

07 42 65
Short Form Guide Specification

THERMAL AND AIR BARRIER WALL SYSTEM

SECTION 07 42 65
THERMAL AND AIR BARRIER WALL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a thermal and air barrier wall system for exterior cold-formed metal wall assemblies. Work includes:
1. Provide exterior wall insulation.
 2. Provide interior spray polyurethane foam.

B. Related Sections:

1. Section 05 40 00 Cold-Formed Metal Framing: Load-bearing, metal exterior wall framing assemblies.
2. Section 09 21 16 Gypsum Board Assemblies: Interior gypsum board wall finish.

1.2 REFERENCES

A. Reference standards:

1. ASTM International (ASTM):
 - a. ASTM C203-[99]: Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
 - b. ASTM C209-[98]: Test Method for Cellulosic Fiber Insulating Board.
 - c. ASTM C518-[04]: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - d. ASTM C1029-[05]: Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
 - e. ASTM C1289-[06]: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - f. ASTM D1621-[04a]: Test Method for Compressive Properties of Rigid Cellular Plastics.
 - g. ASTM D1622-[03]: Test Method for Apparent Density of Rigid Cellular Plastics.
 - h. ASTM D2126-[99]: Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - i. ASTM E84-[05]: Test Method for Surface Burning Characteristics of Building Materials.
 - j. ASTM E96/E96M-[05]: Test Method for Water Vapor Transmission of Materials.
 - k. ASTM E331-[00]: Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
 - l. ASTM E 2357-[05]: Test Method for Determining Air Leakage of Air Barrier Assemblies.
2. Factory Mutual (FM):
 - a. FM 4880: Class I Wall and Ceiling Panels Building Corner Fire Test.
3. Underwriters Laboratories Inc. (UL):
 - a. UL 723: Surface Burning Characteristics of Building Materials.
4. National Fire Protection Association (NFPA):
 - a. NFPA 285 [2006]: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus

1.3 SYSTEM DESCRIPTION

- A. Furnish and install an 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. Insulated sheathing secured to the exterior of the metal wall framing assembly.
 2. Spray polyurethane foam applied to the interior wall cavity.
 3. Joint, penetration and gap sealing material for sealing component joints, penetrations through the wall system and gaps between the building envelope enclosure components and wall opening frames.

- B. Performance Characteristics:
1. Thermal performance:
 - a. Exterior insulation: ASTM C518, Stabilized R-value of 6.5 per inch of thickness with a minimum six month exposure capability to outdoor elements [and 15 year thermal warranty].
 - b. Interior spray polyurethane foam: ASTM C518, 140degreeF/90day Aged R-Value (measured at 75degree F Mean Temp.), for product with a minimum 30 degree F ambient and substrate application temperature is R6.1/inch and 140degreeF/90day Aged R-Value (measured at 75degree F Mean Temp.), for product with a minimum 45 degree F ambient and substrate application temperature is R6.4/inch and 140 degreeF/90day Aged R-Value (measured at 75 degree F Mean Temp.), for product with a minimum 60 degree 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, at a test pressure of not less than 6.24 psf, air infiltration shall not exceed 0.04 cfm per square foot ($0.2 \text{ L/s}\cdot\text{m}^2$) of fixed wall area. Testing should be conducted at positive and negative sustained wind loading of 12.5psf (600Pa) for one-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 25psf.
 3. Water penetration: When tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of 6.24 psf for minimum test duration of 2hrs.
 4. Mold resistance: Thermal wall [and air barrier] system components shall provide non-food source for fungal growth.
- C. Code Compliance: Exterior wall system and component materials shall comply with the following requirements:
1. Exterior Insulation:
 - a. Class 1 (<and/or= 25 Flame Spread Index and < 450 Smoke Developed Index) classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.
 - b. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.
 2. Spray Polyurethane Foam:
 - a. Class 1 (<and/or= 25 Flame Spread Index and < 450 Smoke Developed Index) classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.
 - b. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code
 3. System complies with ASTM E2357-[05]: Test Method for determining Air Leakage of Air Barrier Assemblies
 4. System complies with NFPA 285 [06]: Standard method of Testing for the Evaluation of Flammability Characteristics of Exterior Non-Load Bearing Wall Assemblies containing Combustible components using the Intermediate Scale, Multi-Story Test Apparatus.
- D. Fire Resistance:
1. System complies with NFPA 285 [2006]: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.
 2. Fire-stopping measures, per code, should be included at the floor line in the stud cavity when the wall assembly extends beyond the edge of the floor line.
- E. All joints, penetrations and gaps of the thermal [and air barrier] wall system shall be made watertight [and air-tight].

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each thermal wall [and air barrier] system component product required.
- B. At bid submission, provide the following evidence to the Architect:
 - 1. Thermal and Air Barrier Wall System Manufacturer Contractor Accreditation
 - a. Acceptable Accreditation Methods:
 - 1) Dow Thermax Wall System Accreditation Program
 - 2) Or Equal
- C. Reports:
 - 1. Submit Test Reports, summarized by Manufacturer of material(s), verifying qualities of thermal [and air barrier] wall system components meet or exceed specified requirements.
 - a. Include results of ASTM E2357 air barrier system testing and ASTM E331 water penetration tests.
 - b. Include mill certificates indicating steel framing sheet complies with the specified requirements.
 - 2. Submit Field Inspection and Test Reports in accordance with Field Quality Control requirements
- D. Samples: Submit following material samples.
 - 1. Insulation panel, 12" square.
 - 2. Insulation fasteners/washers and joint flashing tape, one each.
- E. Submit Material Safety Data Sheets (MSDS) for thermal [and air] barrier wall system components.

1.5 QUALITY ASSURANCE

- A. Spray Polyurethane Foam Installation: Spray polyurethane foam installer shall be accredited by Thermal and Air Barrier Wall System manufacturer.
- B. Installer Qualifications:
 - 1. The air barrier Installer shall be, during the award period as well as for the duration of the installation, officially recognized as a Certified Installer by the Thermal and Air Barrier Wall System Manufacturer (Certified Installer). The Certified Installer shall carry liability insurance and bonding.
 - 2. Each worker who is installing air barriers must be a, or accompanied by a, Certified Installer.
 - 3. Each Certified Installer can supervise a maximum of five workers. The Certified Installer shall be thoroughly trained and experienced in the installation of air barriers of the types being applied. Certified Installers shall perform or directly supervise all air/vapor barrier work on the project.
 - 4. Certified Installers shall have their Thermal and Air Barrier Wall System Manufacturer Certification photo-identification cards in their possession and available on the project site, for inspection upon request.
- C. Pre-installation Meeting: Prior to commencement of application of spray polyurethane foam review and document methods and procedures related to installation, including the following:
 - 1. Participants: Authorized representatives of the Contractor, [Construction Manager,] [Owner,] Architect, [Engineer,] Applicator, Independent Inspector and Manufacturer.
 - 2. Review metal wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work
 - 3. Review insulated sheathing and spray polyurethane foam methods and procedures related to application, including manufacturer's installation guidelines, Thermal and Air Barrier Wall System Manufacturer's Certification Program.
 - 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 as applicable.
 - 6. Review field quality control procedures.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver Thermal and Air Barrier Wall System materials in Manufacturer's unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and installation.
- B. Store, protect and handle Thermal and Air Barrier Wall System materials in accordance with the Manufacturer's recommendations to prevent damage, contamination and deterioration. Keep materials free of dirt and other foreign matter.

1.7 PROJECT CONDITIONS

- A. Environmental Requirements: Install Thermal and Air Barrier Wall System work only when weather conditions are in compliance with Manufacturer's specific environmental requirements and conditions will permit work to be performed in accordance with Manufacturer's recommendations and warranty requirements.
- B. Spray polyurethane foam:
 - 1. Do not proceed with installation of spray polyurethane foam until sheathing substrate construction is complete and openings and penetrating items have been installed and sealed.
 - 2. Do not proceed with installation of spray polyurethane foam until substrate surface temperatures accepting the spray polyurethane are above the manufacturer's recommended minimum surface temperatures.
 - 3. 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.
 - 4. Do not apply spray polyurethane after the 6 months expiry date printed on the label of each container.
 - 5. Ventilate area to receive spray polyurethane foam by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.
 - 6. Provide temporary enclosures to prevent spray and noxious vapors from contaminating air beyond application area.
 - 7. Protect workers as recommended by spray polyurethane foam manufacturer.
 - 8. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
 - 9. Dispose of waste foam daily in location designated by Architect [Engineer] and empty drums in accordance with foam manufacturer's instructions.

1.8 WARRANTY

- A. Submit the following warranties:
 - 1. Exterior insulation warranty: Six month exposure [and 15 year thermal warranty].
 - 2. Flashing Tape: Limited Warranty
 - 3. Spray Polyurethane Foam: Limited Warranty

PART 2- PRODUCTS

2.1 INSULATION

- A. Exterior Insulation: 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.
 - 3. Aged Thermal Resistance (ASTM C518, measured at Mean Temp of 75F): [R-6.5 at 1 inch] [RSI 1.06 per 25 mm] of thickness [with 15 year thermal warranty]
 - 4. Flexural Strength (ASTM C203): Minimum 40 psi.
 - 5. Water Absorption (ASTM C209): Maximum 1.0 percent by volume.
 - 6. Water Vapor Permeance (ASTM E96): <0.3 perms.
 - 7. Maximum Use Temperature: 250 degrees F.

- B. Acceptable Products: The Dow Chemical Company “THERMAX™ ci Exterior Insulation.”
1. Panel Size: 4'-0" wide x 8'-0" [12'-0"] long, square edge, shiplap (shiplap on thickness of 1.55" and greater) panels.
 2. Thickness and Stabilized R-Value: Nominal 0.625 inch thickness, R-4.1 [1.0 inch thickness, R-6.5] [1.55 inch thickness, R- 10.1] [2 inch thickness, R-13.0] [2.5 inch thickness, R-15.8] [3 inch thickness, R 19]
- C. Accessories:
1. Fasteners: Provide insulated sheathing manufacturer's recommended polymer or other corrosion-protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.
 - a. Acceptable Products: Wind-lock Corporation “ci-Lock Steel Series Selection” with 1-3/4 inch diameter high-grade plastic washers
 2. Insulation Flashing Tape: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and veneer tie penetrations through the insulation layer.
 - a. Acceptable Products: The Dow Chemical Company “WEATHERMATE™ Straight Flashing 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 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: The Dow Chemical Company “Great Stuff™ Pro Gaps & Cracks” single-component polyurethane insulating foam sealant.
 - b. Acceptable Products: The Dow Chemical Company “Great Stuff™ Pro Window & Door” single-component polyurethane low-pressure foam sealant
 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
 - 1) NFPA 286 Approval for Exposed use to the interior of the building without the need for a 15-min thermal barrier
 - 2) ASTM E-84 Class A
 6. Flexible polyethylene foam gasketing strip to reduce air infiltration between a concrete foundation and sill plate.
 - a. Acceptable Products: The Dow Chemical Company “WEATHERMATE™ SILL SEAL Foam Gasket.

2.2 SPRAY POLYURETHANE FOAM AIR BARRIER

- A. Spray Polyurethane Foam: Two-component spray polyurethane cellular plastic foam, complying with the following methods and meeting the following physical properties:
1. Core Density (ASTM D1622): [Minimum 2pcf]
 2. Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.1/inch.
 3. Flame Spread (ASTM E84, Class A): 25 or less.
 4. Smoke Developed (ASTM E84, Class A): 450 or less.
 5. Compressive Strength minimum (ASTM D1621, 10% parallel to rise): [20 psi] [182 kPa].
 6. Closed Cell Content (ASTM D2856): minimum 90 percent.
 7. Water Absorption by Volume maximum. (ASTM D2842): 5.0 percent.
 8. Water Vapour 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 [CM2030], [CM 2045], [CM2060].

Formulation required will be dependent upon surface temperature of substrate. Refer to manufacturers recommendations

1. STYROFOAM Spray Polyurethane Foam CM2030:
 - a. Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.1/inch.
 - b. Maximum/Nominal 1.5 inch thickness: Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: R9.2
2. STYROFOAM Spray Polyurethane Foam CM2045:
 - a. Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.4/inch.
 - b. Maximum/Nominal 1.5 inch thickness: Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: R9.6
3. STYROFOAM Spray Polyurethane Foam CM2060:
 - a. Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.1/inch.
 - b. Maximum/Nominal 1.5 inch thickness: Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: R9.2

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and installation 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 the thermal wall system are placed and penetration gaps and cracks are properly sealed before installation of spray polyurethane foam.
 4. Do not proceed with thermal and air barrier wall system installation until unsatisfactory conditions have been corrected.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.2 INSULATION INSTALLATION

- A. Install insulation in accordance with manufacturer's recommendations. Fasten to exterior face of exterior metal stud wall framing using sheathing manufacturer's recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.
 1. Install sheathing panels horizontally with blue aluminum facing to exterior. Use maximum 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 panels to each support with fasteners spaced 12 inches on center at perimeter and 16 inches on center in panel field. Set back perimeter fasteners 3/8" from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not countersink. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 1.75" diameter of the washer used to fasten the board to the studs. Maximum of two board joints may be bridged per fastener.
 3. Install flashing joint tape at end and edge joints with sufficient hand pressure to ensure seal and in accordance with sheathing manufacturer's joint sealing recommendations.
 4. Install flashing tape behind wall tie and mechanical fastening assemblies for rain screen claddings.
 5. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer's joint and penetration sealing recommendations.

6. After base flashing, which may include a termination bar running horizontally along the top edge of the flashing, is installed on exterior of insulated sheathing, install WEATHERMATE™ Flashing 6 inch or 9 inch", with butyl rubber adhesive to the exterior sheathing and lapped over the top edge of the base flashing.

3.3 SPRAY POLYURETHANE FOAM INSTALLATION

A. Preparation

1. Mask and cover adjacent areas to protect from overspray.
2. Apply primers for special conditions as recommended by manufacturer.
3. Cover wide joints with transition sheet membrane as specified in Section 07 27 50
4. Clean work area prior to application of sprayed insulation.
5. Verify substrate temperature meets manufacturer's requirements for specific formulations used.
6. Ensure that all stud cavity fire-stopping is installed prior to application of spray foam.

B. Application: Spray apply polyurethane foam in accordance with ASTM C1029 and manufacturer's installation guidelines; complying with preparation methods outlined in 3.3.A.

1. Apply spray polyurethane foam by picture framing around the interior studs at the insulated sheathing – steel stud interface and one 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 the layer applied first to cool to the max. substrate temperature or less recommended for the STYROFOAM™ Spray Polyurethane Foam CM Series.
4. Avoid formation of sub-layer air pockets.
5. Apply spray polyurethane foam in overlapping layers, in a manner to obtain 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. Site Tolerances: Maximum Variation in Applied Thickness - minus [1/4 inch] [6 mm], plus [5/8 inch] [10 mm].

C. Field Quality Control. Submit spray polyurethane foam field inspection and test reports for the following:

1. The Certified Installer shall complete the Daily Work Record and record all information required including the results of the testing. The Daily Work Record shall be kept on site for routine inspection. Copies of the Daily Work Record shall be forwarded to the manufacturer, owner or owner's representative upon request.
2. The costs incurred for daily testing and inspection by the Certified Installer and the completion of the Daily Work Record shall be borne by the Accredited Contractor.
3. If required by the owner, arrange for site inspections by a qualified third party inspector. The frequency and cost of inspections shall be included in the bid at the owners request. If the site inspection reveals any defects, the Accredited Contractor shall immediately rectify all such defects at his cost.
4. The Certified Installer's daily work record shall verify conformance with the Thermal and Air Barrier Wall System Manufacturer's instructions, the standard ULC S705.2-02 Installation standard and this section of the project specification.
 - a) Follow Manufacturer guidelines for proper temperature settings regarding spray equipment as stated on Manufacturer product information sheets.
 - b) Follow Manufacturer guidelines for proper spray polyurethane foam formulation based on substrate and ambient temperatures product will be applied to.
 - c) Test completed application daily for core density and cohesion/adhesion to substrate. Record results daily in test reports.
 - d) After product has properly cured, conduct tests to verify adhesion between the spray polyurethane foam and the substrate.
 - e) Conduct adhesion tests on all corners and building angles, at wall-to-slab junctions, and at wall-to-roof junctions.

- f) Perform one adhesion test for every wall less than [100 feet] [30 meters] in length. Perform two tests for every wall greater than [100 feet] [30 meters] and less than [200 feet] [60 meters] in length, with an additional test conducted for every additional [100 feet] [30 meters], or part thereof, in wall length.
- g) Transition membranes shall be pull tested in accordance with the Certified Installer training program requirements before installing the spray polyurethane air barrier material.

PRODUCT DATA SHEET 1 - Cleaning

- 1.1 Remove overspray from non-prescribed surfaces without causing damage to surfaces.
- 1.2 Remove protective covers from adjacent surfaces.

END OF SECTION 07 42 65

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