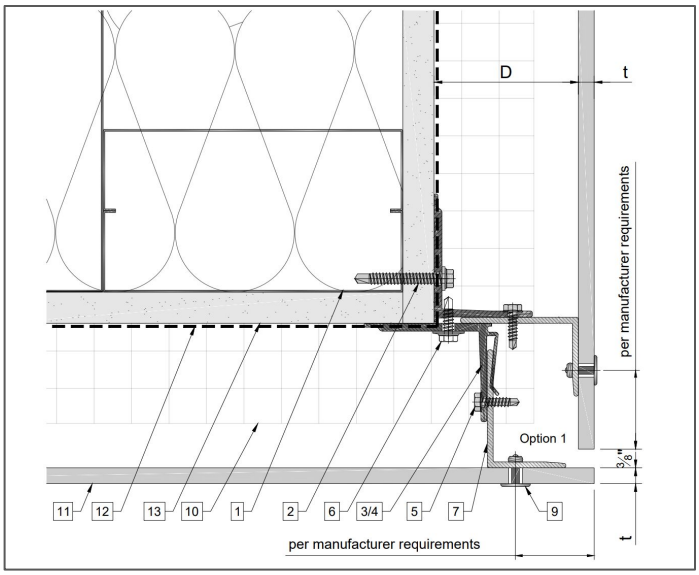
Sliding point: Absorbs dynamic loads & expansion

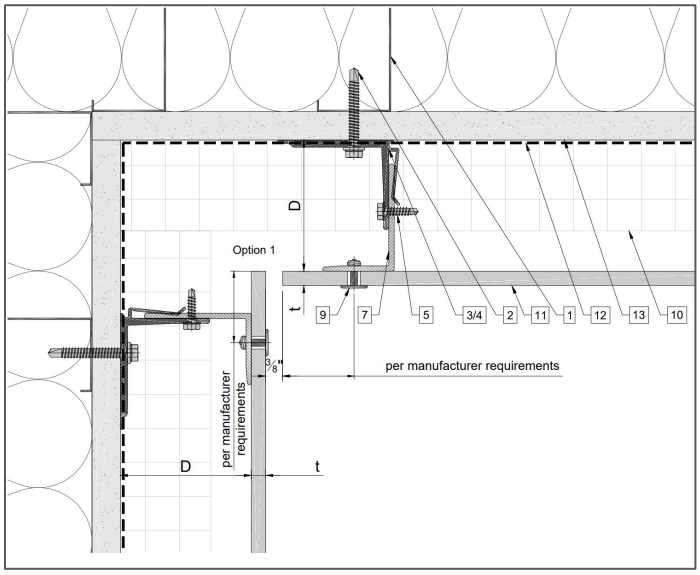
Only one bracket per profile should have fasteners in the fixed points (round holes); all subsequent brackets should have fasteners in the sliding points (slots).

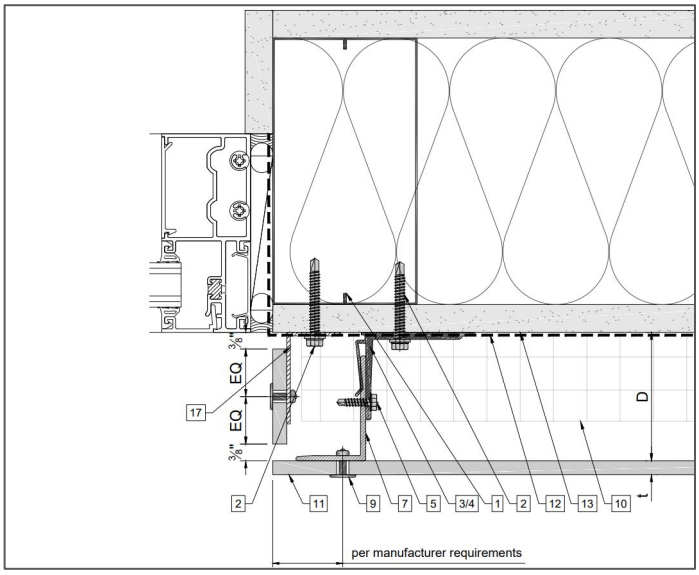
- Check profile positions in relation to actual panel positions and joints.
- Raise the panel and support in horizontal position.
- Adjust level and height of panel before fitting next panel above.
- Repeat on next panels.
- Panel joints should follow the manufacturer's recommendations on horizontal and vertical joint gaps.

Note: Typically, profiles are cut so that the panel(s) are located on one set of vertical profiles and do not bridge an expansion gap between two profiles.







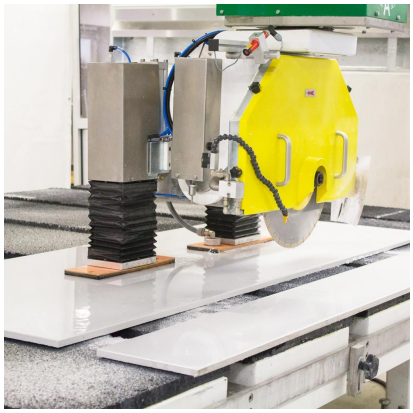


1. Steel stud (16 GA typical)
2. Perimeter anchor
3. Alpha V wall bracket
4. Alpha V+ wall bracket
5. st/st self-drilling screw
6. st/st self-drilling screw
7. Vertical L-profile
8. Vertical T-profile
9. Blind rivet
10. Insulation
11. Panel
12. A/V barrier
13. Exterior wall
14. Outer corner closure
15. Inner corner closure
16. Jamb closure
17. Aluminum angle
18. Coping
19. Perforated window head closure
20. Window sill
21. Perforated base closure
22. D - System depth t - Panel thickness

03

Handling

3.1 Cutting



3.1.1 Stationary Cutting – Wet Cut

UHPC panels can be precisely cut using a water jet, which is ideal for intricate shapes such as curves and diagonals. After wet cutting, it is crucial to clean the panels with clean water and allow them to dry thoroughly. The panels should never be handled or stacked while wet, as this can compromise their quality.

3.1.2 Stationary Cutting – Dry Cut

UHPC panels can also be cut using a circular saw bench equipped with a diamond saw blade, like those from Tyrolit or similar brands.

3.1.3 On-Site Cutting – Dry Cut

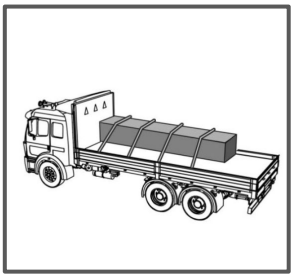
For precise adjustments on-site, a circular hand saw with a guide rail, such as a Festool plunge cut saw or a similar tool, is recommended. This tool allows for cut-outs, diagonal cuts, and mitre cuts with accuracy.

Note

Any dust generated from drilling or cutting should be removed promptly and thoroughly to prevent damage or staining of the panel surfaces.

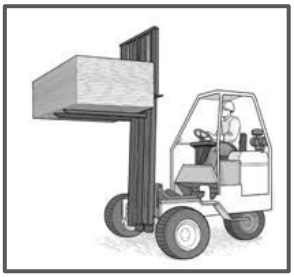
3.2 Loading & Transportation

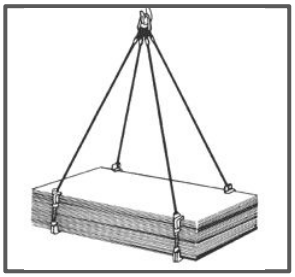
Loading & Unloading



3.2.1 Loading Guidelines

Make sure the loading process is snug and secure. Do not place larger pallets on smaller ones, and avoid stacking other goods on the pallets. For container transport details, consult the Datasheet Container.

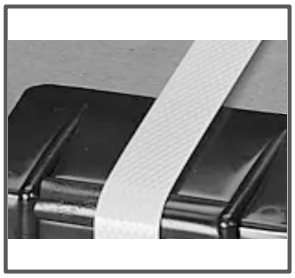




3.2.2 Proper Unloading

Unloading and transport should be done solely with a forklift, truck, or crane. Bending the pallets can lead to cracks or even breakage of the panels, so it's crucial to avoid vibrations during handling. Maintain appropriate load-bearing distances. Lift pallets individually—do not stack or rest them on the edge of the pallet below.

Care



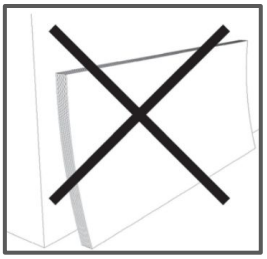
3.2.3 Edge Protection

Transport safety is ensured only with sturdy edge protection. The number of lashing straps must comply with legal regulations to guarantee secure loading.

3.3 Storage

3.3.1. Storage Area

During the planning phase, especially for large projects, it's advisable to designate a suitable storage space for the UHPC Panels. Ensure the ground is level when placing materials. Pallets should not be stacked on top of each other at the site.

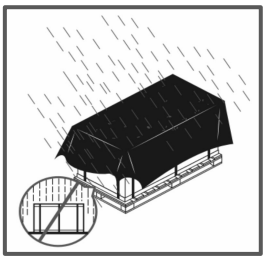


3.3.2. No Leaning

To prevent sagging, bending, or swinging, do not store panels on corners or edges without proper protection, such as Styrofoam or Styrodur.

3.3.3. Protection When Stacking Panels

When stacking panels, ensure there is proper protection between each one. Avoid placing fiberglass-reinforced concrete elements or pieces of wood between the UHPC panels. To prevent damage from friction between the panels, place a foam sheet between each panel.



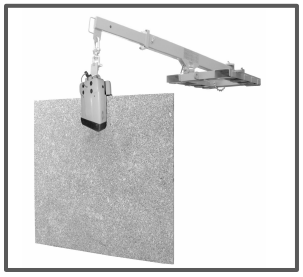
3.3.4. Protection Against the Elements

The UHPC panels should be securely stored and well-protected until they are ready for installation. Remove the panels from their packaging only immediately before assembly. If any pallets are already open, they must be reclosed and protected from moisture. The packaging film alone does not provide adequate protection against weather conditions.

3.4 Safe Handling

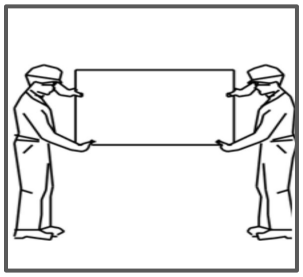
3.4.1. Instruments and accessories

It's essential to have the right technical resources and suitable technology for unloading, reloading, transportation, and assembly. Make sure to use clean protective gloves during the process!



3.4.2 Unloading of Panels

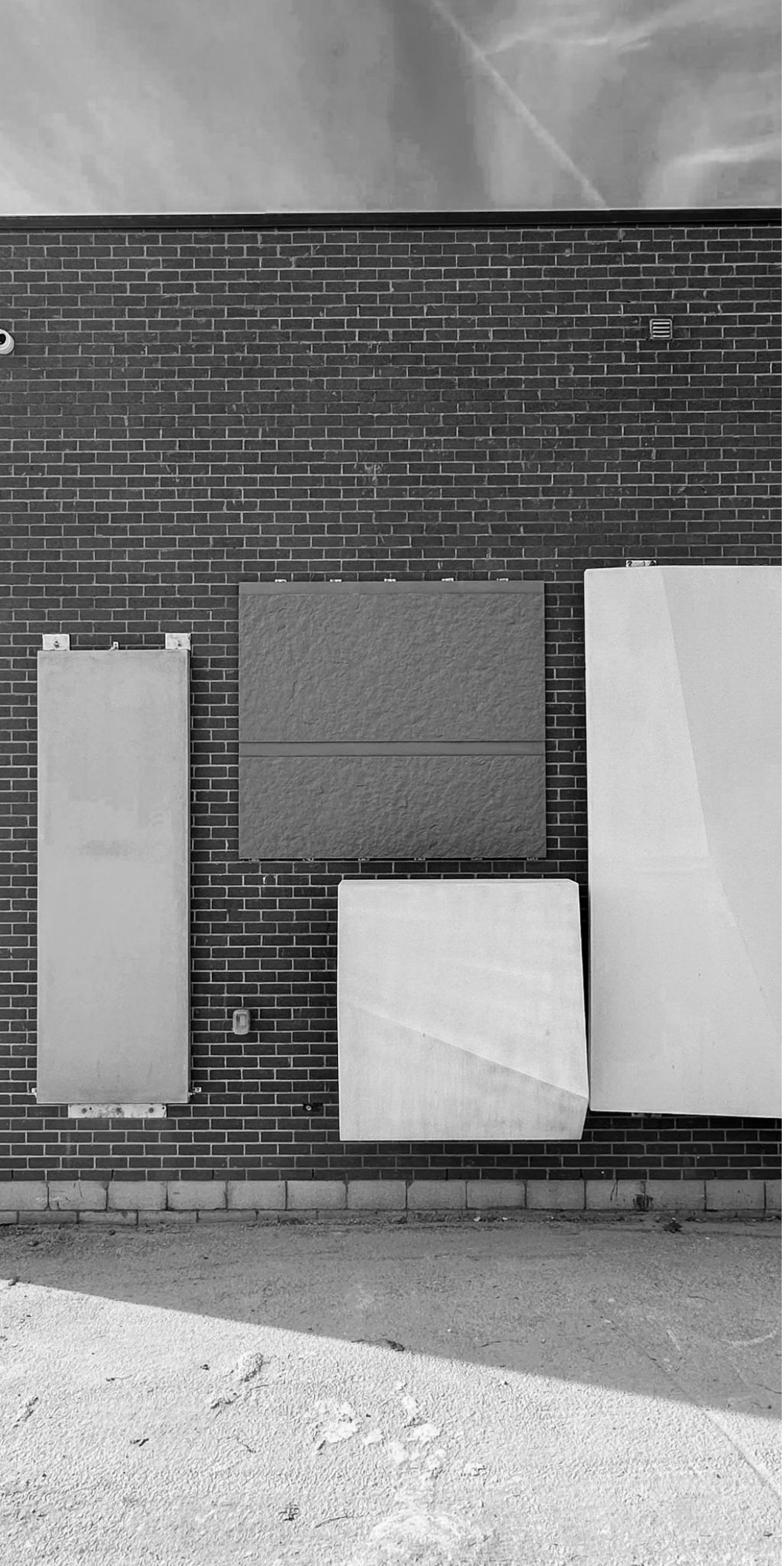
Avoid pushing or pulling panels from the stack; always twist them instead. Ensure that panels do not rub against each other.



3.4.3 Handling of the Panels

When carrying or handling the panels, make sure to transport them upright and manually. Wear protective gloves and industrial safety gear. Be aware that the panels are heavy and can cause injury. Avoid swinging or bending the panels, as this may lead to cracks or even breakage. Handle narrow, longboards with extra caution. Do not place boards on their edges or corners without proper protection.

Simran Kaur Randhawa



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ARCHITECTURAL MOLDED COMPOSITES

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