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Short Form Guide Specification

**THERMAL AND AIR BARRIER WALL SYSTEM
W/ RAIN SCREEN PORCELAIN TILE FAÇADE
ATTACHED AND SUPPORTED BY
CI-SYSTEM METAL FRAMING**

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SECTION 07 42 65
THERMAL AND AIR BARRIER WALL SYSTEM W/ RAIN SCREEN PORCELAIN TILE FAÇADE
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SPEC NOTE: This guide specification is intended for use when specifying Knight Wall Systems' panelized porcelain tile cladding and support/attachment framing over the THERMAX™ Wall System by Dow to provide ASHRAE 90.1 compliant continuously insulated rain screen walls.

SPEC NOTE: Make any required selections, such as insulation thickness, board sizes, etc. Where selection is indicated with an [OR] statement, select the appropriate paragraph and delete the inappropriate statement. Delete all SPEC NOTES and [OR] statements prior to final printing.

DISCLAIMER: The manufacturer has reviewed the product information contained in this guide specification. The information is organized and presented to assist the specification writer working on a construction project to select the appropriate products and to save time in writing the project specification Section. The specification writer is responsible for product selection as well as the use and application of this information, and should contact the manufacturer to ensure that all options are available and that the associated specification information is valid and correct.

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a complete true continuous exterior-insulated rain screen wall assembly inclusive of the following:
1. Thermal and air barrier wall system
 2. Cold-formed metal support framing and attachment system
 3. Rain screen porcelain tile finish panels mounted on pressed metal backing

1.2 REFERENCES

SPEC NOTE: Select the applicable reference standards to suit Project requirements. Delete non-applicable standards.

- A. ASTM International (ASTM):
1. A792 / A792M-[05] Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 2. C67-[09]: Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

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3. C203-[99]: Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
 4. C209-[98]: Test Method for Cellulosic Fiber Insulating Board.
 5. C518-[04]: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 6. C645-[07]: Standard Specification for Nonstructural Steel Framing Members.
 7. C1029-[05]: Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
 8. C1289-[06]: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 9. C1513-[04]: Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Members.
 10. D1621-[04a]: Test Method for Compressive Properties of Rigid Cellular Plastics.
 11. D1622-[03]: Test Method for Apparent Density of Rigid Cellular Plastics.
 12. D2126-[99]: Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 13. E72-[05]: Standard Strength Tests of Panels for Building Construction.
 14. E84-[05]: Test Method for Surface Burning Characteristics of Building Materials.
 15. E96/E96M-[05]: Test Method for Water Vapor Transmission of Materials.
 16. E330-[02]: Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 17. E331-[00]: Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
 18. E2357-[05]: Test Method for Determining Air Leakage of Air Barrier Assemblies.
 19. F1642-[04(2010)]: Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
1. 90.1-2010 Energy Standard for Buildings except Low-Rise Residential Buildings.
- C. Factory Mutual (FM):
1. FM 4880: Class I Wall and Ceiling Panels Building Corner Fire Test.
- D. Underwriters Laboratories Inc. (UL):
1. UL 723: Surface Burning Characteristics of Building Materials.
- E. National Fire Protection Association (NFPA):
1. NFPA 286 [2006]: Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- F. American Iron and Steel Institute (AISI)
1. Code of Standard Practice.
 2. TS-1-02 Rotational-Lateral Stiffness Test Method for Beam-to-Panel Assemblies.
 3. TS-3-02 Standard Methods for Determination of Uniform and Local Ductility.
 4. TS-4-02 Standard Test Method for Determining the Tensile and shear Strength of Screws.
 5. TS-5-02 Test Methods for mechanically Fastened Cold-Formed Steel Connections.

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6. TS-6-02 Standard Procedures for Panel and anchor Structural Tests.

G. United Facilities Criteria (UFC)

1. 4-010-01: Department of Defense (DOD) Minimum Antiterrorism Standards for Buildings.

H. U.S. General Services Administration

1. TS01-2003: Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.

1.3 SYSTEM DESCRIPTION

A. Furnish and install exterior wall system that effectively controls thermal, air and water performance and provides continuity of the building envelope enclosure. The system shall include the following:

1. Aluminum-faced, fiberglass-reinforced rigid insulation secured to exterior of metal wall framing assembly.
2. Medium-density, closed-cell spray polyurethane foam applied to interior wall cavity.
3. Cold-formed steel support framing / attachment system installed to exterior of insulated sheathing, consisting of vertical girts, horizontal mounting tracks, thermal isolators and associated fasteners.
4. Porcelain tile finish panels structurally mounted on Kynar-painted black pressed metal backing via structural adhesive, manufactured for easy installation over cold-formed framing system.
5. Penetration and gap sealing material for sealing penetrations through wall system and gaps between building envelope enclosure components and wall opening frames.
 - a. [single component spray polyurethane foam][two component spray polyurethane foam][single component caulk or sealant].
6. Joints or reveals where black metal panel backing overlap is exposed may be field grouted, caulked or left exposed.
7. Butyl-based flashing tape to seal insulation board joints, damaged areas, and appropriate penetrations.

B. Design Requirements

1. Constructed exterior wall system and component materials shall be acceptable for use under the building code in force in the jurisdiction of the project.
2. Constructed system shall comply with ANSI/ASHRAE 90.1-2010 definition of Continuous Insulation (c.i.).
3. Products may be dimensioned in either English or Metric units. Design calculations, details and shop drawings shall take this into account.
4. Structural Design: Exterior-insulated rain screen wall assemblies capable of withstanding effects of load and stresses from dead loads, wind loads, snow loads and normal thermal movement without evidence of permanent defects of assemblies or components.
 - a. Dead Load: As required by (applicable building code) (_____).
 - b. Live Load: As required by (applicable building code) (_____).
 - c. Wind Load: Uniform pressure (velocity pressure) of (Insert Design Criteria) lb/sq ft. (Insert Design Criteria), acting inward or outward.

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- d. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum changes (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:
 - 1) Temperature Change (range): 120 degrees F (67 degrees C), ambient: 180 degrees F (100 degrees C), material surfaces.
 - 2) Panel joints shall allow movement of panels during expansion and contraction while preventing uncontrolled penetration of moisture.
 - e. Manufacturing, installation, and sealing shall prevent deformation of exposed surfaces.
 - f. Maximum allowable deflection of span: L/175.
 - g. Accommodate substructure tolerance of +0 to -1/4 inch.
5. Support Framing / Attachment System:
- a. Frequency and spacing of vertical box girts as shown on shop drawings.
 - b. Additional horizontal J tracks may be required where panel size, penetrations, or vibration and loading dictate.
- C. Performance Requirements:
- 1. Thermal Performance:
 - a. Exterior Insulation: ASTM C518, Stabilized R-value of 6.5 at 1 inch of thickness with a minimum 6-month exposure capability to outdoor elements [and 15-year thermal warranty].
 - b. Interior Closed-Cell Spray Polyurethane Foam: ASTM C518, 140 degrees F / 90-day Aged R-Value (measured at 75 degrees F mean temperature), for product with a minimum 30 degrees F ambient and substrate application temperature is R6.1/inch, and 140 degrees F / 90-day Aged R-Value (measured at 75 degrees F mean temperature), for product with a minimum 45 degrees F ambient and substrate application temperature is R6.4/inch, and 140 degrees F / 90-day Aged R-Value (measured at 75 degrees F mean temperature), for product with a minimum 60 degrees F ambient and substrate application temperature is R6.1/inch.
 - 1) Core density: ASTM D1622, Minimum 2.0 pcf.
 - 2) Acceptable adhesion to substrate based on specific minimum application temperature.
 - 2. Air Barrier Performance: When tested in accordance with ASTM E2357-[05], at a test pressure of not less than 6.24 psf, air infiltration shall not exceed 0.04 cfm per square foot (0.2 L/s*m²) of fixed wall area. Testing should be conducted at positive and negative sustained wind loading of 12.5 psf (600 Pa) for 1-hour duration in each direction, pressure cycling of the wall at 2000 cycles in both the positive and negative direction, ending with wind gust loading at 25 psf.
 - 3. Water Penetration: When tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of not less than 6.24 psf and not more than 12.0 psf for minimum test duration of 2 hours.
 - 4. Mold Resistance: Thermal wall [and air barrier] system components shall not provide food source for fungal growth.
 - 5. All joints, penetrations and gaps of the thermal [and air barrier] wall system shall be made watertight [and air-tight].
- D. Fire Resistance:
- 1. Include fire-stopping measures at floor line in stud cavity, per code, when wall assembly extends beyond edge of floor line.

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2. Exterior Insulation:
 - a. Class 1 (<and/or= 25 Flame Spread Index and < 450 Smoke Developed Index) classified at maximum thickness per UL 723 criteria or ASTM E84 criteria.
 - b. Minimum density 2.0 pcf and closed-cell polyurethane foam.
 3. Spray Polyurethane Foam:
 - a. Class 1 (<and/or= 25 Flame Spread Index and < 450 Smoke Developed Index) classified at maximum thickness per UL 723 criteria or ASTM E84 criteria.
- E. Blast Resistance:
1. Provide cladding assemblies that meet the following requirements for air blast resistance:
 - a. ASTM F1642-[04]: No Break
 - b. UFC 4-010-01: High Level of Protection
 - c. GSA-TS01-2003: Performance Condition 1 (High)

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions and Submit Material Safety Data Sheets (MSDS) for each component product required for complete wall system. Submit manufacturer's product literature and descriptions of testing performed on system components to indicate that they will meet or exceed performance specified herein.
- B. With Bid submission, provide the following to the Architect [Engineer]:
 1. Spray Polyurethane Foam Manufacturer Contractor Accreditation
 - a. Acceptable Accreditation Methods:
 - 1) DOW THERMAX™ Wall System Accreditation Program
 - 2) Or approved equivalent
 2. Tile panel manufacturer's color charts showing full range of available colors and finishes
- C. Shop Drawings: Submit shop drawings from Tile Cladding manufacturer, signed and sealed by engineer licensed to practice in authority having jurisdiction, detailing system installation and attachment.
- D. Structural Calculations: Submit Tile Cladding manufacturer's comprehensive analysis of design loads, including dead loads, live loads, wind loads and thermal movement.
- E. Samples: Submit following materials samples.
 1. Insulation panel: 8-inch square
 2. Insulation fasteners/washers, thermal isolating washers and 8-inch sample of joint flashing tape: one each
 3. Vertical Box Girts and Horizontal Rails: Two 12-inch long samples of each
 4. Wall panel: 12-inch square for each selected finish color and texture

1.5 QUALITY ASSURANCE

- A. Spray Polyurethane Foam (SPF)
 1. Contractor Qualifications: SPF installation contractor shall be accredited by the Thermal and Air Barrier Wall System manufacturer (Accredited Contractor).

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2. Installer Qualifications:
 - a. During award period and for duration of installation, SPF installer shall be an officially recognized Certified Installer certified by Thermal and Air Barrier Wall System Manufacturer (Certified Installer). Certified Installer shall carry liability insurance and bonding.
 - b. Each worker installing SPF must be, or be accompanied by, a Certified Installer.
 - c. Each Certified Installer can supervise a maximum of 5 workers. The Certified Installer shall be thoroughly trained and experienced in the installation of SPF thermal and air barriers of the types being applied. Certified Installers shall perform or directly supervise all SPF installation work on the project.
 - d. Certified Installers shall have their Thermal and Air Barrier Wall System Manufacturer Certificate in their possession on project site, available for inspection upon request.
 - e. Certified Installer shall ensure that all workers have been trained on and are practicing proper health and safety precautions required when applying SPF.
 3. Follow manufacturer's guidelines for proper temperature settings regarding spray equipment as stated on manufacturer's product information sheets.
 4. Follow manufacturer's guidelines for proper spray polyurethane foam formulation based on substrate and ambient temperatures to which product will be applied.
- B. Support Framing / Attachment System
1. Installer Qualifications
 - a. In good standing with manufacturer as qualified installer for work of this Section.
 - b. Superintendent or foreman overseeing installation on site during work of this Section.
 - c. [Able to document completed projects of equivalent scope and quality upon request by [Architect] [Engineer]].
 2. Manufacturer Qualifications
 - a. Minimum 5 years' experience manufacturing wall support framing and panel systems similar to those specified. Demonstrate conformance to testing requirements.
 - b. Design provided by a professional engineer experienced in the design of curtain wall systems and licensed in the applicable State.
 - c. Design of anchors and fasteners for attachment to substrate provided by professional engineer licensed to practice in the applicable State.
- C. Pre-installation Meeting:
1. Participants: Authorized representatives of the General Contractor, installation subcontractor, [Construction Manager,] [Owner,] Architect, [Engineer,] SPF applicator, independent inspector, and [Manufacturer's engineer or technical representative].
 2. Review metal wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
 3. Review and document methods, procedures and manufacturer's installation guidelines and safety procedures for insulated sheathing, flashings, spray polyurethane foam, support framing / attachment system, finish panels, and penetration and gap sealant.
 4. Review construction schedule and confirm availability of products, applicator personnel, equipment and facilities.
 5. Review governing regulatory requirements and requirements for insurance and certificates.
 6. Review field quality control procedures

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D. Mock-Ups:

1. Mock up complete system at location as directed by Architect [Engineer].
2. Mock-up shall demonstrate prepared substrate, support/attachment framing, insulation, panel façade, corner return, penetrations, exterior finishes and aesthetic appearance.
3. Verify mock-up as conforming to manufacturer's instructions and provisions of Contract Documents.
4. Do not begin work of this Section until after inspection by façade manufacturer's representative is complete and mock-up has been accepted in writing by Architect [Engineer].
5. Protect and maintain accepted mock-up as standard of quality for work of this Section.
6. Accepted mock-ups may be incorporated into the work of this Section.

E. Field Measurements: Verify actual supporting and adjoining construction before fabrication; record field measurements on project record shop drawings.

F. Established Dimensions: Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of wall panel assemblies corresponding to established dimensions.

1.6 DELIVERY, STORAGE AND HANDLING

A. Ordering: Conform to manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver materials and components in manufacturers' unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and installation.

C. Store, protect and handle materials and components in accordance with manufacturer recommendations to prevent damage, contamination and deterioration. Keep materials clean, dry, and free of dirt and other foreign matter.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Undertake installation work only when weather conditions are in compliance with manufacturers' specific environmental requirements and when conditions will permit work to be performed in accordance with manufacturer recommendations and warranty requirements.

1. Spray Polyurethane Foam (SPF):

- a. Do not proceed with installation of SPF until sheathing substrate construction is complete and openings and penetrating items have been installed and sealed.
- b. Do not proceed with installation of SPF until substrate surface temperatures are above the manufacturer's recommended minimum surface temperatures for application.
- c. Verify that substrate surfaces to receive SPF are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
- d. Do not apply SPF past the 6-month expiry date printed on the label of each container.
- e. Ventilate area to receive SPF by introducing fresh air and exhausting air continuously during and for 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.
- f. Provide temporary enclosures and ensure all air ducts and openings to other areas of the building are covered to prevent spray and noxious vapors from contaminating air beyond application area.
- g. Protect workers as recommended by SPF manufacturer. Restrict access to spray area to spray applicator(s) and their helper(s) while spraying. Anyone in spray area must be wearing

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full and proper personal protection equipment (PPE). Follow manufacturer's re-entry guidelines.

- h. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
 - i. Dispose of waste foam daily in location designated by Architect [Engineer] and empty drums in accordance with SPF manufacturer's instructions.
2. Rain Screen Wall System: Coordinate construction to ensure that panel assemblies fit properly to supporting and adjoining construction; coordinate schedule with construction in progress to avoid delaying work.

1.8 SEQUENCING

- A. Coordinate construction to ensure that assemblies fit properly to supporting and adjoining construction; coordinate schedule with construction in progress to avoid delaying work.

1.9 WARRANTY

- A. Manufacturer Warranties:
 - 1. Exterior Insulation: 6-month exposure [and 15-year thermal warranty]
 - 2. Flashing Tape: Limited warranty
 - 3. Spray Polyurethane Foam: Limited warranty
 - 4. Metal Support Framing / Attachment System: Standard limited 20-year materials warranty covering defective materials
 - 5. Porcelain Tile: Limited warranty
- B. Contractor's Warranties: [1-year] [2-year] labor warranty, starting from [date of Owner acceptance of completed work][Substantial Completion], to cover repair of materials found to be defective as a result of installation errors.
- C. Limitation of Warranties: Warranties are limited to replacement of defective materials, including labor as required, resulting from framing and panel system component or performance failures. Warranties exclude repairs, replacement, and corrective work to the substrate, structure, and/or property. Warranties exclude mechanical damage due to abuse, neglect, structural failure, or forces of nature greater than normal weather conditions.

1.10 MAINTENANCE

- A. Extra Materials: For use by Owner in building maintenance and repair, provide [a recommended percentage of] [3 percent] additional façade panels in new, unopened cartons, packaged with protective covering for storage and identified with appropriate labels.

PART 2 - PRODUCTS

2.1 RIGID INSULATION BOARD

- A. Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4-mil embossed white or blue acrylic-coated aluminum on one side and 1.25-mil embossed aluminum on the other side, complying with ASTM C1289 and meeting the following physical properties:
 - 1. ASTM C1289 Type 1, Class 2
 - 2. Compressive Strength (ASTM D1621): 25 psi, minimum

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3. Aged Thermal Resistance (ASTM C518, measured at mean temperature of 75 degrees F): [R-6.5 up to 2 inches], R-6.0 above 2 inches] [RSI 1.14 up to 50 mm, RSI 1.07 above 50 mm] of thickness.
4. Flexural Strength (ASTM C203): Minimum 40 psi
5. Water Absorption (ASTM C209): Maximum 1 percent by volume
6. Water Vapor Permeance (ASTM E96): <0.3 perms
7. Maximum Use Temperature: 250 degrees F

B. Acceptable Products:

1. The Dow Chemical Company "THERMAX™ (ci) Exterior Insulation or approved equivalent.
 - a. Panel Size: 4'-0" wide by 8'-0" [12'-0"] long, square edge, shiplap (shiplap on thicknesses of 1.55 inches and greater on long edges) panels.
 - b. Thickness and Stabilized R-Value: Nominal 0.625-inch thickness, R-4.1 [1-inch thickness, R-6.5] [1.55-inch thickness, R-10.1] [2-inch thickness, R-13] [2.5-inch thickness, R-15] [3-inch thickness, R-18].

C. Accessories:

1. Temporary Fasteners: Provide insulated sheathing manufacturer's recommended fasteners for temporary anchoring of sheathing to metal wall framing. Fastener size and length based on wall sheathing thickness and sufficient to provide solid attachment through rigid insulation to substructure as indicated on shop drawings.
 - a. Acceptable Products: ci-LOCK fasteners by Wind-Lock or approved equivalent.
2. Insulation Flashing Tape: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and façade tie penetrations through the insulation layer.
 - a. Acceptable Products: The Dow Chemical Company "WEATHERMATE™" Straight Flashing" or approved equivalent, 4-inch width with butyl rubber adhesive
3. Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
 - a. Acceptable Products: The Dow Chemical Company "WEATHERMATE™" Straight Flashing or approved equivalent, 6-inch and 9-inch with butyl rubber adhesive, at straight opening heads, jambs and sills
 - b. When greater widths are required for through-wall flashings, butyl rubber adhesive is recommended.
4. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
 - a. Acceptable Products:
 - 1) The Dow Chemical Company "GREAT STUFF PRO™ Gaps & Cracks" single-component polyurethane insulating foam sealant or approved equivalent
 - 2) The Dow Chemical Company "GREAT STUFF PRO™ Window & Door" single-component polyurethane low-pressure foam sealant or approved equivalent
5. Gap Air Infiltration Filler: Two-Component Quick Cure Polyurethane Foam.
 - a. Acceptable Products: The Dow Chemical Company "FROTH-PAK™ Foam Insulation" two-component quick-cure polyurethane foam or approved equivalent
 - 1) NFPA 286 Approval for exposed use to the interior of the building without the need for a 15-minute thermal barrier
 - 2) ASTM E-84 Class A

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6. Flexible polyethylene foam gasket strip to reduce air infiltration between a concrete foundation and sill plate.
 - a. Acceptable Products: The Dow Chemical Company "STYROFOAM™ SILL SEAL Foam Gasket" or approved equivalent.

2.2 COLD FORMED METAL ATTACHMENT/SUPPORT FRAMING:

- A. Cold rolled steel framing to ASTM A792, 55 percent AL-ZN, nominal coating weight of 0.5 oz per square foot (total both sides) of gauge and spacing required to comply with metal wall panel system's structural requirements as recommended by the panel manufacturer and engineer of record and in accordance with approved shop drawings.
 1. Vertical Box Girt: Minimum 0.0475-inch thick (18 gauge) cold-formed steel.
 - a. Dimensions: 2.0 inches wide by 0.75 inches deep:
 - b. Attachment:
 - 1) Pre-drilled holes, 8 inches on center, to receive fasteners and thermally isolated washer assembly for attachment to substructure.
 - 2) Regularly spaced, threaded holes in vertical box girt indented to double thickness of metal at opening to facilitate M8 screw attachment of horizontal J track.
 - c. Recommended Product: CI-Girt™ by Knight Wall Systems or approved equivalent.
 2. Horizontal J Track: Nominal 0.0475 inch thick (18 gauge) cold-formed steel.
 - a. Dimensions: 0.75 inches at base with 1.125 and 1.875 inch legs.
 - b. Weep Drains: 0.75 inches diameter at 2 inches on center along base to allow for drainage.
 - c. Attachment Slots: 2 inches on center along 1.875 inch leg to facilitate M8 screw attachment to vertical box girt.
 - d. Recommended Product: RS-Rail™ by Knight Wall Systems or approved equivalent.
- B. Accessories:
 1. Fasteners: Stainless steel as instructed by panel manufacturer.
 - a. M8 hex socket screws to be used to attach horizontal rail to vertical box girt.
 - b. Minimum No. 12 stainless steel self-drill hex-head screw fasteners of sufficient length to provide solid attachment through rigid insulation to substructure as indicated on shop drawings.
 2. Thermal Isolating Washers: Polyoxymethylene copolymer (POM) washers with integral centering lip to act as a thermal break between steel fastener and box girt.
 - a. Recommended Product: ThermaStop™ Isolator by Knight Wall Systems or approved equivalent.
 3. Galvanic Protection: Utilize tapes and other methods as necessary to separate and prevent contact between dissimilar metals.

2.3 SPRAY POLYURETHANE FOAM AIR BARRIER

- A. Spray Polyurethane Foam: 2-component spray polyurethane cellular plastic foam, complying with the following methods and meeting the following physical properties:
 1. Core Density (ASTM D1622): [Minimum 2 pcf]
 2. Thermal Resistance (ASTM C518): 140 degrees F / 90-day Aged R-Value, measured at 75 degrees F mean temperature: Minimum R-6.1 per inch
 3. Flame Spread (ASTM E84, Class A): 25 or less

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4. Smoke Developed (ASTM E84, Class A): 450 or less
 5. Compressive Strength Minimum (ASTM D1621, 10 percent parallel to rise): [20 psi] [182 kPa]
 6. Closed Cell Content (ASTM D2856): minimum 90 percent
 7. Water Absorption by Volume Maximum (ASTM D2842): 5 percent
 8. Water Vapor Permeability Maximum (ASTM E96): [3.0 perm-inches] [4.4 ng/(Pa.s.m)]
- B. Acceptable Products: The Dow Chemical company "STYROFOAM™ Spray Polyurethane Foam Insulation [CM2030] [CM-2045] [CM2060]" or approved equivalent. Formulation required will depend upon surface temperature of substrate. Refer to manufacturers recommendations.
1. STYROFOAM™ Spray Polyurethane Foam Insulation CM2030:
 - a. Thermal Resistance (ASTM C518): 140 degrees F / 90-day Aged R-Value, measured at 75 degrees F mean temperature: Minimum R-6.1 per inch.
 - b. Maximum/Nominal 1.5-inch Thickness: Thermal Resistance (ASTM C518): 140 degrees F / 90-day Aged R-Value, measured at 75 degrees F mean temperature: R-9.2.
 2. STYROFOAM™ Spray Polyurethane Foam Insulation CM2045:
 - a. Thermal Resistance (ASTM C518): 140 degrees F / 90-day Aged R-Value, measured at 75 degrees F mean temperature: Minimum R-6.4 per inch.
 - b. Maximum/Nominal 1.5 inch Thickness: Thermal Resistance (ASTM C518): 140 degrees F / 90-day Aged R-Value, measured at 75 degrees F mean temperature: R-9.6.
 3. STYROFOAM™ Spray Polyurethane Foam Insulation CM2060:
 - a. Thermal Resistance (ASTM C518): 140 degrees F / 90-day Aged R-Value, measured at 75 degrees F mean temperature: Minimum R-6.1 per inch.
 - b. Maximum/Nominal 1.5 inch thickness: Thermal Resistance (ASTM C518): 140 degree F / 90-day Aged R-Value, measured at 75 degrees F mean temperature: R-9.2.

2.4 PORCELAIN TILE PANELS

- A. Porcelain Tile Panels: Approximately [12 by 24 by 0.25 inches] [24 by 24 by 0.25 inches] [24 by 48 by 0.25 inches], mounted on Kynar-coated pressed steel frame via polymer modified cementitious joint mortar.
1. Approximate Panel Weight: 8.5 lb. per square foot.
 2. Panels to be assembled in manufacturer-certified production facility.
 3. Color and Series: As selected by [Architect] [Engineer] from tile manufacturer's standard range.
- B. Pressed Steel Panel Backing: Minimum 0.30-inch thick, grade AZ50 galvalume sheet steel coated with black Kynar. Backing to include multiple rows of 6-inch long by 1-inch high punched and raised clips to positively engage horizontal 'J' track. Rows to be spaced every 4 inches, minimum 4 clips each row, staggered.
- C. Acceptable Products: Porcelain Tile Panel Curtain Wall System by Knight Wall Systems or approved equivalent.
- D. Panel Hardware and Accessories
1. Stainless steel self-drill 3/16 by 3/4 inch hex-head screws to be used for attachment of adjacent panels along exposed perimeter of steel backing.

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2. Seismic Rivets:
 - a. W&E P/N 25-2122: FORD-OE 385323-S100/CHRYSLER-OE 6031091 Super Split "Glass Stop" Rivet 1/4-inch diameter - .257/.261 hole required, Grip range .520 - .590, or
 - b. W&E P/N 25-2622: 20184399, 389268-S100, Window Regulator Rivet, 1/4-inch diameter, 1/2-inch flange, .68 - .75 grip range, aluminum/steel.
3. Sealant for Expansion Joints: GE Silicone

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation conditions affecting performance of the work.
 1. Verify that metal wall studs, opening framing, bridging, bracing and other framing support members and anchorage have been installed within thermal wall system alignment tolerances and requirements.
 2. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond
 3. Verify that items required to penetrate thermal wall system are placed and penetration gaps and cracks are properly sealed before installing spray polyurethane foam.
 4. Do not proceed with installation until unsatisfactory conditions have been corrected.
 5. Ensure weather-resistant barrier (WRB) is installed in conformance with WRB manufacturer's instructions and discontinuities in WRB are properly flashed and sealed prior to installing support framing and attachment system.
- B. Field verify architectural details and mechanical and electrical requirements prior to commencing installation.
- C. Commencement of installation constitutes acceptance of existing conditions and acceptance of responsibility for satisfactory performance.

3.2 INSULATION BOARD INSTALLATION

- A. Do not install more insulation than can be permanently fastened with vertical cold-formed steel box girts in the same day. Do not leave insulation overnight or for extended periods that is not permanently fastened to building substructure with vertical girts.
- B. Install insulation in accordance with manufacturer's recommendations.
- C. Temporary Fastening: Temporarily fasten rigid insulation panels to exterior face of exterior metal stud wall framing. Abut panels tightly together and around openings and penetrations.
 1. Install panels horizontally with blue aluminum facing to exterior. Use maximum panel lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing, plates or sill members.
 2. Fasten rigid insulation panels to each support with temporary fasteners, one at each corner [and one at top and bottom of panel at each stud location]. Set back corner fasteners by 3/8 inch from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not overdrive or tear aluminum skin of insulation. [Perimeter fasteners can be detailed to bridge

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gap of abutting board joints due to 1.75-inch diameter washer used to fasten board to studs. Maximum of 2 board joints may be bridged per fastener.]

3. Install flashing joint tape at end and edge joints using sufficient hand pressure to ensure seal and in accordance with rigid insulation manufacturer's joint sealing recommendations.
4. Install flashing tape on insulation behind wall tie and mechanical fastening assemblies for rain screen claddings.
5. Seal joints and penetrations in accordance with rigid insulation panel manufacturer's joint and penetration sealing recommendations.
6. After base flashing is installed on exterior insulation, which may include a termination bar running horizontally along the top edge of the flashing, install 6-inch or 9-inch flashing with butyl rubber adhesive to the exterior sheathing, lapped over top edge of base flashing.

3.3 COLD-FORMED METAL FRAMING INSTALLATION

A. Preparation:

1. Verify vertical girt spacing and framing clearances relative to studs or other points of attachment.

B. Installation

1. Use laser or chalk line to mark starting height of vertical box girt.
2. Mount vertical box girts, fastened at 16 or 24 inches on center (as determined by the engineer of record) overtop of installed rigid insulation, using one self-tapping screw for each attachment hole or for every second attachment hole in box girt, as indicated on shop drawings.
 - a. Check plumb of vertical girts both parallel and perpendicular to the structure. Use slots in girt to ensure parallel alignment of face of framing.
 - b. Tighten screws that attach vertical girt through insulation to substructure to 95 in. lbs. of torque. If installed using hand tools, verify for each installer at beginning of project using snug-tight criteria.
 - c. Where vertical obstructions are present and unavoidable (i.e. window openings), use laser or chalk line to restart vertical girt, ensuring horizontal alignment of screw holes for horizontal J track.
3. Mount first (lowest) horizontal J track, to lowest holes in vertical box girt using M8 screws, with 1.875 inch leg against box girt. Install next J track appropriately above the first, as indicated on shop drawings, such that a bearing surface will be created for proper panel attachment and the successive panel above may be attached. Tighten to between 90-100 in. lbs. of torque. Verify equivalent snug-tight condition for installers using hand tools.
 - a. Install successive horizontal J tracks as indicated on shop drawings for proper panel alignment.
 - b. At windows and other openings, mount horizontal J track so that fastening points are as close to the lower and upper edges of opening as possible.

3.4 SPRAY POLYURETHANE FOAM INSTALLATION

A. Preparation

1. Follow all safety precautions.
2. Mask and cover adjacent areas to protect from overspray.
3. Apply primers for special conditions as recommended by manufacturer.
4. Cover wide joints with transition sheet membrane as specified in Section 07 25 00.

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5. Clean work area prior to applying spray insulation.
 6. Verify substrate temperature meets manufacturer's requirements for specific formulations used.
 7. Ensure that all stud cavity fire-stopping is installed prior to applying spray foam.
- B. Application: Spray-apply polyurethane foam in accordance with ASTM C1029 and manufacturer's installation guidelines; comply with preparation methods outlined in 3.3.A.
1. Apply spray polyurethane foam by picture-framing around interior studs at insulated-sheathing-to-steel-stud interface and spraying single pass across all board joints and penetrations.
 2. Finish applying spray polyurethane foam with one pass not exceeding 1.5 inches in thickness. Two passes are acceptable to reach maximum thickness of 1.5 inch.
 3. If more than one layer is being applied, allow layer applied first to cool to maximum substrate temperature or lower as recommended by spray polyurethane foam insulation manufacturer.
 4. Avoid formation of sub-layer air pockets.
 5. Apply spray polyurethane foam in overlapping layers to achieve a smooth, uniform surface, total thickness as indicated.
 6. Maintain [3-inch] [75 mm] clearance around chimneys, heating vents, steam pipes, recessed lighting fixtures and other heat sources.
 7. Do not apply spray polyurethane foam to inside of exit openings or electrical junction boxes.
 8. Maintain a continuous layer of spray foam from floor to floor to roof to complete air barrier.
 9. Maximum Variation in Applied Thickness: minus [1/4 inch] [6 mm], plus [5/8 inch] [10 mm].

3.5 PORCELAIN TILE FINISH PANEL INSTALLATION

A. Preparation

1. Visually survey vertical and horizontal framing components (box girts and J tracks), and verify readiness to receive finish panels. Spot-check torque on M8 hex socket screws and confirm plumb of framing members.
2. Verify and document procedure for bending panel backing clips prior to installation; perform spot checks during installation.

B. Installation

1. Install panels, beginning at bottom of wall (as was done with horizontal tracks).
2. Hang lowest (first) panel on 2 lowest horizontal J tracks, by lower and uppermost rows of clips on panel backing.
3. Proceed with installation, working from left to right and planning atypical situations in advance.
4. Panel backing clips along row (or rows) used for hanging panel MUST engage front of horizontal J track.
 - a. As required, bend clips outward along rows used for hanging panels, as palletizing and shipping may have unintentionally bent clips straight, preventing positive engagement with horizontal track.
 - b. Leading edge of clip should protrude between 1/4 and 3/8 inches (~ 6 to 9.5 mm) from back of tile panel.
 - c. Do not over-bend clips outward, as this will also weaken the panel-to-framing attachment.
 - d. As panel backing engagement cannot be easily observed during installation, take particular care during installation to ensure full engagement of appropriate clips with track.

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5. With the exception of atypical conditions, panels installed above lowest row are to be hung from top row of clips only.
6. Overlap each adjacent panel; top over bottom, right over left.
7. Attach panels at overlaps using 3/16 by 3/4 inch hex-head screws (snug tight) at approximately 12 inches on center along horizontal and vertical joints.
8. Do not allow screws to engage framing. Linked panels are not meant to be mechanically attached to framing members.
9. At spacing frequency determined by engineer of record, drill a hole slightly larger than seismic rivet diameter at locations where rivet will pass through opening in front of horizontal 'J' track. Engage rivet. Cut off rivet shank flush with rivet head so it is completely encapsulated within vertical grout.

3.6 FIELD QUALITY CONTROL:

A. Spray Polyurethane Foam:

1. Certified Installer: Completion of a daily work record is recommended to record all information required, including results of testing. Keep daily work record on site and make available for routine inspection. Upon request, forward copies of daily work record to manufacturer, owner or owner's representative.
2. Costs incurred for daily testing and inspection by Certified Installer and completion of daily work record shall be borne by manufacturer's Accredited Contractor.
3. If required by Owner, arrange for site inspections by qualified third-party inspector. Frequency and cost of inspections shall be included in bid at Owner's request. If site inspection reveals defects, manufacturer's Accredited Contractor shall immediately rectify all such defects at own cost.
4. Certified Installer's daily work record shall verify conformance with thermal and air barrier wall system manufacturer's instructions.
 - a. Follow manufacturer's guidelines for proper temperature settings regarding spray equipment as stated on manufacturer's product information sheets.
 - b. Follow manufacturer's guidelines for proper spray polyurethane foam formulation based on substrate and ambient temperatures to which product will be applied.
 - c. After product has properly cured, conduct tests to verify adhesion between spray polyurethane foam and substrate.

3.7 CLEANING

- A. Remove overspray from non-prescribed surfaces in accordance with manufacturer's recommendations, without causing damage to surfaces. Remove protective covers from adjacent surfaces.
- B. Remove any protective film from finish panels immediately following installation.
- C. Leave panel surfaces clean and free of debris and residue. Where required, clean exposed panel surfaces in accordance with manufacturer's instructions.

END OF SECTION 07 42 65.23

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CAUTION: THERMAX (ci) Insulation is combustible and shall only be used as specified by the local building code with respect to flame spread classification and to the use of a suitable thermal barrier. For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400 in the U.S. or 1-519-339-3711 in Canada **WARNING: Rigid foam insulation does not constitute a working walkable surface or qualify as a fall protection product.**

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FROTH-PAK™ Polyurethane Spray Foam contains isocyanate, hydrofluorocarbon blowing agent and polyol. Read the instructions and Material Safety Data Sheets carefully before use. Wear protective clothing (including long sleeves), gloves, goggles or safety glasses, and proper respiratory protection. Supplied air or an approved air-purifying respirator equipped with an organic vapor sorbent and a P100 particulate filter may be required to maintain exposure levels below ACGIH, OSHA, WEEL or other applicable limits. Provide adequate ventilation. Contents under pressure.

GREAT STUFF PRO™ sealant and adhesive products contain isocyanate and a flammable blowing agent. Read the label and Material Safety Data Sheet carefully before use. Eliminate all sources of ignition before use. Wear long sleeves, gloves, and safety glasses or goggles. Provide adequate ventilation or wear proper respiratory protection. Contents under pressure.

STYROFOAM™ Brand Spray Polyurethane Foam contains isocyanate, hydrofluorocarbon blowing agent and polyol. Read the instructions and Material Safety Data Sheets carefully before use. Wear protective clothing (including long sleeves), gloves, goggles and proper respiratory protection. Supplied air or an approved air-purifying respirator equipped with an organic vapor sorbent and a P100 particulate filter is required to maintain exposure levels below ACGIH, OSHA, WEEL or other applicable limits. Provide adequate ventilation. Contents under pressure. STYROFOAM™ Brand SPF should be installed by a trained SPF applicator.

CAUTION:

When cured, FROTH-PAK™, GREAT STUFF PRO™ and STYROFOAM™ Spray Polyurethane Foam Insulation) are combustible and will burn if exposed to open flame or sparks from high-energy sources. Do not expose to temperatures above 240°F (116°C). For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400 in the U.S. or 1-519-339-3711 in Canada

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