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SECTION 07 0543.15

COMPOSITE METAL HYBRID (CMH) ADJUSTABLE CONTINUOUS INSULATION SUPPORT SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Composite metal hybrid (CMH) adjustable sub-framing support system with in-fill continuous insulation integrated within [metal wall panels] [brick veneer] [CMU veneer] [phenolic panels] [fiber cement panels] [terracotta] or [<____>] exterior wall cladding.
 - 1. Substrate: [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 2500 – Weather Barriers: Air, water, vapor barrier at exterior wall.
- F. Section 07 4200 – Wall Panels: Exterior wall panel system.
- G. Section 07 9200 – Joint Sealants: Perimeter sealant.
- H. Section 09 2116 – Gypsum Board Assemblies: Exterior wall sheathing.

1.03 REFERENCE STANDARDS

- A. ASCE American Society of Civil Engineers (www.asce.org).
 - 1. ASCE 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2022.
 - 2. ASCE – Structural Plastics Design Manual.
- B. ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers (www.ashrae.com).
 - 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; 2020.
- C. ASTM International – American Society for Testing and Materials (www.astm.org).
 - 1. ASTM A653/A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2022.
 - 2. ASTM C518 – Standard Test Method for Stead-State Thermal Transmission Properties by Means

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- of Heat Flow Meter Apparatus; 2021.
3. ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (2019).
 4. ASTM C612 – Standard Specification for Mineral Wool Fiber Block and Board Thermal Insulation; 2014 (2019).
 5. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attachment Gypsum Panel Products; 2020.
 6. ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
 7. ASTM C1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2019.
 8. ASTM C1396/C1396M – Standard Specification for Gypsum Board; 2017 (2022).
 9. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (2018).
 10. ASTM D570 – Standard Test Method for Water Absorption of Plastics; 2022.
 11. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
 12. ASTM D638 – Standard Test Method for Tensile Properties of Plastics; 2022.
 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; 2016.
 14. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.
 15. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2020.
 16. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2020.
 17. ASTM D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics; 2017.
 18. ASTM D2842 – Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
 19. ASTM D4385 – Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products; 2019.
 20. ASTM D6641/D6641M – Standard Test Method for Compressive Properties of Polymer Matrix Composite Materials Using a Combined Loading Compression (CLC) Test Fixture, 2016e2.
 21. ASTM D7332-B – Standard Test Method for Measuring the Fastener Pull-Through Resistance of a Fiber-Reinforced Polymer Matrix Composite; 2022.
 22. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.
 23. ASTM E96/E96M – Standard Test Method for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a.
 24. ASTM E119 – Standard Test Method for Fire Tests of Building Construction and Materials; 2022.
 25. ASTM E283/E283M – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (2021).
 26. ASTM E2178 – Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- D. IBC – International Building Code (ICC – International Code Council); 2021.
- E. IECC – International Energy Conservation Code; 2021.
- F. IgCC – International Green Construction Code; 2021.
- G. NFPA – National Fire Protection Association (www.nfpa.org).
1. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

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- H. Voluntary Product Standard; Department of Commerce (DOC) and National Institute of Standards and Technology (NIST) (www.apawood.org).
 - 1. PS 1 – Structural Plywood; 2019 (Revised 2020).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate installation of continuous insulation sub-framing support system as indicated on drawings for proper drainage, flashing, trim, backup 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 meet established schedule.
 - 3. Review means and methods related to installation in accordance with manufacturer's installation instructions.
 - 4. Examine support conditions for compliance with installation 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 is related to 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.
- B. Product Data: Submit for each product being used as indicated, including installation details, material descriptions, dimensions of individual components and profiles, and necessary accessories for a complete assembled system.
- C. Test and Engineering Reports: Submit Test and Engineering reports on each type of composite sub-framing system based on the evaluation of comprehensive tests performed by a certified testing agency and/or Professional Engineers (PE) approved by authorities having jurisdiction.
 - 1. Structural Composite Sub-Framing Submittal:
Provide PE stamped calculations for the composite sub-framing system carrying the associated cladding system that takes into account:
 - a. Anisotropic properties of the sub-framing.
 - b. Point loading of the fasteners and representative dynamics of the cladding system.
 - c. Uniform loading calculations not being allowed as it is not representative to actual wall systems.
 - d. Calculations for eccentric cantilever conditions.
 - e. Calculations providing a safety factor minimum of 4 at the high service temperature of 180 degrees Fahrenheit.
 - f. Fastener Creep and Durability Test for FRP sub-girts, certified by third party/PE. Test to be completed per reference section 2.03E.
 - g. Fire: ASTM E84 Class A and NFPA 285 tested for the specific wall assembly in this project.
- D. Warranty: Submit manufacturer's sample warranty and ensure forms have been completed in Owner's name, registered with manufacturer for the Manufacturer's Warranty for the Sub-Framing System, and FRP Manufacturer's Warranty for Screw Creep and Durability per section 1.09.

1.06 QUALITY ASSURANCE

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- A. Manufacturer Qualifications: Company specializing in manufacturing 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 support system and cladding system design.
 - 2. Code Conformance: CMH adjustable system to have been evaluated by IAPMO Uniform Evaluation Service and found satisfactory for compliance with 2018 International Building Code.
- B. Installer Qualifications: Company specializing in performing work as indicated in this section with at least three years of documented experience and approved by manufacturer.
 - 1. Install system in strict compliance with manufacturer's installation instructions.
- C. Design Engineer's Qualification: 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. Environmental: CMH system to follow the below guidelines:
 - 1. CMH system to be registered as red list chemical free with the 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. See Section 01 7419 – Construction Waste Management and Disposal for material waste requirements.
- B. Deliver materials to site without damage or deformation in manufacturer's original unopened containers and with labels that clearly identify product name and manufacturer.
- C. Storage: Store materials in clean, dry, and level interior or exterior areas for limited duration in accordance with manufacturer's written instructions.
- D. Protect components during transportation, handling, and installation from moisture, excessive temperatures, and other construction operations in accordance with manufacturer's written instructions.
- E. Handle components in accordance with manufacturer's written instructions and in a manner to prevent bending, warping, twisting, and surface, edge, or corner damage.

1.08 SITE CONDITIONS

- A. Weather Limitations: Only proceed with installation when existing and forecasted weather conditions allow for assembly of this Work in accordance with manufacturer's written installation instructions.

1.09 WARRANTY

- A. See Section 01 7800 – Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty for the Sub-Framing System: Provide five (5)-year manufacturer's warranty for composite metal hybrid (CMH) sub-framing support system commencing on the date of manufacture or date of substantial completion.
- C. FRP Manufacturer's Warranty for Screw Creep and Durability: Provide 20-year manufacturer's non-prorated, product replacement warranty against fastener creep and/or decreased fastener retention capacity

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for cladding fasteners that are anchored solely into an FRP substrate in lieu of a metal substrate. FRP material to be warrantied to perform long term to retain fasteners in a load capacity equivalent to 16 Ga. steel under the same loading, temperature, duration, and durability.

PART 2 – PRODUCTS

2.01 MANUFACTURER

- A. Advanced Architectural Products (A2P):
 - 1. Address: 959 Industrial Drive, Allegan, Michigan 49010.
 - 2. Phone: (269) 355-1818; Fax: (866) 858-5568; Website: GreenGirt.com.
- B. Products:
 - 1. GreenGirt Delta Adjustable System.
 - 2. 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 support system components **[through exterior sheathing into metal stud framing]** **[through exterior sheathing into wood stud framing]** **[to concrete masonry units (CMU)]** or **[to poured concrete wall]** as indicated on drawings.
 - 1. See Section 03 3000 for concrete substrate.
 - 2. See Section 04 2000 for CMU substrate.
 - 3. See Section 05 4000 for metal stud framing.
 - 4. See Section 06 1000 for **[exterior sheathing]** and/or **[wood stud framing]**.
 - 5. See Section 07 4200 for wall panels system.
- B. Install CMH sub-framing support system components **[vertically]** through exterior sheathing into stud support system as indicated on drawings in compliance with project requirements.
- C. Install CMH sub-framing support system components **[vertically]** onto **[masonry]** or **[concrete]** substrate system with shims as indicated on drawings in compliance with project requirements.
- D. If necessary, install metal hat channel as indicated on drawings, mounted **[horizontally to vertical]** CMH sub-framing support system, connecting adjacent supports in series to each other.

2.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: 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 location and potential for occurrence based on data from wind velocity maps and other provisions of 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 maximum 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.
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 that installed continuous insulation and CMH sub-framing support system, 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. Verify that system thermal design meets or exceeds thermal design requirements in accordance with [ASHRAE 90.1] [ASHRAE 189.1] [IECC] or [IgCC] energy code.
 2. Thermal Resistance, Overall: Provide wall assembly R-Value of [], minimum.
 3. Thermal Performance Test: Provide thermal resistance (R-value) indicated, in accordance with ASTM C1363, corrected to 15 mph wind outside and still air inside, with installed condition including fasteners and joints.
 4. 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.
 5. Provide test unit with at least one insulation panel horizontal and vertical joint length and height of test chamber area.
 6. Provide finite element analysis of three-dimensional simulation of described wall assembly sealed by a professional engineer in compliance with code performance requirements and exceeding it by at least 3 percent.
- C. Temperature Range: Comply with structural loading requirements within a temperature range of minus 55 degrees F to 180 degrees F.
- D. Fire-Resistance Ratings: Provide CMH sub-framing support system with fire testing in accordance with ASTM E119 test methods and applied by approved testing agency acceptable to authorities having jurisdiction (AHJ).
1. Surface Burning Characteristics: Test in accordance with ASTM E84 test method for continuous insulation, composite metal hybrid (CMH), and interior surfaces as follows:
 - a. Flame Spread Index (FSI): 25 or less.
 - b. Smoke Developed Index (SDI): 450 or less.
 2. Immediate 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.
- E. Fastener Creep and Durability Test: For fasteners anchored into an FRP substrate without metal backer/retention system, perform per ASTM D7332-B, seven (7) day continuous fastener loading at the project's specified high service temperature of 180 degrees F.

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1. The fastener thread pull-out test is to be performed for self-drilling screws anchored solely into an FRP substrate. Test with ASTM D7332-B fixture using a fixture with a clearance opening of 34mm (1.313") in diameter. The pulling yoke is to be attached to the fastener head, with the load transferring into the anchoring threads. Ramp loading for no less than 30 seconds and no more than 120 seconds.
2. Testing to be performed inside a climate chamber at a temperature of 180 degrees F for a period of 7 days at ultimate fastener load. Passing load values to be considered ultimate pull-out values for project engineering purposes.
3. Test for 5 samples at same loading and temperature without pull-out. Testing to be certified by independent 3rd party.
4. Test results of fastener head/thread pull-through performed at room temperature with static ASTM D7332-B are not considered valid for creep and durability testing and are not to be used for determining ultimate screw loading values.

2.04 COMPOSITE METAL HYBRID (CMH) ADJUSTABLE SUPPORT SYSTEM

- A. CMH Adjustable Support System: Provide CMH support bracket system consisting of polyester resin matrix with recycled materials, fire retardant additives and reinforced with integral continuous metal inserts the full length with pre-drilled holes to align with substrate fastener locations.
1. Provide **[vertical]** application for cladding attachment.
 2. Length of CMH Support Bracket: 6 inches long.
 3. Depth of CMH Support Bracket: **[2 inches] [3 inches] [4 inches] [5 inches]** or **[6 inches]** deep.
 4. Overall System Depth:
 - a. HZ System: **[3-1/4 inches] [8-1/2 inches] [10-1/2 inches]** or **[() inches]**.
 - b. Vertical System: **[2-1/4 inches] [8-1/2 inches] [10-1/2 inches]** or **[() inches]**.
 5. Spacing of CMH Support Bracket for Attachment to Substrate:
 - a. HZ Spacing: **[16 inches] [24 inches] [32 inches]** or **[48 inches]** on center.
 - b. Vertical Spacing: **[16 inches] [24 inches] [32 inches]** or **[48 inches]** on center.
 6. Fastener Retention System: Provide galvanized steel insert for engagement of fasteners, at least 16 gauge thick, with G90 galvanized coating in accordance with ASTM A653/A653M.
 - a. Fasten CMH bracket to substrate structure through steel insert located within bottom of CMH bracket.
 - b. Insert appropriately sized dual grip retention clip into bottom of CMH bracket.
 - c. Provide screw pullout testing that meets or exceeds [**< ____ >**].
 7. Insert **[CMH HZ Clip] [Galvanized Steel HZ Clip] [Aluminum HZ Clip] [CMH L Rail] [Galvanized Steel L Rail]** or **[Aluminum L Rail]** within CMH bracket.
 - a. Length of CMH HZ Clip: 6 inches long.
 - b. Length of **[Galvanized]** or **[Aluminum]** Z Clip: 6 inches long.
 - c. Depth of HZ Clip: **[2 inches] [3 inches] [4 inches] [5 inches]** or **[6 inches]** deep.
 - d. Length of CMH L Rail: 6 feet long.
 - e. Length of **[Galvanized]** or **[Aluminum]** Vertical L Rail: 10 feet long.
 - f. Depth of Vertical Rail: **[2 inches] [3 inches] [4 inches] [5 inches]** or **[6 inches]** deep.
 8. CMH support bracket is self-extinguishing in accordance with ASTM D635.

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9. Visual defects in CMH support bracket is classified in accordance with ASTM D4385.
10. Tensile Properties: Engineered lengthwise and crosswise tensile properties of CMH support bracket comply with performance loading criteria and specified safety factors in accordance with ASTM D638.
 - a. Lengthwise 50,000 psi and crosswise 40,000 psi, minimum.
11. Compressive Properties: Engineered lengthwise and crosswise compressive properties of CMH support bracket comply with performance loading criteria and specified safety factors in accordance with ASTM D641/D6641M.
 - a. Lengthwise 50,000 psi and crosswise 30,000 psi, minimum.
12. Flexural Properties: Engineered lengthwise and crosswise flexural properties of CMH support bracket comply with performance loading criteria and specified safety factors in accordance with ASTM D790.
 - a. Lengthwise 50,000 psi and crosswise 40,000 psi, minimum.
13. Modulus of Elasticity: CMH support bracket is engineered to meet performance loading criteria and specified safety factors in accordance with ASTM D638.
 - a. Lengthwise 3,000,000 psi and crosswise 3,300,000 psi, minimum.
14. Water Absorption: CMH support bracket absorbs less than 0.46 percent by weight within 24 hours when tested in accordance with ASTM D570.
15. Relative Density: CMH support bracket is within range of 0.062 to 0.070 lbs/cubic inch when tested in accordance with ASTM D792.
16. Coefficient of Linear Thermal Expansion: CMH support bracket is at 7.0×10^{-6} inch/inch/degrees F when tested in accordance with ASTM D696.
17. Notched Izod Pendulum Impact Resistance, Lengthwise: CMH support bracket is at 160 ft lbs/inch when tested in accordance with ASTM D256 within standard temperature range.
18. Notched Izod Pendulum Impact Resistance, Crosswise: CMH support bracket is at 100 ft lbs/inch when tested in accordance with ASTM D256 within standard temperature range.
19. Barcol Hardness: 45, in accordance with ASTM D2583.
20. 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.
21. Flammability: Comply with ASTM E84.
22. Thermal Transmission: CMH sub-framing support 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) |
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|------|--------|
| 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 |

2.05 INSULATION

- A. Mineral Fiber Board Insulation: Rigid or semi-rigid mineral fiber, in accordance with ASTM C612 or ASTM C553.
- Surface Burning Characteristics:
 - Flame Spread Index (FSI), Unfaced: Zero (0) when tested in accordance with ASTM E84.
 - Smoke Developed Index (SDI), Unfaced: Zero (0) when tested in accordance with ASTM E84.
 - Board Size: **[16 by 48 inches] [24 x 48 inches] [32 by 48 inches] or [] by [] inches**.
 - Board Thickness: **[1-1/2 inches] [2 inches] [2-1/2 inches] [3 inches] [3-1/2 inches] [4 inches] or [] inches**.
 - Thermal Resistance: R-Value of **[4.2]** or **[]** per inch, minimum, at 75 degrees F when tested in accordance with ASTM C518.
 - Comply with fire-resistance requirements, as indicated on drawings, and as part of an exterior non-load-bearing exterior wall assembly, tested in accordance with NFPA 285.
 - Board Edges: Square.
 - Density: **[2 pcf] [4 pcf] [6 pcf] [8 pcf] or [] pcf**, minimum, when tested in accordance with ASTM C612 or ASTM C303.
 - Acceptable Products:
 - Johns Manville; Product MinWool Curtainwall 40 (www.jm.com).
 - Owens Corning; Product Thermafiber RainBarrier HD (www.thermafiber.com).
 - ROCKWOOL; Product Rockwool Plus MB (www.rockwool.com).
 - []
 - Substitutions: See Section 01 6000 – Product Requirements.

2.06 COMPOSITE METAL HYBRID (CMH) TRIM

- A. CMH Trim: Provide nonstructural trim at rough openings to properly transition continuous insulation (CI) system.
- Use angled and flat trim to enclose CI system and to provide thermally broken transitions within wall assemblies.
 - Angled Trim: **[2 by 3 inches] or [As indicated on drawings]**.
 - Flat Trim: **[6 inches] and/or [12 inches] wide, or [As indicated on drawings]**.
 - Use sealant and tapes as required to transition weather-resistive barriers (WRB) from substrate onto trim.
 - Trim to provide 90-degree transition of CI substrate for weather-resistive barriers (WRB) and exterior flashing.
 - Cover trim with exterior panel assembly and flashings.

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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, 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 ASSEMBLY

- A. Assembly CMH sub-framing support system in accordance with manufacturer's installation instructions and as necessary to comply with performance requirements indicated.
 1. Comply with CMH sub-framing support system dimensional and structural requirements as indicated on drawings.
 2. Install CMH sub-framing support system in acceptable sequence in accordance with manufacturer's written installation instructions.
 3. Install spray foam sealant on backside of cantilevered fasteners that completely puncture insulation layer.
 4. Provide uninterrupted, monolithic drainage plane as required per project details.

2.08 ACCESSORIES

- A. Provide necessary accessories for complete installation of CMH sub-framing support system including **[metal closure trim] [transition angle] [strapping] [tie-in brackets] or [<____>]**, and other similar items.
- B. Fasteners: Corrosion-resistant, self-tapping, and self-drilling screws, bolts, nuts, and other fasteners as recommended by CMH sub-framing support system manufacturer for CMH materials and other project applications.
 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 or Concrete Masonry Units (CMU): Use standard masonry or concrete screw anchors in pre-drilled hole.
 4. CMH to Wood Stud Wall Framing: Use standard wood screw anchors.
 5. Use of powder, air, or gas-actuated fasteners or actuated fastener tools is not permitted.
 6. Use of impact wrenches when fastening to or from CMH is not permitted.
 7. 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; Grade C-D and Exposure I in accordance with Voluntary Product Standard PS 1.
 1. Refer to drawings for thickness and see Section 06 1000 for additional requirements.

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- D. Wall Sheathing: Gypsum board; V-shaped long edges and Type X fire-resistant in accordance with ASTM C1396/C1396M.
 - 1. Refer to drawings for thickness and see [Section 06 1000] or [Section 09 2116] for additional requirements.
- E. Tape (if necessary): Pressure-sensitive adhesive-coated polypropylene woven fabric. Must be mold, water, tear and UV resistant. Must be applicable in a wide temperature range (-20 degree F).
- F. Weather-Resistive Barriers (WRB): See Section 07 2500 for additional information.
- G. Sealants (if necessary): See Section 07 9200 for additional information.
- H. Closure and Transition Accessories (if necessary): 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 support 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 in accordance with installation instructions of CMH sub-framing support system manufacturer.
- C. Examine components and systems penetrating CMH sub-framing support system prior to installation during rough-in stage of construction to coordinate actual locations of penetrations relative to CMH sub-framing support system's joint locations.
- D. Verify that mechanical and electrical-related installations for exterior walls have been completed and verify that adjacent materials and finishes are dry and ready for insulation installation.
- E. Proceed with installation of CMH sub-framing support system 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 substrate surfaces using methods recommended in writing by CMH sub-framing support system manufacturer to achieve excellent results under project conditions.
- C. Prepare sub-framing, base angles, sills, furring, and other CMH sub-framing support system components and provide anchorage in accordance with ASTM C754 for substrate and wall cladding types in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install CMH sub-framing support system in accordance with manufacturer's installation instructions.
- B. Install CMH sub-framing support 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.

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- 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 to excess of 60 days without adequate protection.
 - 1. When extended exposure is anticipated, protect exposed insulation surfaces including corners, windows and door openings with a compatible waterproof tape.
- J. Install CMH sub-framing support system in compliance with system orientation, sizes, and locations as indicated on drawings.

3.04 TOLERANCES

- A. Shim and align CMH sub-framing support system with installation tolerances of ¼ inch in 20 feet, non-cumulative, level, plumb, and aligned with locations as indicated on drawings.

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 within CMH sub-framing support system.
- C. Replace damaged insulation prior to Date of Substantial Completion.

END OF SECTION