

SECTION 07 4210.11

ADJUSTABLE COMPOSITE METAL HYBRID (CMH) BRACKET AND SUB-FRAMING SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Adjustable composite metal hybrid (CMH) bracket and sub-framing system with in-fill insulation integrated with [metal wall panels] [brick veneer] [phenolic panels] [fiber cement panels] or [<____>] exterior wall cladding.
 - 1. Substrate: [Exterior sheathing over metal stud framing] [Exterior sheathing over wood stud framing] [Concrete masonry units (CMU)] or [Pour 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: Wall cladding system
- 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 C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015
 - 3. ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013
 - 4. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014
 - 5. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015
 - 6. ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013
 - 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

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9. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010e1
 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 D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2013a
 18. ASTM D2842 – Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012
 19. ASTM D4385 – Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products; 2013
 20. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a
 21. ASTM E96/E96M – Standard Test Methods for Water Vapor Transmission of Materials; 2015
 22. 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)
 23. ASTM E2178 – Standard Test Method for Air Permeance of Building Materials; 2013
- 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

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 place, 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.
- 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.
1. Continuous insulation support system attachment methods and required fasteners
 2. Wall-mounted items including doors, windows, louvers, and lighting fixtures
 3. Wall penetrations including pipes, electrical fixtures, and any other utilities

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- C. Coordination Drawings: Submit scaled exterior elevations that provide the following items in coordination with each other and input from installers of these items:
 - 1. Adjustable CMH sub-framing system attachment methods and required fasteners
 - 2. Adjustable CMH base bracket and sub-framing
 - 3. Continuous insulation support system attachment methods and required fasteners
 - 4. Wall-mounted items including doors, windows, louvers, and lighting fixtures
 - 5. Wall penetrations including pipes, electrical fixtures, and any other utilities
- D. 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.
 - 1. Provide thermal report on assembly specific to orientation and spacing of sub-framing members.
- E. 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 products specified in this section with at least ten years of documented experience.
 - 1. System Review: Manufacturer to provide engineering assessment based on adjustable CMH sub-framing and cladding system design.
- 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.
- 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. Engineering information provided shall be signed and verified by licensed Structural Engineer.

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

- 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. Adjustable CMH Sub-Framing System Warranty: Provide written warranty by manufacturer agreeing to correct defects in manufacturing within a **[five year]** or [**<____>**] period after Date of **[Delivery]** or **[Substantial Completion]**.

PART 2 – PRODUCTS

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2.01 MANUFACTURER

- A. **Advanced Architectural Products (A2P):** SMARTci GreenGirt Delta Adjustable CMH Sub-Framing System with Integral Insulation and Rail Retention – Dual-Grip™.
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.
 4. No substitutions permitted.

2.02 DESCRIPTION

- A. Attach adjustable CMH bracket vertically to [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 continuous [CMH] or [metal] vertical rail components as indicated on drawings in compliance with specified requirements.
- C. Install [CMH] or [metal] insert to receive horizontal framing components as indicated on drawings in compliance with specified requirements.

2.03 PERFORMANCE REQUIREMENTS

- A. Structural: Provide system designed 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 adjustable composite metal hybrid (CMH) 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.
 2. Provide finite element analysis (FEA) to model and evaluate areas of the longest cantilever from substrate attachment for each cladding system.
 3. Adjustable CMH Sub-Framing System: Structurally engineered to provide in excess of **[four (4)]** times structural safety factor for lengthwise, longitudinal, and crosswise loading.
 4. Adjustable CMH Attachment: Structurally engineered to provide in excess of **[four (4)]** times structural safety factor for lengthwise, longitudinal, and crosswise loading.
- B. System Thermal Design: Ensure installed insulation and adjustable CMH sub-framing system, rough opening trim, sub-framing, clips and cladding attachment does not have thermal bridging of through wall metal connections 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 effective R Value of [].
- C. Temperature: Comply with structural loading requirements within a temperature range of minus 55 degrees Fahrenheit to 190 degrees F.
1. Submit the following tests at the high value (at least 180 degrees F) of the temperature range:

- a. Fastener pullout
 - b. Tensile Strength
 - i. Crosswise (CW)
 - ii. Lengthwise (LW)
 - c. Modulus of Elasticity
 - 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 temperatures (at least 180 degrees Fahrenheit) – if not included, submittal is not approved.

D. Fire-Test-Response Characteristics: Provide adjustable 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 steel and fiber reinforced polymer (CMH) 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 ADJUSTABLE COMPOSITE METAL HYBRID (CMH) SUB-FRAMING SYSTEM

A. Adjustable CMH Sub-Framing System: Provide adjustable CMH sub-framing 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 adjustable CMH sub-framing systems with glass strand rovings used internally for longitudinal (lengthwise) strength and continuous strand glass mats or stitched reinforcements used internally for transverse (crosswise) strength. Adjustable CMH brackets to provide insulation retention with integral insulation cleats. Adjustable CMH brackets to receive continuous rail, adjusted within the bracket to meet required overall system depth:

1. Depth of Base Bracket: [3 inch] [4 inch] [5 inch] or [6 inch] deep.
2. Horizontal On Center Spacing: [16 inch] [24 inch]
3. Vertical On Center Spacing: [16 inch] [24 inch] [32 inch]
4. Type of Rail: [CMH rail] [Metal rail]
5. Depth of Rail: [3 inch] to [6 inch]
6. Rail Adjustability: at least 50 percent of base bracket depth.
7. Overall system depth: [3 inch] to [10.5 inch].
8. Provide continuous non-corrosive steel insert for engagement of fasteners, at least 16-gauge thick with G90 galvanized coating designation in compliance with ASTM A653/A653M.

- a. Anchor sub-girts and other wall cladding support accessories to steel insert set into and part of CMH.
 - b. Provide screw pullout testing that meets or exceeds [<____>].
9. Provide force distribution zones integrally designed into profile of CMH.
10. Adjustable CMH Bracket Thermal Transmission: Adjustable CMH sub-framing system design should limit rate of heat flow crosswise through the profile section to less than [____] watts per 6” 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)
3”	0.074W
4”	0.055W
5”	0.044W
6”	0.037W

- 11. 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.
- 12. Flammability: Comply with ASTM E84.
- 13. Self-Extinguishing: Comply with ASTM D635.
- 14. Profile Visual Requirements: Comply with ASTM D4385.
- 15. Mechanical Strength Requirements: Provide adjustable 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	3,000,000 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

- 16. Barcol Hardness: 45, in accordance with ASTM D2583.
- 17. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.
- 18. Density: Within range of 0.062 to 0.070 lbs/cubic inch, in accordance with ASTM D792.
- 19. Notched Izod Impact, Lengthwise: 160 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.
- 20. Notched Izod Impact, Crosswise: 100 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.

2.05 INSULATION

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.
5. 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

6. Surface Burning Characteristics:
Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
7. 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 284.
8. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.
9. Acceptable Products:
 - a. SMARTci Trim
 - b. Alternative: Performance CI system utilizing stainless steel 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. Assembly adjustable CMH sub-framing system using manufacturer’s standard procedures and processes identical to tested units and as necessary to comply with performance requirements indicated.

1. Comply with adjustable CMH sub-framing system and dimensional and structural requirements as indicated on drawings.
2. Erect adjustable CMH sub-framing system in established sequence in accordance with manufacturer’s standard installation procedures.
3. Provide spray foam sealant on backside of the cantilevered fasteners that completely puncture insulation layer as required per project details.
4. Provide uninterrupted, monolithic drainage plane as required per project details.

2.04 ACCESSORIES

- A. Provide accessories necessary for complete adjustable 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 adjustable CMH sub-framing manufacturer for adjustable CMH material and project application.
 - a. Cladding to adjustable CMH Metal Insert: Use standard self-tapping metal screws.
 - b. Adjustable CMH to Metal Stud Wall Framing: Use standard self-tapping metal screws.
 - c. Adjustable CMH to Concrete/CMU: Use standard masonry or concrete crew anchors in predrilled hole.
 - d. Adjustable CMH to Wood Framing: Use standard wood screw anchors.
 - e. DO NOT USE powder, air, or gas actuated fasteners or actuated fastener tools. DO NOT USE impact wrenches when fastening to or from the adjustable CMH.
 - f. Composite 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.
 - a. 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.
 - a. Refer to drawings for thickness and [Section 06 1000] or [Section 09 2116] for additional requirements.
- E. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, square long edges, Type X fire-resistant.
 - a. Refer to drawings for thickness and [Section 06 1000] or [Section 09 2116] for additional requirements.
- F. Weather Resistant Barrier (WRB): Refer to Section 07 2500 for requirements.
- G. Sealants: Refer to Section 07 9200 for sealant information.
- H. 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 adjustable CMH sub-framing system manufacturer.
- C. Examine rough-in for components and systems penetrating adjustable CMH sub-framing system to coordinate actual locations of penetrations relative to adjustable CMH sub-framing systems 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.
- E. Proceed with installation only after wall substrate surfaces have been properly prepared and unsatisfactory conditions have been corrected.

3.02 PREPARATION

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- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by adjustable CMH manufacturer for achieving best result for substrate under project conditions.
- C. Prepare sub-framing, base angles, sills, furring, and other adjustable 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 adjustable CMH sub-framing system in accordance with manufacturer's installation instructions.
- B. Install adjustable 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. Exposed insulation must be protected from open flame.
- G. Exterior wall insulation is not intended to be left exposed for extended periods of time without adequate protection.
- H. Install adjustable CMH sub-framing system in compliance with system orientation, sizes, and locations as indicated on drawings.

3.04 TOLERANCES

- A. Align and adjust rail with adjustable CMH bracket assembly to accommodate potential out of plumb conditions.

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

END OF SECTION