

SECTION 07 4210.21

CONTINUOUS INSULATION (CI) WITH COMPOSITE METAL HYBRID (CMH) SUBFRAMING SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Continuous insulation (CI) composite metal hybrid (CMH) sub-framing system integrated with [metal wall panels] [brick veneer] [CMU veneer] [phenolic panels] [fiber cement panels] [terracotta] or [<____>] exterior wall cladding.
 - 1. Substrate: [Metal stud framing] [Exterior sheathing over metal stud framing] [Exterior sheathing over wood stud framing] [Concrete masonry units (CMU)] or [Poured concrete].

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 – Cast-in-Place Concrete: Concrete wall substrate
- B. Section 04 2000 – Unit Masonry: Concrete masonry unit (CMU) wall substrate
- C. Section 05 4000 – Cold-Formed Metal Framing: Metal stud substrate support framing
- D. Section 06 1000 – Rough Carpentry: Exterior sheathing and wood stud substrate support framing
- E. Section 07 4200 – Wall Panels: Wall cladding system
- F. Section 07 2500 – Weather Barriers: Air, water, vapor barrier over exterior sheathing
- G. Section 07 9200 – Joint Sealants: Perimeter sealant
- H. Section 09 2116 – Gypsum Board Assemblies: Exterior sheathing

1.03 REFERENCE STANDARDS

- A. ASCE American Society of Civil Engineers (www.asce.org)
 - 1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures; 2016 with Supplements and Errata
 - 2. ASCE – Structural Plastics Design Manual
- B. ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers (www.ashrae.org)
 - 1. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings; 2019
 - 2. ASHRAE 189.1 – Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings; 2017
- C. ASTM International (American Society for Testing and Materials; www.astm.org)
 - 1. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015
 - 2. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board; 2015
 - 3. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015
 - 4. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015
 - 5. ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013
 - 6. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2015
 - 7. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2011
 - 8. ASTM C1396/C1396M – Standard Specification for Gypsum Board; 2014a
 - 9. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010e1

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10. ASTM D570 – Standard Test Method for Water Absorption of Plastics; 2010e1
 11. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014
 12. ASTM D638 – Standard Test Method for Tensile Properties of Plastics; 2014
 13. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between minus 30 degrees C and 30 degrees C with a Vitreous Silica Dilatometer; 2008e1
 14. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics; 2015
 15. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2010
 16. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2013
 17. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2010
 18. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging; 2015
 19. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2013a
 20. ASTM D4385 - Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products; 2013
 21. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
 22. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a
 23. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2015
 24. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 04(2012)
 25. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014
 26. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2009
 27. ASTM E2357 – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011
- D. IBC – International Building Code (International Code Council); 2018
- E. IECC – International Energy Conservation Code; 2018
- F. IgCC – International Green Construction Code; 2018
- G. NFPA – National Fire Protection Association (www.nfpa.org)
1. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2015
- H. Voluntary Product Standard; National Institute of Standards and Technology (NIST)
1. PS 1 – Structural Plywood; 2009

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate construction of wall cladding support system over substrate indicated for proper drainage, flashing, trim, back-up support, soffits, and other related Work.
1. Review and finalize construction schedule.
 2. Verify availability of materials, installer's personnel, equipment, and facilities needed to maintain schedule.
 3. Review means and methods related to installation, including manufacturer's written instructions.
 4. Examine support conditions for compliance with requirements, including alignment and attachment to structural support system.
 5. Review flashings, wall cladding details, wall penetrations, drainage plane, openings, and condition of other construction that affects this Work.
 6. Review temporary protection requirements for during and after installation of this Work.

1.05 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

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- B. Product Data: Submit for each type of product indicated; include construction details, material descriptions, dimensions of individual components and profiles, and accessories as necessary for complete fully functioning and assembled system.
- C. Test and Inspection Reports: Submit test and inspection reports on each type of wall cladding/veneer system based on evaluation of comprehensive tests performed by nationally recognized testing agency.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with at least ten years of documented experience.
 - 1. Engineering Review: Manufacturer to provide Technical Engineering Report (TER) based on CMH and cladding system design.
 - 2. Code Conformance: CMH sub-framing system to have been evaluated by IAPMO Uniform Evaluation Service and found satisfactory for compliance with 2018 International Building Code.
- B. Installer: Company specializing in performing work of this section and the following:
 - 1. Install system in strict compliance with manufacturer's installation instructions.
 - 2. Have not less than three years of documented experience.
 - 3. Factory trained and approved by CMH sub-framing system manufacturer.
- C. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a licensed Structural Engineer experienced in design for this type of Work and licensed in State that Project is located. Engineering information provided shall be signed and verified by licensed Structural Engineer.
- D. Source Limitations: Obtain continuous insulation (CI) and CMH sub-framing system from single source and single manufacturer.
- E. Environmental: CMH sub-framing system to follow the below guidelines:
 - 1. CMH sub-framing system to be registered as red list chemical free with the Living Building Challenge and Declare label.
 - 2. The components shall be certified to be halogen/bromine free.
 - 3. CMH composite member shall utilize a minimum of 25% post-consumer recycled material content.
 - 4. Environmental Product Declaration: CMH Manufacturer shall provide a product specific EPD Type III report in accordance with EN 15804 and ISO 14025.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original unopened containers and packaging with labels clearly identifying product name and manufacturer.
- B. Deliver components and other manufactured items or accessories without damage or deformation.
- C. Storage: Store materials in clean, dry, and level interior areas or outdoor areas for limited duration in accordance with manufacturer's written instructions.
- D. Protect components and auxiliary accessories during transportation, handling, and installation from moisture, excessive temperatures and other construction operations in accordance with manufacturer's written instructions.
- E. Handle components in strict compliance with manufacturer's written instructions and recommendations, and in a manner to prevent bending, warping, twisting, and surface, edge or corner damage.

1.08 SITE CONDITIONS

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- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work in accordance with manufacturer's written installation instructions and warranty requirements.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. CI and CMH Sub-Framing System Warranty: Provide written warranty by manufacturer and installer agreeing to correct defects in manufacturing within a [**five year**] or [**<____>**] period after Date of [**Delivery**] or [**Substantial Completion**].

PART 2- PRODUCTS

2.01 MANUFACTURER

- A. **Advanced Architectural Products (A2P): SMARTci 2.5-in-1 System**
 - 1. Address: 959 Industrial Drive, Allegan, Michigan 49010.
 - 2. Phone: (269) 355-1818; Fax: (866) 858-5568; Website: www.smartcisystems.com
 - 3. Other products shall be pre-submitted and approved products that meet materials and performance requirements with specified and validated third party testing.

2.02 DESCRIPTION

- A. Attach CMH sub-framing system components to [open metal stud framing without sheathing] [open wood stud framing without sheathing] [exterior sheathing over metal stud framing] [exterior sheathing over wood stud framing] [concrete masonry units (CMU)] or [poured concrete].
 - 1. Refer to Section 05 4000 for metal stud framing.
 - 2. Refer to Section 06 1000 for wood stud framing.
 - 3. Refer to Section 03 3000 for concrete substrate.
 - 4. Refer to Section 04 2000 for CMU substrate.
- B. Install CI panels and CMH sub-framing system components [**horizontally on substrate system**] as indicated on drawings in compliance with specified requirements.
- C. Install exterior sheathing and barrier system as indicated on drawings in compliance with specified requirements.

2.03 PERFORMANCE REQUIREMENTS

- A. Structural: Provide system tested in accordance with ASTM E330/E330M and certified to be without permanent deformation or failure of structural members in accordance with design wind velocities for project geographic location and probability of occurrence based on data from wind velocity maps provided in ASCE 7 and as approved by authorities having jurisdiction (AHJ).
 - 1. Provide finite element analysis (FEA) to model and evaluate areas of the longest composite girt cantilever span possible between intermediate framing members/attachment.
 - a. FEA shall include max dead load and wind load conditions
 - b. FEA shall include point loads representative of fastener locations
 - c. Maximum directional stresses in model shall have a safety factor of 4 or greater.
 - d. Stresses shall be indicated and analyzed in 3 directions.
 - e. FEA shall accurately replicate the wall system and physical loading dynamics.
 - f. Report shall be furnished with the submittal.
 - g. FEA shall be approved by a licensed PE.

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2. Butt joints (non-interlocking joints) of adjacent girts shall be installed on a minimum surface width of 3” or double stud condition to accommodate proper fastener margins to composite.
- B. System Thermal Design: Ensure installed CI and CMH sub-framing system, opening trim, sub-framing, clips and cladding attachment does not have thermal bridging of fasteners or framing that creates a continuous metal path from exterior surface of insulation to interior face of insulation.
1. System thermal design shall meet or exceed thermal design requirements in compliance with [ASHRAE 90.1] [ASHRAE 189.1] [IECC] or [IgCC] energy code.
 2. Thermal Resistance: Wall assembly R Value of [].
 3. Thermal Performance Test: Provide thermal resistance (R-value) indicated, in compliance with ASTM C1363, corrected to 15 mph outside and still air inside, with installed conditions including trim for openings, fastening and joints.
 - a. Provide efficiency of no less than [93 to 98 percent] or [percent], with a maximum temperature differential of 18 degrees F from interior wall surface to interior wall cavity and node locations with a 70 degrees F exterior to interior wall temperature delta.
 - b. Provide test unit with at least one insulation panel horizontal and vertical joint length and height of test chamber area.
 - c. Provide finite element analysis of three-dimensional simulation of described wall assembly sealed by professional engineer in compliance with code performance requirements and exceeding it by at least 3 percent.
- C. Temperature: Comply with structural loading requirements within a service temperature range of minus 55 degrees Fahrenheit to 190 degrees F.
1. Submit the following tests at the high value (at least 190 degrees F) of the temperature:
 - a. Fastener pullout – ASTM D7332/D7332M
 - b. Tensile Strength – ASTM D638
 - i. Crosswise (CW)
 - ii. Lengthwise (LW)
 - c. Modulus of Elasticity – ASTM D638
 - i. Crosswise (CW)
 - ii. Lengthwise (LW)
 - d. Engineering calculations that include the following:
 - i. Point load calculations of the cladding attachment to the sub-framing
 1. Uniform loading not allowed.
 - ii. Include Live and Dead Load simultaneously modeled.
 - iii. Deflection meeting specified criteria.
 2. Performance criteria from high end of the service range to meet the minimum specified properties.
 3. Test reports must include data at high end elevated service temperatures (at least 190 degrees Fahrenheit) – if not included, submittal is not approved.
- D. Fire-Test-Response Characteristics: Provide composite metal hybrid (CMH) sub-framing support system with fire-test results indicated as determined by test standard indicated and applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
1. Surface Burning Characteristics: In compliance with ASTM E84, for foam insulation, composite metal hybrid and interior surfaces as follows:
 - a. Flame Spread Index (FSI): 25 or less.
 - b. Smoke Developed Index (SDI): 450 or less.
 2. Intermediate Scale Multistory Fire Test: Comply with NFPA 285 and/or IBC acceptance criteria for wall height above grade and fire separation distances, when wall type and other noted conditions require such testing or compliance with requirements as indicated.

2.04 COMPOSITE METAL HYBRID (CMH) SUB-FRAMING SYSTEM

- A. CMH Sub-Framing System: Provide composite metal hybrid (CMH) framing support system consisting of polyester resin matrix with recycled materials, fire retardant additives and reinforced with integral continuous metal inserts the length of profile at all fastening locations. Reinforce CMH sub-framing systems with glass

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strand rovings used internally for longitudinal (lengthwise) strength and continuous strand glass mats or stitched reinforcements used internally for transverse (crosswise) strength.

1. Depth of GreenGirt: [2 inch] [2-1/2 inch] [3 inch] or [3-1/2 inch] [4 inch] deep.
2. On Center Spacing: [16 inch] [24 inch] or [<____>].
3. Provide continuous non-corrosive steel insert for engagement of fasteners, 16 gage, minimum thickness, with G90 galvanized coating designation in compliance with ASTM A653/A653M.
 - a. Fully engage steel insert with adjacent CMH at ends.
 - b. Anchor sub-girts and other wall cladding support accessories to steel insert set into and part of CMH.
 - c. Provide screw pullout testing that meets or exceeds [<____ lbs.>].
4. Provide integral 3-point compression seal in CMH sections to ensure insulation panel will not dislodge.
5. Provide integral anti-siphon grooves on exterior and interior flanges of CMH.
6. Provide force distribution zones integrally designed into profile of CMH.
7. Provide spline seals for adjacent insulation units into profile of CMH.
8. Thermal Transmission: CMH sub-framing system design should limit rate of heat flow crosswise through the profile section to less than [_____] watts per 8' length in profile and temperature delta of 100 degrees Fahrenheit. Rate of heat flow to be determined in accordance with ASTM C1045-01, validated by a third party.

REFERENCE CHART

| Profile Depth | Rate of heat flow (watts) |
|---------------|---------------------------|
| 1.5" | 2.380W |
| 2" | 1.785W |
| 2.5" | 1.428W |
| 3" | 1.190W |
| 3.5" | 1.020W |
| 4" | 0.892W |
| 4.5" | 0.793W |
| 5" | 0.714W |
| 5.5" | 0.649W |
| 6" | 0.595W |

9. Surface Burning Characteristics:
 - a. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
 - b. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
10. Flammability: Comply with ASTM E84.
11. Self-Extinguishing: Comply with ASTM D635.
12. Profile Visual Requirements: Comply with ASTM D4385.
13. Mechanical Strength Requirements: Provide CMH system in compliance with the performance loading criteria and specified safety factors to meet the below requirements:

Longitudinal:

| Evaluation | Method | Minimum Longitudinal |
|-----------------------|-----------|----------------------|
| Modulus of Elasticity | ASTM D638 | 29,000,000 psi |
| Tensile Strength | ASTM D638 | 50,000 psi |
| Compressive Strength | ASTM 6641 | 50,000 psi |
| Flexural Stress | ASTM D790 | 50,000 psi |

Crosswise:

| Evaluation | Method | Minimum Crosswise |
|------------|--------|-------------------|
|------------|--------|-------------------|

| | | |
|-----------------------|-----------|---------------|
| Modulus of Elasticity | ASTM D638 | 3,300,000 psi |
| Tensile Strength | ASTM D638 | 40,000 psi |
| Compressive Strength | ASTM 6641 | 30,000 psi |
| Flexural Stress | ASTM D790 | 40,000 psi |

14. Barcol Hardness: 45, in accordance with ASTM D2583.
15. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.
16. Density: Within range of 0.062 to 0.070 lbs./cubic inch, in accordance with ASTM D792.
17. Lengthwise Coefficient of Thermal Expansion: 7.0×10^{-6} inch/inch/degrees F, in accordance with ASTM D696.
18. Notched Izod Impact, Lengthwise: 160 ft lbs./inch, in accordance with ASTM D256 within temperature range indicated.
19. Notched Izod Impact, Crosswise: 100 ft lbs./inch, in accordance with ASTM D256 within temperature range indicated.

2.05 INSULATION

- A. Insulation Panel Edges: Provide factory formed edges on insulation panels that interlock with CMH sub-framing system components.
- B. Polyisocyanurate Panel Insulation: Rigid closed cell foam, complying with ASTM C1289; **[Type I with impermeable aluminum foil facing on both sides; Class 1 with non-reinforced foam core]** or **[Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 3, 25 psi compressive strength]**.
 1. Flame Spread Index (FSI): 25 or less, tested in accordance with ASTM E84.
 2. Smoke Developed Index (SDI): 450 or less, tested in accordance with ASTM E84.
 3. Thermal Resistance: **[2 inch, R-Value 13] [2-1/2 inch, R-Value 16] [3 inch, R-Value 19] or [3-1/2 inch, R-Value 22]**; ASTM C518 at 75 degrees F. -R-values reported by Hunter (BOD).
 4. Comply with fire-resistance requirements, as indicated on drawings, and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 5. Board Edges: Square.
 6. Compressive Strength: **[Grade 1, 16 psi] [Grade 2, 20 psi] or [Grade 3, 25 psi]**; tested in compliance with ASTM D1621.
 7. Dimensional Stability: Less than 2 percent linear change after 7 days; ASTM D2126.
 8. Moisture Vapor Permeance: Less than 0.05 perm; ASTM E96/E96M.
 9. Water Absorption: Less than 0.05 percent by volume; tested to ASTM C209.
 10. Service Temperature: Range of minus 100 degrees F to 250 degrees F.
 11. Acceptable Products:
 - a. Basis of Design (BOD): Hunter Panels, LLC; Product Xci Foil (www.hunterxci.com)
 - b. Atlas Roof Insulation (www.atlasroofing.com)
 - c. Firestone Building Products; Product Enverge ISO (www.firestonebpc.com)
 - d. Dupont (DOW); Thermax Sheathing Insulation (www.dupont.com)
- C. Extruded Polystyrene (XPS) Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
 1. Type: ASTM C578, **[Type X, 15 psi compressive strength] [Type IV, 25 psi compressive strength] or [Type [], [] compressive strength]**.
 2. Flame Spread Index (FSI): 25 or less, tested in accordance with ASTM E84.
 3. Smoke Developed Index (SDI): 450 or less, tested in accordance with ASTM E84.
 4. Thermal Resistance: **[1-1/2 inch, R-Value 7.5] [2 inch, R-Value 10] [2-1/2 inch, R-Value 12.5] [3 inch, R-Value 15] or [3-1/2 inch, R-Value 17.5] [4 inch, R-Value 20]**; ASTM C518 at 75 degrees F.
 5. Comply with fire-resistance requirements, as indicated on drawings, and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 6. Board Edges: Square.
 7. Water Absorption, Maximum: 0.3 percent, by volume; ASTM C578.
 8. Acceptable Products:
 - a. Dow Chemical Company (www.dow.com)

- b. Owens Corning Corporation (www.ocbuildingspec.com)
- c. Kingspan Insulation LLC (www.kingspan.com)

2.06 COMPOSITE MATERIAL TRIM FOR OPENINGS

- A. Composite Trim; Provide nonstructural composite trim at rough openings to properly transition CI system.
 - 1. Use trim angles and accessories sized to enclose CI system to provide thermally broken transition from opaque wall assemblies.
 - 2. Use sealant and tapes as required to transition vapor barrier from substrate onto trim.
 - 3. Trim to provide 90-degree transition of continuous insulated substrate for vapor barrier and exterior flashings.
 - 4. Trim to be covered by exterior panel construction and flashings.

Mechanical Strength Requirements: Provide FRP in compliance with the performance loading criteria and specified safety factors to meet the below requirements:

Longitudinal:

| Evaluation | Method | Minimum Longitudinal |
|-----------------------|-----------|----------------------|
| Modulus of Elasticity | ASTM D638 | 2,500,000 psi |
| Tensile Strength | ASTM D638 | 33,000 psi |
| Compressive Strength | ASTM 6641 | 30,000 psi |
| Flexural Stress | ASTM D790 | 25,000 psi |
| | | |

Crosswise:

| Evaluation | Method | Minimum Crosswise |
|-----------------------|-----------|-------------------|
| Modulus of Elasticity | ASTM D638 | 2,500,000 psi |
| Tensile Strength | ASTM D638 | 33,000 psi |
| Compressive Strength | ASTM 6641 | 30,000 psi |
| Flexural Stress | ASTM D790 | 30,000 psi |

- 5. Surface Burning Characteristics:
 - a. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
 - b. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
- 6. Comply with fire-resistance requirements, as indicated on drawings, and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
- 7. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.
- 8. Acceptable Products:
 - a. SMARTci Trim
 - b. Alternative: Performance CI system utilizing metal trim to provide spray foam insulation at a depth of 6" extending 32" around openings to reduce thermal transfer at wall transitions.

2.07 CONTINUOUS INSULATION SYSTEM ASSEMBLY

- A. Assemble CI with CMH and trim system using manufacturer's standard procedures and processes identical to tested units and as necessary to comply with performance requirements indicated.
 - 1. Comply with CMH sub-framing system and dimensional and structural requirements as indicated on drawings.
 - 2. Erect CMH sub-framing system in sequence in accordance with manufacturer's standard installation procedures.
 - 3. Provide spray foam sealant on backside of cantilevered fasteners that completely puncture the insulation layer.
 - 4. CMH and CI system shall create a substrate for the application of external barrier systems per project details.
 - 5. Provide uninterrupted, monolithic drainage plane as required per project details.

2.08 ACCESSORIES

- A. Provide accessories necessary for complete CMH sub-framing system including **[metal closure trim]** **[transition angle]** **[strapping]** **[tie-in brackets]** or [>] and similar items.
- B. Fasteners: Corrosion-resistant, self-tapping and self-drilling screws, bolts, nuts, and other fasteners as recommended by CMH sub-framing system manufacturer for CMH material and project application.
 - 1. Cladding to CMH: Use standard self-tapping metal screws.
 - 2. CMH to Metal Stud Wall Framing: Use standard self-tapping metal screws.
 - 3. CMH to Concrete/CMU: Use standard masonry or concrete screw anchors in predrilled hole.
 - 4. CMH to Wood Framing: Use standard wood screw anchors.
 - 5. DO NOT USE powder, air, or gas actuated fasteners or actuated fastener tools. DO NOT USE impact wrenches when fastening to or from the CMH.
 - 6. CMH attachments to follow guidelines of ASCE Structural Plastics Design Manual:

| | Ratio of distance to fastener diameter |
|----------------------------|---|
| | Minimum Distance Allowable |
| Edge distance- end | 3.0 |
| Edge distance- side | 2.0 |

- C. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.
 - 1. Refer to Drawings for thickness and Section 06 1000 for additional requirements.
- D. Wall Sheathing: Gypsum board, complying with requirements of ASTM C1396/C1396M for gypsum sheathing, V-shaped long edges, Type X fire-resistant.
 - 1. Refer to Drawings for thickness and **[Section 06 1000]** or **[Section 09 2116]** for additional requirements.
- E. Tape: Pressure sensitive adhesive coated polypropylene woven fabric. Must be mold, water, tear and UV resistant. Must be applicable in a wide temperature range (-20 degrees F).
- F. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, square long edges, Type X fire-resistant.
 - 1. Refer to Drawings for thickness and **[Section 06 1000]** or **[Section 09 2116]** for additional requirements.
- G. Weather Resistant Barrier (WRB): Refer to Section 07 2500 for requirements.
- H. Sealants: Provide sealants as recommended by CMH manufacturer for openings within CMH sub-framing system and perimeter conditions.
 - 1. Refer to Section 07 9200 for sealant information.
- I. Closure and Transition Accessories: Use **[metal]** or **[FRP]** angles and flat stock per standard system details.

PART 3- EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas of this work, and project conditions with installer present for compliance with requirements for installation tolerances, substrates, CMH sub-framing system conditions, and other conditions affecting performance of this Work.
- B. Examine structural wall framing to ensure that angles, channels, studs, and other structural support members have been installed within alignment tolerances required by CMH sub-framing system manufacturer.
- C. Examine rough-in for components and systems penetrating CMH sub-framing system to coordinate actual locations of penetrations relative to CMH sub-framing system joint locations prior to installation.
- D. Verify that mechanical and electrical services for exterior walls have been installed and tested and, if appropriate, verify that adjacent materials and finishes are dry and ready to receive insulation.

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- E. Proceed with installation only after wall substrate surfaces have been properly prepared and unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by CMH manufacturer for achieving best result for substrate under project conditions.
- C. Prepare sub-framing, base angles, sills, furring, and other CMH sub-framing system members and provide anchorage in accordance with ASTM C754 for substrate type and wall cladding type in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install CMH sub-framing system in accordance with manufacturer's installation instructions.
- B. Install CMH sub-framing system to meet requirements of ASCE Structural Plastics Design Manual.
- C. Install system to fill-in exterior spaces without gaps or voids, and do not compress insulation panels.
- D. Trim insulation neatly to fit spaces and insulate miscellaneous gaps and voids.
- E. Fit insulation tight in spaces and tight to exterior side of Mechanical/Electrical services within plane of insulation.
- F. Seal gaps, voids or penetrations completely with approved expandable foam sealant on exterior and interior (if visible) before enclosing wall.
- G. Provide spray foam to seal metal penetrations, including cantilevered fasteners, to prevent interstitial space condensation.
- H. Exposed insulation must be protected from open flame and kept dry at all times.
- I. Exterior wall insulation panels are not intended to be left exposed for periods of time in excess of 60 days without adequate protection.
 - 1. When extended exposure is anticipated, protect exposed insulation surfaces including corners, window and door openings with a compatible waterproof tape.
- J. Install CMH sub-framing system in compliance with system orientation, sizes, and locations as indicated on drawings.

3.04 TOLERANCES

- A. Shim and align CMH sub-framing system within installed tolerances of 1/4 inch in 20 feet, non-cumulative, level, plumb, and on location lines as indicated.

3.05 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Ensure that insulation panels are not exposed to moisture.
 - 1. Remove wet insulation panels or allow them to completely dry prior to installation of CMH sub-framing system.
- C. Replace damaged insulation panels prior to Date of Substantial Completion.

END OF SECTION

AUTHOR
FILE NAME

(CI) (2.5 IN 1) COMPOSITE METAL HYBRID (CMH) SUB-FRAMING SYSTEM
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