Envel UHPC Guide Specification; Rainscreen Façade Panels

SECTION 074247 – 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 & 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”.

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” 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: 1/180 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.

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 12x12 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.

5. Manufacturers’ Field Reports: Manufacturers’ field reports specified herein.

E. Closeout Submittals:

1. Operation and Maintenance Data:

a. Operation and maintenance data for installed products in accordance with Division 1 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 (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 addenda.

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 mini- mum 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 foot 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.

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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.

**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 with Ductal utilizing organic PVA fibers in a volume of no less than 3% by weight. Envel as distributed by Metro Building Solutions, Inc., Alex Moshenberg, 917.584.7538, [alex@metrobuilding.biz](mailto:alex@metrobuilding.biz).

C. Panel Performance Characteristics / Minimum Required Testing:

1. Thermal Expansion (ASTM C531-00): 6.41E-06 in/in/degree F ( 0.01inches per meter at 40 degree temperature change)
2. Density – Thin Panel (ASTM C642): 150 lbs./ft³.
3. 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.
4. Freeze/Thaw (Cladding) (ASTM C666): Pass. No visible cracks and not less than 95% post-exposure strength retention
5. Anchor Pullout Strength (ASTM E488-96): 8.5 mm embed in 13mm thick panel
   1. Tension (Min. Mean) Peak Load – 350 lbf or greater
   2. Shear (Min. Mean) Peak Load – 1000 lbf or greater
6. Surface Burning Characteristics (ASTM E84-09):
   1. Flame Spread – Pass
   2. Smoke Developed – Pass
   3. Class A.
7. Compressive Strength (ASTM C39): ≥ 18,000 lbs./in² (120 MPa).
8. Tensile (splitting matrix prism) Strength (ASTM C496): 725 lbs./in² (5 MPa).
9. Water Tightness Test: In accordance with ASTM 1186-12 Section 11. No water droplet formation allowed.
10. ASTM E488 post freeze thaw fastener pull out 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: Architect; fill in appropriate information regarding panel finish, texture & color.

a. Panel Thickness: 1/2-inch (13-mm) nominally, thickness variation +/- 1/16

b. Panel Edges: Architect choose from either butt at all inside and or outside corners, or butt at inside and quirk miter at outside.

c. Panel Weight: 6 lbs/ ft² , at ½” thickness

d. Panel Sealant: Choose; E97 with 10 year limited warranty or PG Matte Tinted with a 5 year limited warranty.

SUPPORT STRUCTURE

A. Aluminum Panel Support Structure:

1. 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 manufacturers recommendations and in accordance with project specific structural calculations.
2. Extrusions for panel to wall attachment shall be, Architect to choose panel system, concealed, or face fastened as well as manufacturer. Continuous aluminum extrusions mounted to wall shall be black powder coat to reduce their appearance in open panel joints.

B. Wall Framing Components:

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

2.2 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.

3.2 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 engineers 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.

3.3 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 074247**

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| ULTRA-HIGH PERFORMANCE CONCRETE PANEL CLADDING |  |