



Envel UHPC Guide Specification — Rainscreen Façade Panels

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SECTION 07 42 46 – ULTRA-HIGH PERFORMANCE CONCRETE (UHPC) PANELS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section includes the furnishing and installation of factory-cast, ultra-high performance concrete (UHPC) solid exterior and interior wall panels and pre-engineered support structure (system). Panels shall be provided with all pre-drilled fastening holes and attachment system factory installed.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 05 Section “Cold-Formed Metal Framing”.
- B. Division 06 Section “Sheathing”.
- C. Division 07 Section “Thermal Insulation”.
- D. Division 07 Section “UV-Stabilized Air Barriers”.
- E. Division 07 Section “Sheet Metal Flashing and Trim”.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturers’ products representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Failure also includes the following:
 - 1. Thermal stresses transferring to building structure.
 - 2. Solid exterior wall panels and support structure cracking or breakage.
 - 3. Noise or vibration created by wind and thermal and structural movements.
 - 4. Loosening or weakening of fasteners, attachments, and other components.
- C. Structural, Wind and Pressure Loads: Engineered to meet local codes.
- D. Structural Performance: Provide Solid Exterior Wall Panel and support system as follows:
 - 1. Will not evidence deflection exceeding specified limits.
 - 2. At 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, will not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.

3. Durations: As required by design wind velocity, but not less than 10 seconds.
4. Deflection of Framing Members: At design wind pressure, as follows:
 - a. Deflection Normal to Wall Plane: Limited to edge of panel in a direction perpendicular to panel plane not exceeding L/180 of the panel edge length for each panel or an amount that restricts edge deflection of individual panels to manufacturer's product limitations, whichever is less.
 - b. Deflection Parallel to Panel Plane: Limited to L/180 of clear span or ¼ inch, whichever is smaller.
 - c. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to 2 times the length of cantilevered member divided by 175, or manufacturer's product limitations, whichever is smaller.
- E. Story Drift: Accommodate design displacement of adjacent stories.
- F. Design Displacement: As indicated on Structural Drawings.
- G. Maximum Solid Exterior Wall Panels Deflection: L/180 of span or less when tested in accordance with positive and negative pressures.

1.5 SYSTEM DESCRIPTION

- A. Complete system shall include the design and installation of the solid exterior wall panels and support structure system to provide, in conjunction with wall substrate and air barrier, a weather-tight wall assembly utilizing rain screen principle.
- B. Panel joints are open with no joint closure.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated, including manufacturer's written installation instructions and recommendations.
- B. Shop Drawings: Submit shop drawings showing anchor placement, joint locations, and complete pattern layout plan.
- C. Samples: Representative of finished exposed face of solid exterior UHPC panel. For each color and pattern specified, submit a minimum of two samples, each not less than 12 x 12 inches, and of actual thickness showing possible range of color and material characteristics indicative of actual production.
- D. Quality Assurance Submittals:
 1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
 2. Certificates: Qualification Certificates: Submit certificate indicating compliance with qualification requirements in "Quality Assurance" article.
 3. Product certificates signed by manufacturers certifying materials comply with specified performance characteristics and criteria and physical requirements.
 4. Manufacturers' Instructions: Manufacturers' written installation instructions.
- E. Closeout Submittals:
 1. Operation and Maintenance Data:
 - a. Operation and maintenance data for installed products in accordance with Division 01 Closeout Submittals (Maintenance Data and Operation Data) Section.
 - b. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.7 QUALITY ASSURANCE

- A. Pre-Bid Pre-Qualification Submittal:

1. Contractors interested in proposing a solid exterior wall panel system produced by a manufacturer that is not the basis of design indicated in this section, must provide company and product details as a necessary pre-bid pre-qualification submittal, to demonstrate full compliance with the documents and design and quality standards, and to demonstrate capabilities and experience required by the documents and the project scope. The following also applies to this pre-bid Pre-Qualification submittal:

- a. A list of at least three (3) complete projects demonstrating use of the Ultra-High Performance Concrete mix used for wall panel systems produced by a manufacturer that is not the basis of design.
- b. In addition to demonstrating full compliance with the documents quality standards, the submitted solid exterior wall panel system must meet the design intent, including specified colors, surface sheen, and patterns as judged solely by the Architect.
- c. The Architect's decision shall be final. All approvals shall be made in writing and evidence shall be provided via an addendum.

B. Fabricator/Installer Qualifications:

1. Installer shall be experienced in performing work with thin concrete cladding panels of similar type and scope. Supervisors and installers shall have a minimum 5 years' experience of projects of similar type.

C. Mockups:

1. Build mockup indicated on Drawings to verify selections made under sample submittals, and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
2. Build mockup, including insulation, supports, attachments, and accessories for typical conditions/parts not to exceed one (1) window surround, cornice section and/or building corner and not more than 150 square feet in area.
3. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Mockup construction may be incorporated into the final Work.

D. Pre-installation Meetings:

1. Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturers' installation instructions.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver exterior solid UHPC wall panels and support system components packaged to comply with manufacturers' requirements and adequately protected from damage during shipment.
- B. Protect components from adverse job conditions prior to installation.
- C. Protect components from other trades after installation.
- D. Panels are to be stored and handled vertically until installed.
- E. Store exterior solid UHPC wall panels and support system components on platforms or pallets, covered with tarpaulins or other suitable weather-tight ventilated covering. Store components so that water accumulations will drain freely.
- F. Do not store exterior solid UHPC wall panels and support system components in contact with other materials that might cause staining, denting, surface damage or other deleterious effects.

1.9 PROJECT CONDITIONS

A. Field Measurements:

1. Verify actual measurements/openings by field measurements before material fabrication, and show recorded measurements on shop drawings.

2. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.10 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace UHPC panels that fail in materials or manufacture within the specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failure, cracking, or delamination of the panel under normal use and under the design loads specified in this Section.
 - b. Deterioration of the panel beyond normal weathering.
 2. Warranty Period: 5 years from date of Substantial Completion.
 3. Warranty excludes damage resulting from impact or abuse, cleaning or maintenance not in accordance with the manufacturer's written instructions, movement or failure of the supporting structure, installation not in accordance with the manufacturer's written instructions and approved shop drawings, and causes beyond the manufacturer's control.
- B. Special Finish Warranty: Where sealer-stained panels are specified in Article 2.1, manufacturer's standard form covering the applied sealer stain against the following:
 1. Loss of adhesion, peeling, or blistering.
 2. Color variation in excess of 5 Delta-E units when measured in accordance with ASTM D2244.
 3. Warranty Period: 10 years from date of Substantial Completion.
 4. Warranty is conditioned upon cleaning and maintenance in accordance with the manufacturer's written instructions at intervals not exceeding 5 years.
 5. Efflorescence, naturally occurring color and texture variation inherent to through-body pigmented concrete, and staining originating from adjacent materials are excluded.
 6. This warranty applies only to sealer-stained panels. Panels with a natural media-blasted finish are not covered by this Article.
 7. This warranty covers the applied sealer stain only and does not extend, revive, or enlarge the manufacturer's warranty in Paragraph A.
- C. Installer's Warranty: Installer's written warranty covering the installation against defective workmanship, including water penetration attributable to the installation, for a period of [2] years from date of Substantial Completion.
- D. Warranties specified in this Article shall be in addition to, and shall not limit, other rights the Owner may have under the Contract Documents.

PART 2 - PRODUCTS

2.1 SOLID EXTERIOR UHPC WALL PANELS

- A. Manufacturers: The construction documents are based on the manufacturer and product / system noted below. As such, Envel (www.envelfacade.com) is a pre-approved Manufacturer for the scope described under this section. Other manufacturers will be considered, provided that they submit for approval according to the Part 1 "Quality Assurance" provisions of this specification section.
- B. Basis of Design Product/Manufacturer: Envel UHPC panels utilizing organic PVA fibers in a volume of no less than 3% by weight. Contact Envel Façade, Inc., Craig Heaney, cheaney@envelfacade.com.
- C. Panel Performance Characteristics / Minimum Required Testing:
 1. Thermal Expansion (ASTM C531): 6.41E-06 in/in/°F (0.26 mm/m at a 40°F temperature change).
 2. Flexural Strength (Thin Panel) – Wet (ASTM C1609): Pass, Mean length direction not less than 2,200 lbs./in² and width direction 2,200 lbs./in².

3. Freeze/Thaw (Cladding) (ASTM C666): Pass. No visible cracks and not less than 95% post-exposure strength retention.
4. Anchor Pullout Strength (ASTM E488): 8.5 mm embedment in 5/8 inch (16 mm) nominal panel.
 - a. Tension (Min. Mean) Peak Load – 350 lbf or greater.
 - b. Shear (Min. Mean) Peak Load – 1000 lbf or greater.
5. Surface Burning Characteristics (ASTM E84):
 - a. Flame Spread – Pass.
 - b. Smoke Developed – Pass.
 - c. Class A.
6. Compressive Strength (ASTM C39): $\geq 18,000$ lbs./in² (124 MPa).
7. Tensile (splitting matrix prism) Strength (ASTM C496): 725 lbs./in² (5 MPa).
8. Water Tightness Test: In accordance with ASTM C1186, Section 11. No water droplet formation allowed.
9. ASTM E488 post freeze-thaw fastener performance test. Submit data.

D. Panel Finishes:

1. Finish exposed, front-facing surface of UHPC as follows, to match approved design reference samples. Panel faces shall be free of joint marks, grain, or other obvious defects.
2. Design Reference Sample: .

Specifier Note: Insert panel finish, texture, and color.

- a. Panel Thickness: 5/8 inch (16 mm) nominal; thickness variation $\pm 1/16$ inch.
- b. Panel Weight (design value): 7.5 lbs./ft² at 5/8 inch nominal thickness.
- c. Panel Sealant: [Envel Nano sealer (on through-body pigment natural concrete finish)] [Envel SG tinted sealer (color-enhanced sealer for deep saturated color and/or maximum color uniformity)].

Specifier Note: Select one.

E. Support Structure:

1. Aluminum Panel Support Structure:
 - a. Complete sub-frame assembly to support and anchor solid exterior solid UHPC wall panels. Aluminum support structure to be anchored to building structure as per manufacturer's recommendations and in accordance with project specific structural calculations.
 - b. Extrusions for panel-to-wall attachment shall be [concealed] [face-fastened]. Continuous aluminum extrusions mounted to wall shall be black powder coat to reduce their appearance in open panel joints.

Specifier Note: Select one.

2. Wall Framing Components:

- a. Vertical or horizontal hat channels, Z- and/or C-shapes as required for complete installation.

2.2 ACCESSORIES

A. Fasteners:

1. Panel clip anchors: Stainless steel.
2. Face-fastened anchors: Stainless steel, with head finished to match approved panel color.
3. Fasteners to building structure: Type, size, and spacing as required by the approved attachment design and compatible with the substrate.

- 4. Do not use fasteners of a material or coating that will cause staining, corrosion, or galvanic action in contact with the panel or support system.
- B. Isolation of Dissimilar Materials: Where aluminum components contact steel, concrete, masonry, or preservative-treated wood, separate the contact surfaces with nonmetallic isolation tape to prevent galvanic corrosion.
- C. Flashing, Closures, and Trim: Sheet metal flashing, closures, and trim specified in Division 07 Section "Sheet Metal Flashing and Trim," finished to match [panel color] [support system color].
- D. Cavity Closures: Where the rainscreen cavity is closed at base, head, or perimeter, provide [corrosion-resistant insect screen] at ventilation openings.

2.3 FABRICATION

- A. Fabricate wall panels and accessory items in accordance with manufacturers' recommendations and approved submittals.
- B. Panels shall be fabricated to size, with all anchor holes and panel extrusion clips factory-installed by the UHPC panel manufacturer.
- C. Field-cut panels (if required) and drill face-fastening anchor holes in accordance with the UHPC panel manufacturer's written directions.
- D. Do not field-modify factory-drilled concealed/undercut panel anchor holes.
- E. Fabricate all panels to profiles, colors and textures per samples and approval selected by the Architect.

PART 3 - EXECUTION

3.1 MANUFACTURERS' INSTRUCTIONS

- A. Compliance: Comply with manufacturers' product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 EXAMINATION

- A. Examine structure and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 ERECTION/INSTALLATION – DELEGATED DESIGN

- A. Install wall reinforcements, channel cleats, clips, hangers, and other accessories required for connecting UHPC wall panels to supporting members and backup materials per project/façade engineer's approved design.
- B. Provide miscellaneous reinforcement of adhered panel parts and unitized panel parts per manufacturer and installation contractor's engineer.
- C. Lift UHPC wall panels and install without damage.
- D. Install UHPC panels level, plumb, square, and in alignment.
- E. Provide temporary supports and bracing as required to maintain position, stability, and alignment of panels until permanent connections are completed.
 - 1. Maintain horizontal and vertical joint alignment and uniform joint width.
 - 2. Remove temporary projecting hoisting devices.

3.4 CLEANING AND PROTECTION

- A. Perform cleaning procedures according to UHPC panel manufacturer's written instructions.

- B. Clean soiled UHPC surfaces with non-abrasive cleaners and water, using soft fiber brushes, rags and sponges, and rinse with clean water.
- C. Prevent damage to UHPC surfaces and staining of adjacent material.

END OF SECTION 07 42 46