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SECTION 07 05 43.05

STRUCTURAL THERMAL FRAMING FOR WINDOWS AND OPENINGS

This document is intended to serve as a best practice guide that provides Advanced Architectural Products' recommendation for specification language that applies to their products.

This document does not inherently serve as a pre-written master specification. Review and edit as needed to suit each Project's individual requirements. Text in bold parenthesis indicates choices or options that the specifier preparing the Project specifications must select.

ABOUT US

Advanced Architectural Products, based in Allegan, Michigan, is a leading innovator in high-performance building enclosure and continuous insulation systems. Since our founding in 2012, we have been dedicated to developing cutting-edge solutions that enhance energy efficiency, structural integrity, and sustainability in modern construction.

Our flagship products, **GreenGirt®** CMH and **SMARTci®** systems, utilize advanced composite metal hybrid technology to provide superior thermal performance and moisture control, supporting Architects, Engineers, and builders in creating more efficient and durable structures.

With a state-of-the-art headquarters in Allegan, a 100,000-square-foot manufacturing and research facility in Hamilton, Michigan, and a West Coast distribution center in Washington, we are committed to innovation, quality, and customer success. Recognized as one of Inc.'s Fastest Growing Companies, we continue to push the boundaries of construction technology.

PART 1 - GENERAL

This section specifies **GreenGirt CMH XO™** structural thermal framing system for windows and openings, an advanced composite metal hybrid (CMH) solution designed to address thermal bridging at building openings. The system aligns the thermal plane of insulation with window assemblies, enhancing energy efficiency and structural performance.

1.01 SECTION INCLUDES

- A. Composite metal hybrid (CMH) sub-framing support system for windows and openings.

1.02 RELATED REQUIREMENTS

Keep the following subparagraph(s) to reference requirements that may typically be expected in this Section but are specified in other Sections.

- A. Section 04 2000 – Unit Masonry for concrete masonry unit (CMU) wall substrate.
- B. Section 05 4000 – Cold-Formed Metal Framing for metal stud substrate support framing.
- C. Division 06 for requirements for exterior sheathing and wood stud substrate support framing.

Coordinate with Division 07 Sections for cladding, air barriers, insulation, and firestopping to ensure proper sequencing and performance. Update related section numbers as appropriate.

- D. Section 07 2500 for Weather Barriers for air, water, vapor barrier at exterior wall.
- E. Division 07 for exterior wall panel systems.
- F. Section 07 9200 – Joint Sealants for perimeter sealant.
- G. Section XX XX XX (**Insert Spec Section Name Here**) for (**Insert Description of what item is for here**)

1.03 REFERENCE STANDARDS

- A. ASCE – Design Guide for FRP Composite Connections.
- B. ASCE 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- C. ASHRAE 90.1 -- Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings.
- D. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated or Zinc-Iron Alloy-Coated by the Hot-Dip Process.
- E. ASTM C518 – Steady-State Thermal Transmission Properties by Heat Flow Meter Apparatus.
- F. ASTM C1363 – Thermal Performance of Envelope Assemblies by Means of a Hot Box Apparatus.
- G. ASTM D638 – Tensile Properties of Plastics.
- H. ASTM D790 – Flexural Properties of Plastics.
- I. ASTM E84 – Surface Burning Characteristics of Building Materials.
- J. ASTM E96 – Water Vapor Transmission of Materials.
- K. ASTM E283 – Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
- L. ASTM E330/E330M – Structural Performance by Uniform Static Air Pressure Difference.
- M. ASTM E331 – Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- N. NFPA 285 – Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct preinstallation (**teleconference**) (**conference at Project site**).
 - 1. Attendees: Invite Contractor, Architect, Owner's representative, and Installer to preinstallation conference.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate installation of structural thermal framing 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.

1.06 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data for each type of product and component included in structural thermal framing system.
- B. Shop Drawings: Submit details on layout, spacing, sizes, thicknesses, and types of structural thermal framing systems including, fabrication, fastening, and anchorage details.
 1. Provide details on accessories, connections, and attachment to adjacent work.
 2. Provide a list of locations where structural thermal framing systems are to be used and indicate depth of product at each location.
- C. Certificates:
 1. Any other manufacturer must certify that products meet or exceed specified requirements.
 2. Certificate of compliance with Buy America Act, verifying that all materials meet applicable domestic production requirements.
 3. Certificate confirming all system components, including sub-framing members and fasteners, are manufactured in the United States.

Retain "Delegated Design Submittals" Paragraph below if structural calculations for sub-framing are required.

- D. Delegated Design Submittals: Submit comprehensive structural analysis for structural thermal framing systems in compliance with performance requirements and design criteria, signed and sealed by the qualified professional engineer responsible for preparation.
- E. Structural Thermal Framing Submittal:
 1. Provide professional engineer stamped calculations for the structural thermal framing system carrying the associated cladding system considering the following:
 - 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 composite wall systems.
 - d. Calculations for eccentric cantilever conditions.
 2. Provide calculations demonstrating a minimum safety factor of 6 under ultimate loading conditions at a high service temperature of 180 degrees Fahrenheit.
 3. Provide finite element analysis (FEA) for complete assembly of structural thermal framing system to confirm compliance with project loading conditions, including dead load creep resistance and live load cyclic performance.
 - a. FEA shall include maximum dead load and wind load conditions.
 - b. FEA shall include maximum live load conditions.
 - c. FEA shall include point loads representative of fastener locations.
 - d. Maximum directional stresses in model shall have a safety factor of 6 or greater.
 - e. Stresses shall be indicated and analyzed in 3 directions.
 - f. FEA shall accurately replicate the framing system and physical loading dynamics.
 - g. Report shall be furnished with submittal.

Retain "Sustainable Design Submittals" Paragraph below if required to attain sustainability rating or to track sustainability submittals. Coordinate with sustainability consultant to determine if there are requirements for additional documentation for a particular sustainability accreditation.

F. Sustainable Design Submittals:

1. Environmental Product Declarations (EPDs): CMH Manufacturer shall provide a product-specific EPD Type III report in accordance with EN 15805 and ISO 14025.
2. System components to be manufactured in a process meeting net-zero energy emissions criteria.
3. CMH system to be registered as red list chemical free with the Declare Label.
4. The components shall be certified to be halogen/bromine free.
5. CMH composite member shall utilize a minimum of 25 percent post-consumer recycled material content.

G. Warranty: Provide five (5)-year single-source manufacturer's warranty for composite metal hybrid (CMH) structural thermal framing and continuous insulation system commencing on the date of manufacture or date of substantial completion.

Informational Reference:

"FRP Fails, CMH Prevails: What Designers Need to Know to Prevent 'Unavoidable Failure' in Continuous Insulation Systems"

Overview of the structural and thermal performance issues associated with fiber-reinforced polymer (FRP) Z-girts and the advantages of composite metal hybrid (CMH) and steel alternatives.

Available at: <https://greengirt.com/articles/frp-fails-cmh-prevails-what-designers-need-to-know-to-prevent-unavoidable-failure-in-continuous-insulation-systems>

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work as indicated in this section with at least five years of documented experience and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

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

1.09 SITE CONDITIONS

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

PART 2 - PRODUCTS

2.01 PRODUCTS, GENERAL

- A. Provide structural thermal framing materials from a single manufacturer to ensure material compatibility and uniformity, and to establish sole-source responsibility for performance and warranty.
- B. Components specified in this Section shall be manufactured in the United States of America.

2.02 MANUFACTURER

- A. Advanced Architectural Products (A2P):
 - 1. 959 Industrial Drive, Allegan, Michigan, 49010
 - 2. Phone: (269) 355-1818
 - 3. Website: www.GreenGirt.com
- B. Basis of Design Products:
 - 1. **GreenGirt CMH XO™** structural thermal framing system for windows and openings.

2.03 PRODUCT DESCRIPTION

- A. Integrated structural thermal framing system consisting of composite metal hybrid (CMH) sub-framing components and accessories, designed to maintain thermal continuity at window openings for punched opening, storefront, curtain wall, and ribbon window designs, sealing methods, and cladding attachments. System aligns the insulation plane with fenestration framing to reduce thermal bridging and support energy code compliance. All fasteners are permanently anchored into metal components, and the system provides structural support for cladding and insulation assemblies while maintaining compatibility with adjacent enclosure systems.

2.04 SYSTEM COMPONENTS

- A. GreenGirt CMH XO Structural Support Framing:
 - 1. Composite metal hybrid construction combining fiber-reinforced polymer with integrated aluminum flange inserts.

Review depth and select as appropriate for project from the following.

- 2. Available depths: **(2) (3) (4) (5) (6)** inches (1/2" flange spacer attachments can be used to accommodate all depths).
 - 3. Standard length: 96 inches
 - 4. Aluminum flange inserts to be sized according to project requirements.
 - 5. Integrated metal dead load clips as required for project-specific structural loading requirements.
- B. Continuous Insulation Accommodation:
 - 1. Designed to support windows and insulation at building openings.
 - 2. Maintains full insulation thickness across substrate variations.
 - 3. Supports installation of insulation materials in compliance with ASHRAE 90.1 and IECC thermal performance standards.
 - 4. Provides integrated aluminum flange header for proper drainage.
- C. Structural Support: Manufacturer to perform single-source engineering analysis for CMH structural thermal framing and continuous insulation systems to determine:
 - 1. Structural capacity to support window type and cladding system in accordance with project loading requirements.
 - 2. Compatibility with multiple cladding attachment methods.

Coordinate with design team to confirm project-specific wind load, dead load, and thermal requirements. Adjust safety factors or additional testing requirements as needed.

A. Performance Requirements:

1. Minimizes thermal bridging between structural opening and exterior cladding.
2. Contributes to the effectiveness of the window assembly's thermal performance.
3. Maintains structural alignment and fastening integrity under design loads.

B. Thermal Efficiency:

1. Structural thermal framing system shall use non-conductive materials, align the window with the thermal plane of the insulation, and eliminate air and water leaks to achieve high efficiency and eliminate thermal bridging.
2. Thermal Transmission: CMH structural thermal framing system design should limit rate of heat flow crosswise through the profile section to less than (1.785 watts per 8' length and 2" depth in profile); (1.190 watts per 8' length and 3" depth in profile); (0.892 watts per 8' length and 4" depth in profile); (0.714 watts per 8' length and 5" depth in profile); (0.595 watts per 8' length and 6" depth in profile) and temperature delta of 100 degrees Fahrenheit. Rate of heat flow to be determined in accordance with ASTM C1045-01 and validated by a third party.

REFERENCE CHART

Profile Depth	Rate of heat flow (watts)
2"	1.785W
3"	1.190W
4"	0.892W
5"	0.714W
6"	0.595W

C. Structural Capacity:

1. Fastener pull-out capacity shall meet or exceed the performance of 16-gauge cold-formed steel framing.
2. System shall exhibit a high strength-to-weight ratio suitable for vertical and lateral cladding loads.
3. Comply with structural design requirements of ASCE 7, including wind load and component/support criteria.
4. Structural thermal framing components shall be tested to validate performance under combined dead load and live load conditions.
 - a. Testing shall simulate worst-case installation configurations, including unsupported spans and combined axial and bending loads.
 - b. Load testing shall be performed in accordance with ASTM E330.
 - c. Framing components shall demonstrate no permanent deformation, cracking, or loss of structural integrity after full load application.
 - d. Testing to be conducted by a certified independent third-party laboratory.

D. Framing Deflection Criteria:

1. Framing shall limit deflection to L/240 or less under design live load, and L/360 or less under design wind load, consistent with cladding system performance requirements.
2. Deflection limits shall apply to both vertical and horizontal members at window openings.

E. Fire Resistance Ratings:

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: If required by code, 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.

F. Air/Water/Vapor Tightness:

1. Provide structural thermal framing system with air infiltration testing in accordance with ASTM E283.
 - a. Maximum Air Leakage Rate: 0.1 cfm/ft² of window area at 50 psf.
2. Provide structural thermal framing system with static pressure water penetration testing in accordance with ASTM E331. Water penetration is defined as water reaching the interior face of the window assembly, excluding perimeter joints.
 - a. No water penetration of structural thermal framing surround at specified test pressure differential for a duration of 15 minutes.
 - b. Static pressure of 50 psf.
3. Provide structural thermal framing system with vapor permeance testing in accordance with ASTM E96 (Materials, not Assemblies).
 - a. Class I Vapor Retarder: ≤ 0.1 perm.
 - b. Class II Vapor Retarder: > 0.1 perm and ≤ 1.0 perm.
 - c. Class III Vapor Retarder: > 1.0 perm and ≤ 10 perm.

2.06 ALTERNATE MATERIALS

A. Stainless Steel System:

1. Provide a single-source structural insulated 316 stainless steel window system, engineered to meet or exceed the structural, thermal, and weather-tightness performance properties of the specified product. This includes all structural stainless steel framing around the window openings, insulation at the header, stainless steel secondary profiles, and related counter flashing and sealing material to provide a best practices interface at the insulation, substrate, and cladding system. Loading should account for concentrated loading underneath shims.
2. The requirements shown by the details are intended to establish dimensions, profiles, and sight lines. Within these limitations, the Contractor will be responsible for the engineering, design of the stainless steel framing, and attachment and closure assemblies that match the profile, purpose, and performance of the specified system. Maintain the visual design concept as shown, including member sizes, profiles, and alignment of components.

3. All other requirements for the specifications, system performance, and drawings are to be met by the stainless steel system.

4. Stamped calculations are to be provided for structural performance. A third-party finite element analysis shall be submitted verifying matching thermal performance.

B. Materials:

1. Stainless steel: ASTM A240, Grade 2D, Type 316, 30 ksi or larger.
2. Base Channel to be minimum of 10 Ga. for structural performance (specifier note: gauge must be sufficient for specified project design, product selection, and loading).
3. Jamb and Header Channels to be a minimum of 14 Ga. for structural performance.
4. Additional profiles to be a minimum of 18 Ga. for fastener attachment.
5. Counter flashing to be a minimum of 24 Ga.
6. Cavity insulation: Spray foam.
7. 6" deep spray foam insulation to be furnished and installed around 32" wide perimeter for all window openings inside the stud cavity.

C. Fabrication:

1. Custom-fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's Architectural Sheet Metal Manual that apply to design, dimensions, metal, and other characteristics of items indicated. Shop-fabricate items where practical. Obtain field measurements for accurate fit before commencing shop fabrication.
2. Fabricate sheet metal flashing and trim true to line and levels indicated, without excessive oil canning, buckling, and tool marks.
3. Seams for Stainless Steel and Lead: Fabricate non-moving seams in accessories with flat-lock seams. Tin edges shall be seamed and soldered.
4. Fabricate all horizontal surfaces to provide drainage with minimum 5 percent slope.
5. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant according to SMACNA recommendations.
6. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim unless otherwise indicated.

D. Stainless Steel Framing and Flashings:

1. Base Angle: Fabricate with profiles as shown on the drawings.
2. Joint Style: Welded seams.
3. Stainless Steel: 0.140" thick.
4. Jamb Angle: Fabricate with profiles as shown on the drawings.
5. Joint Style: Welded seams.
6. Stainless Steel: 0.078" thick.
7. Header Angle: Fabricate with profiles as shown on the drawings.
8. Joint Style: Welded seams.
9. Stainless Steel: 0.078" thick.
10. Tapered insulation filler.
11. Secondary Supports: Fabricate with profiles as shown on the drawings.
12. Joint Style: Butt joints or laps.
13. Stainless Steel: 0.0625" thick.
14. Counter Flashing: Fabricate with profiles as shown on the drawings.
15. Joint Style: Lap.
16. Stainless Steel: 0.025" thick.
17. Miscellaneous Flashings: Fabricate with profiles as shown on the drawings and from sheet metal materials indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are clean, dry, structurally sound, and free from oil, grease, debris, or irregularities that would impair system performance.
- B. Ensure framing is installed to meet project tolerances for alignment and spacing per contract documents and manufacturer requirements.
- C. Confirm that environmental conditions are suitable for installation, including ambient temperature, wind conditions, and moisture levels.
- D. Verify compatibility and continuity with adjacent assemblies including sheathing, air/water barriers, fenestrations, and transitions.

3.02 INSTALLATION

- A. Install structural thermal framing system in accordance with the manufacturer's instructions, ensuring proper alignment and spacing.
- B. Secure components to the substrate using approved fasteners, penetrating through the fiber-reinforced polymer into the galvanized steel insert.
- C. Place insulation materials between sub-framing components, ensuring a snug fit without gaps.
- D. Attach cladding systems to the sub-framing as per cladding manufacturer guidelines.

3.03 FIELD QUALITY CONTROL

- A. Inspect system during and after installation for:
 - 1. Proper girt spacing and alignment.
 - 2. Tight compression of insulation materials.
 - 3. Secure mechanical fastening.
 - 4. Continuity of insulation across entire surface with no voids or bypasses.
- B. Correct any deficiencies before proceeding with cladding installation.

3.04 CLEANING AND PROTECTION

- A. Remove construction debris from installation area.
- B. Protect installed insulation system components from damage caused by weather, other trades, and subsequent construction.
- C. Replace damaged or non-performing materials with new components as approved by the manufacturer.

END OF SECTION