



Designation: **C1397—09 C1397 – 13**

Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage¹

This standard is issued under the fixed designation C1397; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice covers the minimum requirements and procedures for field or prefabricated application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage. Class PB EIFS are systems applied over insulation board, in which the base coat ranges from not less than $\frac{1}{16}$ in. (1.6 mm) to $\frac{1}{4}$ in. (6.4 mm) in dry thickness, depending upon the number of nonmetallic reinforcing mesh layers encapsulated in the base coat (see Specification E2568). The base coat is then covered with a finish coat of varying thickness in a variety of textures and colors. EIFS with Drainage provides a mechanism to drain incidental moisture

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 The text of this practice references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as a requirement of the standard.

1.4 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

C11 Terminology Relating to Gypsum and Related Building Materials and Systems

C150 Specification for Portland Cement

C1063 Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster

C1177/C1177M Specification for Glass Mat Gypsum Substrate for Use as Sheathing

C1186 Specification for Flat Fiber-Cement Sheets

C1278/C1278M Specification for Fiber-Reinforced Gypsum Panel

C1280 Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing

C1325 Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units

C1382 Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints

C1396/C1396M Specification for Gypsum Board

C1472 Guide for Calculating Movement and Other Effects When Establishing Sealant Joint Width

C1481 Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS)

E1825 Guide for Evaluation of Exterior Building Wall Materials, Products, and Systems

E2110 Terminology for Exterior Insulation and Finish Systems (EIFS)

E2430 Specification For Expanded Polystyrene (“EPS”) Thermal Insulation Boards for Use in Exterior Insulation and Finish Systems (“EIFS”)

E2568 Specification for PB Exterior Insulation and Finish Systems

¹ This practice is under the jurisdiction of ASTM Committee C11 on Gypsum and Related Building Materials and Systems and is the direct responsibility of Subcommittee C11.05 on Application of Exterior Insulating and Finish Systems and Related Products.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

E2570 Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage

3. Terminology

3.1 Definitions used in this standard shall be in accordance with Terminologies **C11** and **E2110**.

4. Significance and Use

4.1 This practice provides minimum requirements for the application of Class PB EIFS and EIFS with Drainage (see Specification **E2568**). The requirements for materials, mixtures, and details shall be contained in the project plans and specifications. See Guide **E1825** for guidance.

5. Delivery of Materials

5.1 All materials shall be delivered in packages, containers, or bundles with the identification and markings intact.

6. Inspection

6.1 Inspection of the materials shall be agreed upon between the purchaser and the supplier as part of the purchase agreement.

6.2 Inspection shall verify that the EIFS materials supplied are as required for the Class PB EIF System or EIFS with Drainage System specified. Mixing of EIFS materials from different manufacturers is not allowed.

7. Rejection

7.1 Materials that are damaged, frozen or in any way defective shall not be used. Rejection of materials shall be promptly reported verbally to the manufacturer and immediately reported in writing. The notice of rejection shall contain a statement documenting the basis for material rejection.

8. Certification

8.1 When specified in the contract documents, the producer shall furnish a report certifying that the materials are in conformance with product and material standards and contract documents.

8.2 Insulation Boards:

8.2.1 Insulation boards shall comply with Specification **E2430**.

8.2.2 The insulation boards shall have been subjected to a third party quality control inspection and shall be marked as approved for use within the EIFS.

8.2.3 Prior to installation, the insulation board shall be inspected for conformance with contract documents. Nonconforming insulation board shall not be used.

8.2.4 The insulation board manufacturer shall furnish, for each shipment, a written certificate of conformance with the EIFS manufacturer's specifications.

9. Storage of Materials

9.1 All materials shall be kept dry by storage under cover and protected from the weather. When outside storage is required, materials shall be stacked off the ground, supported on a level platform and protected from the weather, surface contamination or physical damage in accordance with the EIFS manufacturer's written instructions.

9.2 Materials shall be protected from exposure to direct sunlight and temperatures less than 40 °F (4 °C), unless otherwise specified by the manufacturer.

9.3 Portland Cement shall meet Specification **C150** and shall be kept dry until ready for use. It shall be kept off the ground, under cover and away from damp walls and surfaces.

9.4 Insulation board shall be stacked flat with care taken to avoid damage to edges, ends, or surfaces; or exposure to direct sunlight (ultraviolet radiation).

10. Environmental Conditions

10.1 Cold Weather Conditions:

10.1.1 Wet materials shall not be applied when the temperature is less than 40 °F (4 °C), unless otherwise specified by the manufacturer, unless temporary heat and enclosures are provided to maintain minimum 40 °F (4 °C) for a minimum period of not less than 24 h before, during, and after application (see Annex **A1.9.3**).

10.1.2 Materials shall not be applied to a base containing frost. Substrate surface temperature shall be not less than 40 °F (4 °C). Mixtures for application shall not contain any frozen ingredients.

11. Assessment of Condition of Substrates to Receive Water-Resistive Barrier Coating (if applicable) or Exterior Insulation and Finish Systems or Both

11.1 The substrate shall be as required by the project plans and specifications and as recommended by the EIFS manufacturer for the particular system specified.

11.1.1 Insulation boards shall be as required by the EIFS manufacturer's specification and in the thickness specified.

11.2 The substrate shall be inspected by the applicator and general contractor to ensure that it meets the project plans and specifications and the requirements of 11.3 – 11.8.

11.3 Sheathing materials shall be inspected to ensure that:

11.3.1 The specified sheathing thickness has been installed for the stud spacing used.

11.3.2 Fastener type and fastener spacing are as specified.

11.3.3 All Specification C1396/C1396M gypsum sheathing boards shall have a water-resistant core.

11.3.4 Tongue and groove water-resistant treated core gypsum sheathing boards conforming to Specification C1396/C1396M shall be installed with the tongue edge oriented to the top.

11.3.5 Gypsum sheathing shall be installed in accordance with Specification C1280.

11.3.6 Gypsum sheathing shall be protected from moisture at all penetrations and terminations.

11.3.7 Glass mat gypsum sheathing complying with Specification C1177/C1177M shall be installed in accordance with the sheathing manufacturer's written installation instructions, which include details of framing type and spacing, fastener type and spacing, and sheathing orientation and spacing.

11.3.8 Plywood shall be not less than ½ in. (12.7 mm) nominal in thickness, exterior or exposure 1 wood-based panel sheathing. The plywood shall be installed with a ⅛ in. (3.2 mm) space between sheets.

11.3.9 Oriented Strand Board (OSB) shall be nominal 7/16 in. (11.1 mm) thick APA Exposure 1 rated.

11.3.10 Fiber-cement sheets complying with Specification C1186, Type A, shall be installed in accordance with the sheet manufacturer's written installation instructions, which include details of stud type and spacing, fastener type and spacing, and sheet spacing recommendations.

11.3.11 Water-resistant exterior fiber-reinforced gypsum sheathing complying with Specification C1278/C1278M shall be installed in accordance with the sheathing manufacturer's written installation instructions, which include details of stud type and spacing, fastener type and spacing, and sheathing orientation and spacing.

11.3.12 Fiber-mat reinforced cement sheets complying with Specification C1325, type A, shall be installed in accordance with the sheet manufacturer's written installation instructions, which include details of framing type and spacing, fastener type and spacing, and sheet orientation and spacing.

11.3.13 Sheathing shall be continuous.

11.4 *Alignment*—All substrate surfaces shall be straight and true within ¼ in. (6.4 mm) in 10 ft (3048 mm). More stringent requirements by the EIFS manufacturer shall supersede the above stated requirements.

11.5 *Suitability for Use*—The substrate surface shall be firm, sound, and undamaged in order to receive the Water- Resistive Barrier Coating or EIFS.

11.5.1 Loose, spalling or crumbling concrete or masonry shall be removed by sandblasting or other appropriate means. If the surface condition of the substrate is at all in doubt, an alternative attachment surface or method shall be provided.

11.5.2 Broken, cracked or delaminated substrate boards shall be replaced or restored to a condition equal to adjacent undamaged boards.

11.5.3 All rotted, decayed, or delaminated wood and plywood sheathing shall be replaced.

11.5.4 Paper-faced gypsum sheathing that has been installed and exposed to the elements for more than 30 days shall be checked at not less than two locations, or every 5000 ft² (465 m²), whichever is greater, for integrity of the surface. The procedures for evaluating the gypsum sheathing are found in Annex A2.

NOTE 1—Gypsum sheathing conforming to Specification C1396/C1396M is sometimes not recommended for adhesive attachment by the gypsum sheathing manufacturer. Consult with the gypsum board manufacturer before use.

11.6 *Cleanliness*—The surface of all substrates shall be clean and free from any foreign materials such as paint, form release agents, curing compounds, dust, dirt, frost, oil or grease, efflorescence and laitance that would affect the EIFS or EIFS with Drainage application.

11.6.1 All sheathing board substrates shall have all loose dirt and dust removed by cleaning methods appropriate for the job and job conditions.

11.6.2 Efflorescence and laitance on concrete, masonry, stucco or clay tile substrates shall be removed prior to EIFS application. Concrete masonry shall be cleaned by light sandblasting, pressure washing, or brushing. Heavy deposits shall be removed through use of hand or power impact tools followed by washing with an appropriate cleaner. Light deposits shall be removed by washing with an appropriate cleaner. All loose particles and cleaner residue shall be removed by washing with clean, potable water. The surface shall be allowed to dry.

11.6.3 Existing paint on concrete or masonry surfaces shall be removed by sandblasting or grit blasting. If removal of existing paint is not practical, an alternate attachment surface or method shall be provided.

11.7 *Dryness:*

11.7.1 Newly constructed concrete or masonry surfaces shall be allowed to cure for a minimum of 28 days prior to application of the EIFS or EIFS with Drainage. Repaired areas on existing (aged) walls shall meet the same 28-day curing time.

11.7.2 Sheathing must be dry prior to EIFS or EIFS with Drainage application.

11.7.3 Substrate surfaces shall be free of visible water.

11.8 *Metal Lath*—If metal lath is used, it shall be installed in conformance with Specification **C1063**, except lath edges shall be butted, not lapped. Metal lath shall be 3.4 lb/yd² (1.3 kg/m²) or 2.5 lb/yd² (1.0 kg/m²), self furring or flat, G60 galvanized.

11.8.1 Metal members shall be properly attached, straight, and true unless required by the system design.

11.8.2 Metal members shall be free of rust, oil, or other foreign matter or contaminants, which cause bond failure or unsightly discoloration.

12. Water-Resistive Barrier (WRB) Coating (When Specified) (See Test Methods **E2570**)

12.1 Manufacturer's Recommended Joint Treatment (not required with concrete or masonry substrates)

NOTE 2—Joint treatment materials and methods differ among manufacturers. Some manufacturers use self-adhesive membrane tapes and others use fluid-applied flexible coatings with embedded reinforcing mesh or fabric.

12.1.1 For sheathing substrates, apply manufacturer's recommended treatment along all joints in sheathing, inside and outside corners, and exposed edges of sheathing at terminations in accordance with manufacturers recommended details .

12.1.2 Center the treatment on sheathing joints, edges, etc. For self-adhesive membrane tapes and self-adhesive mesh, apply with the pressure-sensitive adhesive backing in contact with the sheathing surface.

12.1.3 When applicable, use a stainless steel trowel or spatula to apply water-resistive barrier coating over tape and spot all fastener heads. (Spotting of fasteners is not required when applying water-resistive barrier with a trowel.)

12.1.4 After the first pass has dried, check joints and spot any voids that may be present with additional coating to achieve a continuous film.

12.2 Water-Resistive Barrier Coating

12.2.1 Roller Application

12.2.1.1 Use a roller recommended by manufacturer.

12.2.1.2 Apply a uniform, continuous film of the water-resistive barrier coating over the entire surface of the sheathing, concrete, or masonry, including previously treated areas.

NOTE 3—For concrete and masonry ensure that a continuous film of uniform thickness is applied across the entire surface including mortar joints. Substrates with a surface texture or high porosity will require additional material.

12.2.2 Trowel Application

12.2.2.1 Using a stainless steel trowel, apply a continuous film of the water-resistive barrier coating onto the entire wall surface. The material shall be applied at a smooth, uniform, continuous film at the coverage rate specified by the manufacturer.

12.2.3 Spray Application

12.2.3.1 Using a handheld hopper gun or other suitable spray equipment, spray a layer of water-resistive barrier coating onto the wall surface.

12.2.3.2 In order to create a smooth continuous film, use a roller as described in **12.2.1** when specified by the manufacturer.

13. Drainage Means (If Applicable)

13.1 EIFS with Drainage require a means of drainage. This can be accomplished by one of the following methods; vertical notch trowel adhesive application, grooved insulation board, drainage mat, sheet type water-resistive barriers designed for drainage, metallic lath or non-metallic lath.

13.2 The EIFS shall be installed such that EIFS components, including sealants and flashings, do not hinder the drainage capability of the EIFS.

14. Insulation Board Installation

14.1 Method of attachment shall be approved by the system manufacturer.

14.2 *Adhesive Attachment Method*—The adhesive shall be applied to the back of the insulation board by one of the following methods:

14.2.1 *Notched Trowel (Required when Installing EIFS over Sheathing Substrates):*

14.2.1.1 For EIFS with Drainage the notches shall be oriented vertically when using adhesive as the means to create the drainage plane. Refer to EIFS manufacturer for proper size of notch trowel and applications over lath.

14.2.2 *Ribbon and Dab (Acceptable over Concrete and Masonry):*

14.2.2.1 The adhesive shall be applied to the entire perimeter of the insulation board in a ribbon fashion that is not less than 2 in. (50.8 mm) wide by not less than $\frac{3}{8}$ in. (9.5 mm) thick. Dabs not less than 4 in. (101.6 mm) in diameter by not less than $\frac{3}{8}$ in. (9.5 mm) thick shall be applied not more than 8 in. (203.2 mm) on center over the remainder of the board. Refer to EIFS manufacturer for applications over lath.

15. Adhesive and Mechanical Attachment Method

15.1 Adhesive shall be applied using the ribbon and dab method, the notched trowel method, or in accordance with system manufacturer's current published instructions.

15.2 Mechanical fasteners shall be installed into the framing or nailable substrate.

15.3 Fasteners shall penetrate not less than $\frac{5}{16}$ in. (8.0 mm) into steel framing members, 1 in. (25.4 mm) into wood framing members, and 1 in. (25.4 mm) into masonry substrates.

15.4 Mechanical fasteners shall be corrosion resistant. Fastener type and spacing shall be in accordance with system manufacturer's current published instructions.

15.5 Selection and frequency of fasteners and fastener type will vary depending on substrate type, insulation board thickness and design wind load and whether used in combination with an adhesive attachment. Therefore fastener type, patterns, and use shall be in accordance with the EIFS manufacturer's written instructions and shall be included in the project plans and specifications.

16. Mechanical Attachment Method

16.1 Mechanical fasteners shall be installed into the framing or nailable substrate.

16.2 Mechanical fasteners shall be corrosion resistant. Fastener type and spacing shall be in accordance with the EIFS manufacturer's current published instructions.

NOTE 4—Wind-load requirements shall be considered for mechanically fastened systems.

17. General Requirements

17.1 Insulation boards shall be placed from a level base line with vertical joints staggered in a running bond pattern and butted tightly.

17.2 Insulation board joints at all inside and outside corners shall be staggered and interlocked.

17.3 Insulation boards must abut without gaps, eliminating space for adhesive or base coat intrusion between the board edges and ends.

17.4 Fenestration openings and other wall openings shall be cut out of a single insulation board. Board joints shall not be aligned at corners with head, sill or jambs of windows, doors, similar openings, and aesthetic reveals.

17.5 *Adhesively Attached:*

17.5.1 The final insulation board thickness shall be not less than $\frac{3}{4}$ in. (19.1 mm).

17.5.2 Insulation board joints shall be offset not less than 6 in. (152.4 mm) from horizontal sheathing board joints.

17.6 *Mechanically Fastened:*

17.6.1 The insulation board thickness shall be not less than $\frac{1}{2}$ in. (38.1 mm).

17.6.2 Insulation board joints shall be offset from horizontal sheathing board joints.

17.7 When attachment is by adhesive or adhesive and mechanical fasteners, each insulation board shall be installed by sliding it into place until it abuts the adjoining insulation board tightly. Pressure shall be applied over the entire surface of the insulation board to achieve uniform contact and an overall level surface. The insulation board shall be occasionally checked for proper contact with the substrate by removing a piece of insulation board. Proper contact has been achieved when approximately equal portions of the adhesive remain on both the substrate and the insulation board when the board is removed from the wall. The insulation board shall remain undisturbed for no less than 24 h prior to proceeding with the installation of mechanical fasteners or the base coat. Cool, damp weather conditions extend minimum curing or drying time.

17.8 When the boards are attached only with mechanical fasteners, they shall be affixed to a nailable substrate or structural members with the proper fasteners, ensuring that all insulation boards abut tightly. Fastening patterns shall be in accordance with the EIFS manufacturer's recommendation. When installed, the portion of the fastener left flush with the face of the insulation board shall not fracture the insulation board.

18. Aesthetic Reveals

18.1 Aesthetic reveals shall be cut into the insulation board prior to applying the reinforcing mesh.

18.2 The insulation board thickness in the bottom of a reveal shall be not less than $\frac{3}{4}$ in. (19.1 mm).

18.3 Aesthetic reveals shall be cut true and straight.

18.4 Horizontal aesthetic reveal configuration shall provide for outward positive drainage.

18.5 Aesthetic reveals shall not occur at the abutment of two pieces of insulation board.

18.6 The reveal shall be reinforced with base coat and reinforcing mesh prior to application of the full base coat and reinforcing mesh.

19. Reinforced Base Coat Application

19.1 Inspect the insulation board surface to ensure that it is clean, dry, free of all foreign materials, and damage of any type. Insulation board planar irregularities of more than $\frac{1}{16}$ in. (1.6 mm) shall be corrected. All board joints shall be tightly abutted or shall be filled with an insulating material. The entire wall area shall be sanded or rasped to minimize any irregularities.

19.2 *Base Coat Preparation*—All materials requiring field preparation shall be mixed in accordance with the EIFS manufacturer's specifications.

19.3 *Base Coat Application*—The prepared base coat shall be uniformly spread over the entire surface of the insulation board.

19.4 *Nonmetallic Reinforcing Mesh*—The single layer reinforcing mesh shall be fully embedded in wet base coat in the field of the wall, at corners, edges, and joints. While the base coat is wet, trowel from the center to the edge of the reinforcing mesh to avoid wrinkles. Mesh shall not be installed before base coat. The single layer of reinforcing mesh shall be continuous at all corners.

19.4.1 The surface shall be free of voids, projections, trowel marks and other surface irregularities. The base coat thickness shall be sufficient to totally embed the reinforcing mesh.

19.5 *Reinforcing Mesh Overlap*—All reinforcing mesh edges shall be overlapped not less than $2\frac{1}{2}$ in. (63.5 mm).

19.6 *Impact Layers*—When required, higher impact performance shall be achieved with multiple layers of reinforcing mesh or by incorporating heavier weight reinforcing mesh. All areas requiring higher impact performance shall be detailed on the project plans and specifications. When overlapping of high impact mesh is not required, a complete second layer of reinforcing mesh shall be applied over the layer of high impact mesh.

19.7 *Corners*—Reinforcing mesh shall not be lapped within 8 in. (203.2 mm) of any corner. Double wrap the mesh 8 in. (203.2 mm) onto each side of the building's interior and exterior corners, not including small openings such as doors and windows.

19.8 *Wall Penetrations*—All edges of the insulation board at penetrations of the EIFS, such as at windows, doors, HVAC, pipes, ducts, electrical boxes, and at the base of the wall shall be wrapped with either the base coat and reinforcing mesh or trim, or as specified by the EIFS manufacturer. Wall openings such as doors, windows, and HVAC sleeves shall be diagonally reinforced at corners with mesh not less than 9 in. (228.6 mm) by 12 in. (304.8 mm).

19.8.1 The corners of returns to windows, doors, and similar wall openings shall have reinforcing mesh the full width of the return and extending not less than $2\frac{1}{2}$ in. (63.5 mm) on both sides of the corner.

19.9 *Expansion Joints*—All edges of the insulation board at expansion joints shall be wrapped with either the base coat and reinforcing mesh or trim as specified by the EIFS manufacturer for the particular EIFS or EIFS with Drainage. The reinforcing mesh shall be fully embedded in the base coat material.

19.10 *Aesthetic Reveal*—The reinforcing mesh shall be continuous and care shall be taken to ensure that the reinforcing mesh is fully embedded in the base coat material at the base of the reveal and that the reinforcing mesh shall not be cut during application of the base coat.

19.11 *Reinforced Base Coat*—The reinforcing mesh shall be fully embedded in the base coat material throughout the field of the wall, at corners, edges, and joints. The surface shall be free of voids, projections, trowel marks and other surface irregularities.

19.12 *Special Insulation Shapes*—Nonmetallic reinforcing mesh embedded in the base coat material shall be used over specially shaped insulation board.

NOTE 5—Materials other than specified by EIFS manufacturer are not acceptable.

20. Finish Coat Application

20.1 The reinforced base coat shall be allowed to dry and harden for not less than 24 h prior to finish coat application, unless specifically allowed by the EIFS manufacturer.

20.2 *Material Preparation*—The finish coat shall be mixed in accordance with the EIFS manufacturer's specifications. Only clean potable water shall be added to adjust workability. Always add the same amount of water to each container within a given lot of finish.

20.3 *Execution*—Finish shall be applied with a stainless steel trowel or appropriate equipment as specified by the EIFS manufacturer. Tools and equipment shall be kept clean at all times. Finish shall be applied continuously to a natural break such as corners, joints or tape line. Apply finish to the base coat maintaining a wet edge. Sufficient manpower and scaffolding shall be