UNIFIED FACILITIES GUIDE SPECIFICATION

References are in agreement with UMRL dated January 2021
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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 24 00

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USACE / NAVFAC / AFCEC / NASA	**UFGS-07 24 00 (May 2011)** **Change 4 - 08/18**
Preparing Activity: NAVFAC	**Superseding** **UFGS-07 24 00 (August 2008)**

UNIFIED FACILITIES GUIDE SPECIFICATION

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SECTION 07 24 00

EXTERIOR INSULATION AND FINISH SYSTEMS
05/11, CHG 4: 08/18

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NOTE: This guide specification covers the requirements for barrier-type and drainable exterior insulation and finish systems (EIFS), Classes PB and PM, which may be applied to concrete or brick masonry, or to wood or metal frame construction. EIFS are exterior finish systems that include an integral layer of thermal insulation.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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NOTE: Do not specify EIFS for areas below grade or in areas subject to abuse by moving vehicles or equipment, such as a loading dock. Avoid the use of EIFS in expected heavy pedestrian traffic areas. If such use can not be avoided, select an appropriate high-impact resistant system. Avoid exposure of EIFS to standing water or prolonged contact with snow. Do not specify EIFS for other than vertical surfaces, except narrow ledges and window sills where the minimum slope is 25 mm in 50 mm one inch in 2 inch. Flashing is required at parapet caps.

For EIFS directly applied over existing substrate

(brick, concrete), specify preparation of substrate in this section. For EIFS installed over new substrate, specify preparation of substrate under applicable section(s). Substrate must be sound, true, plumb, and within flatness tolerance of EIFS manufacturer, usually not more than 6 mm within 3000 mm 1/4 inch within 10 feet. If existing substrate can not be brought up to these requirements, a new substrate should be provided.

For EIFS installed over new sheathing board, provide sheathing in this section. If sheathing is to be installed on metal furring or studs, provide furring or studs in Section 05 40 00 COLD-FORMED METAL FRAMING, specifying EIFS manufacturer's tolerance requirements.

In marine environments, light gage metal framing is subject to corrosion if water infiltrating through the EIFS is allowed to accumulate in runners. In locations near salt water, do not use metal framing for the support of the substrate or detail carefully to prevent water accumulation.

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NOTE: The coordination of work with other trades is important for the performance of the the EIFS wall assembly, in particular the installation of flashing above windows and door heads, beneath window and door sills, at roof/wall intersections, decks, intersection of lower walls with higher ones, above projecting features, and at the base of the wall to ensure that where water is likely to penetrate the wall assembly, it will be drained to the exterior at the source of the leak.

Design must meet the requirements of UFC 1-200-02, "High Performance and Sustainable Building Requirements" which invokes the requirements within UFC 3-101-01, "Architecture". UFC 1-200-02 and UFC 3-101-01 make references throughout to various ASHRAE documents governing energy efficiency and requirements for the components of building envelope design including moisture control and thermal performance.

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NOTE: EIFS provides insulation and exterior finish for both new and renovated buildings. The systems are available in two classes: PB and PM.

a. Class PB Systems are typically composed of a 2 mm to 6 mm 1/16 inch to 1/4 inch cementitious or non-cementitious base coat, one or more layers of polymer-coated glass fiber mesh, and a non-cementitious finish coat. The Government requires EIFS systems to be Drainable systems. PB

systems are most commonly used over molded expanded polystyrene (MEPS) insulation which is adhesively attached to the substrate. The non-cementitious base coat systems have good impact resistance but may be punctured by sharp objects. The MEPS insulation allows water vapor migration, which can either ventilate the system beneficially or allow moisture into the substrate. Class PB EIFS should not be used in first floor, high traffic areas, or in areas where pedestrians congregate. Where so used, they must have at least one layer of 567 g 20 ounce reinforcing fabric mesh followed by one layer of minimum 113 g 4 ounce reinforcing mesh. Class PB systems are the least expensive and most widely used of the two classes.

b. Class PM Systems are typically composed of a 6 mm to 9 mm 1/4 inch to 3/8 inch thick, rigid, polymer-modified cementitious base coat, a polymer-coated fiber mesh, and a cementitious finish coat. They are most commonly used over an extruded expanded-polystyrene (XEPS) insulation board which is mechanically attached to the substrate. Class PM systems have good puncture resistance, but are susceptible to damage from blunt impacts. The XEPS insulation allows less water vapor movement.

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NOTE: Drainable systems are available from most EIFS manufacturers. These drainable systems are either Class PB or Class PM systems that are designed to provide an avenue for flow and drainage of incidental moisture from the wall assembly.

Each manufacturer has taken a different design approach to achieve drainage of moisture from their systems. ASTM D2273, Standard Test Method for Determining the Drainage Efficiency of EIFS Clad Wall Assemblies has been published. Refer to the requirements of UFC 1-200-02 for further guidance on standards for moisture control of building envelopes and UFC 3-101-01, Architecture.

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NOTE: The following references may be used for additional information on EIFS:

Guide to EIFS Construction, EIFS Industry Members Association (EIMA), Morrow, GA, 2000.

Interim Design Guidance for Exterior Insulation and Finish Systems (EIFS), USACE Technical Instructions, TI 805-15, 2003

Nelson, Peter E. and Richard E. Kroll, Exterior Insulation and Finish Systems (EIFS): Materials, Properties, and Performance, ASTM STP 1269, American

Society for Testing and Materials, Philadelphia, 1996.

Thomas, Robert G. Jr., Exterior Insulation and Finish System Design Handbook, CMD Associates, Inc., Vashon Island, WA, 1992.

Williams, Mark F. and Barbara Lamp Williams, Exterior Insulation and Finish Systems: Current Practices and Future Considerations, ASTM MNL 16, American Society for Testing and Materials, Philadelphia, 1994.

Williams, Mark F. and Richard Lampo, Exterior Insulation and Finish Systems (EIFS): Development, Use, and Performance of, ASTM STP 1187, American Society for Testing and Materials, Philadelphia, 1995.

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NOTE: On the drawings, the following information must be shown:

1. Locations of EIFS.

2. Indicate PB or PM system, color and coarse, medium, or fine finish. Add notes and details to indicate Drainable EIFS system.

3. Wall sections with construction details, including flashings, terminations at openings perimeter, and joints with other materials.

4. Joint layout on elevations. The designer must locate joint spacing and areas within the recommendations of at least three qualified EIFS manufacturers. Show all expansion joints at building expansion joints, where substrates change, and where significant structural movement occurs.

5. Include location of control joints, which are required for Class PM EIFS to help prevent lamina cracking, on the drawings. Individual areas must not exceed 14 sqm 150 sqft, with a maximum dimension not exceeding 5500 mm 18 feet and a maximum length to height ratio of 2.5 to 1.0. (Control joints are not typically required for Class PB EIFS. Consult manufacturer for any specific requirements.)

6. Joint details, showing back wrapping, base coat, backer rod, and sealant.

7. Corner details, including drips at edges of soffits and at undersides of EIFS projections, and details of flashing and its relation to the EIFS and to other building elements and parts.

8. Thermal resistance value (R-Value) for each

location.

9. If different levels of Impact Resistance are specified, indicate locations where each is required.

10. If different thicknesses of insulation board are to be used for architectural details, indicate the locations and thicknesses where required. Provide details which show that additional thicknesses are achieved by adding insulation board on top of the continuous underlaying insulation board.

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C67/C67M	(2020) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C473	(2019) Standard Test Methods for Physical Testing of Gypsum Panel Products
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C847	(2014a) Standard Specification for Metal Lath
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1177/C1177M	(2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1186	(2008; R 2012) Standard Specification for Flat Non-Asbestos Fiber Cement Sheets
ASTM C1278/C1278M	(2017) Standard Specification for Fiber-Reinforced Gypsum Panel
ASTM C1325	(2017a) Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D3273	(2016) Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
ASTM E330/E330M	(2014) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E695	(2003; R 2015; E 2015) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
ASTM E2098/E2098M	(2013) Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution

ASTM E2486	(2006) Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
ASTM E2570/E2570M	(2007; R 2014; E 2014) Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage
ASTM G153	(2013) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 268	(2012) Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source
NFPA 285	(2012) Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) must be a job-fabricated, drainable, exterior wall covering consisting of sheathing,[air and moisture barrier,] insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components must be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. All materials must be installed by an applicator approved by the system manufacturer. EIFS must be [Class PB] [or] [Class PM][as indicated] and must be [_____] color and [_____] finish.

1.2.1 System Requirements and Tests

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NOTE: The overall performance requirements will vary with the design and geographic location of the building, as well as with occupation, type of construction, and other components specified. Include only those systems tests required for the particular building. Require full scale wall tests where prior tests on similar wall designs are not available or where the wall design differs significantly from the design tested. If testing for wind load, base the required pressure on wind speed specified in ICC IBC. Higher values may be used as required by applicable building code or

based on local experience of wind forces at the site. Conduct tests both for positive and negative pressure.

Design must meet the requirements of UFC 3-101-01 Architecture. UFC 3-101-01 provides necessary references to various ASHRAE documents regarding energy efficiency and thermal properties related to the building envelope design including moisture control and thermal performance.

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The system must meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E331. There must be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 300 Pa 6.4 psf, or 20 percent of positive design wind pressure, whichever is greater.

1.2.1.2 Wind Load

Test the system for wind load by uniform static air pressure in accordance with ASTM E330/E330M (procedure A) to a minimum pressure of [_____] Pa [_____] psf. There must be no permanent deformation, delamination, or other deterioration.

1.2.1.3 Full scale or intermediate scale fire test

Conduct wall fire test using apparatus, specimen, performance criteria, and procedure in accordance with NFPA 285 when required by ICC IBC 2603.5.5. The following requirements must be met:

a. No vertical spread of flame within core of panel from one story to the next.

b. No flame spread over the exterior surface.

c. No vertical flame spread over the interior surface from one story to the next.

d. No significant lateral spread of flame from compartment of fire origin to adjacent spaces.

1.2.1.4 Mock-Up Installation of EIFS

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NOTE: Specify mock-up installation only if required because of significance and prominence of project. A mock-up installation may also be justified where out of the ordinary finishes or other special features are specified . The sample installation should be at least one story in height and one bay

wide.
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Complete wall mock-up installation [_____] mm [_____] ft high by [_____] mm [_____] ft wide, including typical control joints [and at least one window opening]. Control joints to be filled with sealant of type, manufacturer, and color selected. Construct mock-up installation at [manufacturer's plant] [job site]. Build mock-up to comply with the following requirements, using materials indicated for the completed work:

a. Locate mock-up installation(s)in the location and size [indicated] [as directed by the Contracting officer].

b. Demonstrate the proposed range of color, texture, thickness, insulation, and workmanship.

c. Obtain Contracting Officer's written approval of mock-up before starting fabrication of work.

d. Maintain mock-up installation(s) during construction as a standard for judging the completed work by protecting them from weather and construction activities.

[e. When directed, demolish and remove mock-up from the site.

]1.2.2 Component Requirements and Tests

The components of the system must meet the performance requirements as verified by the tests listed below.

1.2.2.1 Surface Burning Characteristics

Conduct ASTM E84 test on samples consisting of base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index must be 25 or less and the smoke developed index must be 450 or less.

1.2.2.2 Radiant Heat

The system must be tested in accordance with NFPA 268 on both the minimum and maximum thickness of insulation intended for use with no ignition during the 20-minute period.

1.2.2.3 Impact Resistance

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NOTE: Select impact resistance for Class PB EIFS based on exposure of wall to potential impact hazard. Higher impact resistance may be limited to lower portion (e.g. on first floor only) of wall:

Standard impact resistance:	**3 to 6 J 25 to 49 inch-lbs**
Medium impact resistance:	**6 to 10 J 50 to 89 inch-lbs**

High impact resistance:	**10 to 17 J 90 to 150 inch-lbs**
Ultra high impact resistance:	**Over 17 J Over 150 inch-lbs**

Select lowest impact resistance for wall areas not accessible to public, (e.g. tower structures, air shafts). Select medium impact resistance for areas with limited access to public. Select high impact resistance for areas with general access to public, (e.g. first floor walls). Select ultra high impact resistance in locations with constant access.

The thickness and hardness of Class PM EIFS lamina make these systems inherently more resistant than Class PB EIFS to impact failures (defined as penetration of the lamina) from a small or pointed object, as simulated by the probe-type indenture used in the EIMA test method 101.86. Class PM EIFS are more prone to impact failures (cracking and/or crushing of lamina) from heavy, blunt objects. ASTM E695 is a test method designed to test the whole wall assembly (including the substrate structural supports) and not specifically the impact resistance of Class PM EIFS. However, until a test method to measure the impact resistance for Class PM EIFS is developed, if ever, ASTM E695 provides some means of qualifying minimum performance for impact resistance of Class PM EIFS.

For Class PB EIFS, use paragraph a. Class PB Systems and delete paragraph b. Impact Mass. For Class PM EIFS, use paragraph b. Impact Mass and delete paragraph a. Class PB Systems. If selection of class is Contractor's option, retain both paragraphs and edit accordingly.

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NOTE: If two or more impact resistance requirements are provided, repeat requirement. Indicate on the drawings where each requirement applies.

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a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with ASTM E2486. The test specimen must exhibit no broken reinforcing fabric per ASTM E2486 at an impact of [_____] J [_____] in/lb.

b. Impact Mass: Test 28 day cured specimen of PM EIFS in accordance with ASTM E695. The test specimen must exhibit no cracking or denting after twelve impacts by 13.6 kg 30 lbs lead shot mass from 150 to 1800 mm 6 in to 6 ft drop heights in 150 mm 6 in intervals.

1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen must consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building. For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen must be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D968, Method A. Test a minimum of two specimens. After testing, the specimens must show only very slight smoothing, with no loss of film integrity after 500 liters 132 gallons of sand.

1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G153, Cycle 1. After 2000 hours specimens must exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

1.2.3.3 Mildew Resistance

Test in accordance with ASTM D3273. The specimen shall consist of the finish coat material, applied to clean 75 mm by 100 mm 3 inch by 4 inch glass slides and must be allowed to cure for 28 days. After 28 days of exposure, the specimen must not show any growth.

1.2.3.4 Salt Spray Resistance

Test in accordance with ASTM B117. The specimen must be a minimum of 100 mm by 150 mm 4 inch by 6 inch and must be tested for a minimum of 300 hours. After exposure, the specimen must exhibit no observable deterioration, such as chalking, fading , or rust staining.

1.2.3.5 Water Resistance

Test in accordance with ASTM D2247. The specimen must be a minimum of 100 mm by 150 mm 4 inch by 6 inch. After 14 days, the specimen must exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

1.2.3.6 Absorption-Freeze/Thaw

Class PB systems must be tested in accordance with ASTM E2570/E2570M for 60 cycles of freezing and thawing. After testing, the specimen must exhibit no cracking, checking, or splitting, and negligible weight gain. Class PM systems must be tested in accordance with ASTM C67/C67M for 50 cycles of freezing and thawing. After testing, the specimens must exhibit no cracking or checking and have negligible weight gain.

1.2.3.7 Sample Boards

Unless otherwise stated, provide sample EIFS Component 300 by 600 mm 12 by 24 inches, on sheathing board, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen must consist of

reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

1.2.4 Moisture Analysis

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NOTE: Condensation of water vapor within the system or wall assembly can lead to performance problems. Condensation can cause leaks in the wall leading to damage to the wall structure such as rotting of wood studs, corrosion of metal framing, mold, staining and discoloration of interior finishes, etc. Moisture, if trapped in EIFS, expands upon freezing, and it can damage the EIFS coatings. Should analysis determine that the project design is potentially subject to condensation or mold problems,the installation of a vapor retarder, changing the insulation thickness, or selecting a different insulation material may be required.

Design to meet the requirements of UFC 1-200-02, High Performance and Sustainable Building Requirements, and UFC 3-101-01, Architecture.

For additional guidance see ASHRAE Handbook of Fundamentals, 2013 Chapters 25-27 Heat, Air and Moisture Control in Building Assemblies - Fundamentals, and ASTM C755, Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation. The computer program MOIST is a user-friendly tool based on hourly weather data that provides information on moisture content of building materials, the duration of high moisture content excursions, and on surface relative humidity.

The designer should consult with the system manufacturer when evaluating EIFS for condensation potential. Manufacturers typically offer water vapor transmission analysis services at no cost to designers and contractors.

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NOTE: The following anaylsis ensures the system performance if the Contractor's selected systems differ from the design.

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Perform a job specific vapor transmission analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G[, [_____]]

Show wall layout, construction and expansion joints, decorative grooves, layout of sheathing board, thermal insulation board, and reinforcing mesh and strip reinforcing fabric; joint and flashing details; details at wall penetrations; types and location of fasteners; [details at [windows] [and] [or] [doors];] and details at [base], [roof], [parapet], [corners], [projecting features], [roof/wall intersections], [abutments of lower walls with higher walls], [_____].

SD-03 Product Data

[Sheathing Board

] Thermal Insulation

[Adhesive

][Mechanical Fasteners

] Accessories

Base Coat

Portland Cement

Reinforcing Fabric

Finish Coat

Joint Sealant

Sealant Primer

Bond Breaker

Backer Rod

Insulation Board

[Recycled Content for Insulation Materials; S

] Warranty

Include joint and other details, such as end conditions, corners, windows, and parapet. Include shelf life and recommended cleaning solvents in data for sealants. Include Safety Data Sheets (SDS)for all components of the EIFS. The SDS shall be available at the job site.

SD-04 Samples

Sample Boards; G[, [_____]]

Color and Texture

[Mock-up Installation of EIFS; G[, [_____]]

][SD-05 Design Data

Wind Load Calculations

Moisture Analysis Calculations

] SD-06 Test Reports

Abrasion Resistance

Accelerated Weathering

Impact Resistance

Mildew Resistance

Salt Spray Resistance

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Absorption-Freeze-Thaw

Wall Fire Test

[Water Penetration

][Water Resistance

][Full Scale or Intermediate Scale Fire Test

] Surface Burning Characteristics

Radiant Heat

Substrate

[Wind Load

] SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

Qualifications of Third Party Inspector

Inspection Check List; G[, [_____]]

Submit filled-out inspection check list as required in paragraph "Quality Control," certifying that the installation of critical items meets the requirements of this specification.

SD-08 Manufacturer's Instructions

Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

SD-10 Operation and Maintenance Data

EIFS

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

1.4 QUALITY ASSURANCE

****
NOTE: The experience and warranty clauses in this guide specification have been approved by a level 1 Contracting Officer, in accordance with Naval Facilities Acquisition Supplement (NFAS). NFAS can be found at the following link: http://www.navfac.navy.mil/content/dam/navfac/Small%20Business/PDFs/Contracting_with_NAVFAC/sb_navfac_naval_facilities_acq_supplement_nov_change2.pdf These paragraphs may be used in NAVFAC Projects without further approval or request for waiver.
****

1.4.1 Qualifications of EIFS Manufacturer

The EIFS must be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

1.4.2 Qualification of EIFS Installer

****
NOTE: Training is System (type/class) dependent.
****

The EIFS Installer must be trained by the EIFS manufacturer to perform the installation of the System and must have successfully installed at least five projects at or near the size and complexity of this project. The contractor must employ qualified workers trained and experienced in installing the manufacturer's EIFS.

1.4.3 Qualification of Sealant Applicator

The sealant applicator must be experienced and competent in the installation of high performance industrial and commercial sealants and must have successfully installed at least five projects at or near the size and complexity of this project.

1.4.4 Qualifications of Third Party Inspector

Submit evidence that third party inspector has current certification from the Exterior Design Institute or equal inspector certification as inspector for the installation of EIFS.

1.4.5 Insulation Board

Insulation Board must be approved and labeled under third party quality program as required by applicable building code.

1.4.6 Pre-Installation Conference

After approval of submittals and before commencing any work on the EIFS, including installation of any [sheathing board,] insulation, and associated work, the Contracting Officer will hold a pre-installation conference to review:

a. Drawings, specifications, and samples;

b. Procedure for on site inspection and acceptance of EIFS substrate and pertinent details (for example, mock-up installation);

c. Contractor's plan for coordination of work of the various trades involved in providing EIF system and other components;

d. Inspection procedures; and

e. Safety requirements.

Pre-installation conference must be attended by the Contractor, [EIFS Q.C. Specialist (EIFS Inspector),] and all personnel directly responsible for installation of the EIF system, including sealant applicator, and personnel responsible for related work, such as flashing and sheet metal, windows and doors, and a representative of the EIFS manufacturer. Before beginning EIFS work, the contractor must confirm in writing the resolution of conflicts among those attending the pre-installation conference.

1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 4 degrees C 40 degrees F. Do not expose insulation board to flame or other ignition sources.

1.6 ENVIRONMENTAL CONDITIONS

a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.

b. Apply sealants and wet materials only at ambient temperatures of 4 degrees C 40 degrees F or above and rising, unless supplemental heat is provided. The system must be protected from inclement weather and maintain this temperature for a minimum of 24 hours after installation.

c. Do not leave insulation board exposed to sunlight after installation.

1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty must run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

PART 2 PRODUCTS

2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

2.2 SHEATHING BOARD

****
NOTE: Where local conditions require highly moisture resistant construction, specify cement based Board only and delete Gypsum based Board for applications of PB systems. Local experience is the best guide on where highly moisture resistant construction is required, but specify Cement based Board for buildings near seashores and in all areas identified in the ASHRAE Handbook of Fundamentals as "humid." Include both Cement and Gypsum based Sheathing Boards for applications where local conditions do not require highly moisture resistant construction.
****

2.2.1 Fiber Reinforced Cement Sheathing Board

****
NOTE: Cement sheathing boards meeting ASTM C1186 or ASTM C1325 are manufactured in two types A and B. Use only types A. Select grade and flexural strength to satisfy wind load calculations.
****

a. Meet ASTM C1186, Type A, Grade [I] [_____], or.

b. Meet ASTM C1325, Type A, Flexural Strength [_____]

c. Non-combustible per ASTM E136.

d. Nail Pull Resistance: No less than 534 N 120 lb when tested in accordance with ASTM C473.

e. Thickness no less than 13 mm 1/2 inch.

f. Water Absorption not to exceed 17 percent.

[2.2.2 Glass Mat Gypsum Sheathing Board

a. Conform to ASTM C1177/C1177M; or.

b. ASTM C1278/C1278M, Water Resistant Exterior Type only

c. Flexural Strength [_____]

d. Nail Pull Resistance: No less than 534 N 120 lb when tested in accordance with ASTM C473.

]2.3 ADHESIVE

****
NOTE: Delete the adhesive when using Class PM EIFS.
****

[Manufacturer's standard product, including primer as required, must be compatible with substrate and insulation board to which the system is applied.

]2.4 LATHING AND FURRING

****
NOTE: EIFS are often used for retrofit over existing unit walls. When the bonding conditions of the retrofit is deemed poor for use with adhesively applied Class PB EIFS, a corrosion resistant, self-furring metal lath can be mechanically fastened to the masonry wall to support the adhesive. When specifying a drainage system with air barrier, specify adjesive application instead of mechanical fasteners, to avoid puncturng the air barrier. Delete this paragraph if metal lath is not required.
****

Conform to ASTM C847, 1.4 kg/sqm 2.5 lb/sqyd, self-furring, galvanized.

2.5 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

2.6 THERMAL INSULATION

2.6.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

2.6.2 Insulation Board

****
NOTE: Select R-Value for Thermal Insulation required.

Design must meet the requirements of UFC 1-200-02, "High Performance and Sustainable Building Requirements" which invokes the requirements within UFC 3-101-01, "Architecture". UFC 1-200-02 and UFC 3-101-01 make references throughout to various ASHRAE documents governing energy efficiency and requirements for the components of building envelope design including moisture control and thermal performance.

Show R-Value on drawings.

Do not specify thermal insulation over 100 mm 4 inch thick as part of the EIFS. If the insulating value required to meet energy budget cannot be achieved within the 100 mm 4 inch limitation, provide additional insulation as separate item on interior of EIFS. Specify such insulation under appropriate separate specification section.
****

Insulation board must be standard product of manufacturer and must be compatible with other systems components. Boards must be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at 24 degree C 75 degree F, and thickness. No layer of insulation shall be less than 20 mm 3/4 inch thick. The maximum thickness of all layers must not exceed 100 mm 4 inches. Insulation Board must be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

a. Thermal resistance: As indicated on drawings.

b. Insulating material: [ASTM C578] Type I as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.

c. Drainage: Preform channels into the interior face of insulation board or provide polypropylene drainage lath spacer to provide water drainage system.

****
NOTE: Use materials with recycled content where appropriate for use. Verify suitability, availability within the region, cost effectiveness and adequate competition before specifying product recycled content requirements.
****

[d. Recycled Content: Provide insulation material that has minimum of 10 percent recycled material. Provide data identifying percentage of recycled content for insulation materials.

]2.7 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.8 PORTLAND CEMENT

Conform to ASTM C150/C150M, Type I or II as required, fresh and free of lumps, and approved by the systems manufacturer.

2.9 REINFORCING FABRIC

Reinforcing fabric mesh must be alkali-resistant, balanced, open weave , glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other system materials, and comply with ASTM E2098/E2098M and as recommended by EIFS manufacturer.

2.10 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

2.11 SEALANT PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.12 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, and expansion joints. All metal items and fasteners to be corrosion resistant.

2.13 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C920, as Type S or M, minimum Grade NS, minimum Class 25 and compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

2.14 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.15 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface must be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate must be plane, with no deviation greater than 6 mm 1/4 inch when tested with a 3 m 10 foot straightedge. Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

3.2 SURFACE PREPARATION

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NOTE: The paragraph below only specifies flatness of substrate to the EIFS manufacturer's requirements. Where, because of the prominence of the building, more stringent flatness requirements are necessary, these should be added to the

paragraph.
****

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation instructions [but provide a flatness of not more that [6] [_____] mm in 3000 mm [1/4] [_____] inch in 10 feet]. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. For adhesively attached EIFS, existing deteriorated paint must be removed. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor must not proceed with the installation until all noted deficiencies of the substrate are corrected.

3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS must be installed only by an applicator trained by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations. Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

[3.3.1 Sheathing Board

Edges and ends of boards must be butted snugly with vertical joints staggered to provide full and even support for the insulation. Do not align sheathing board joints with wall openings. Provide support at both vertical and horizontal joints. Attach sheathing board [to metal studs with self-tapping drywall screws] [to concrete or masonry with corrosion resistant metal fasteners]. Place fasteners sufficiently close to support imposed loads, but not more than:

[a. Maximum of 200 mm 8 inches apart on each supporting stud

][b. Maximum of 300 mm 12 inches apart horizontally and vertically into [concrete] [masonry].

] Space fasteners more closely when required for negative wind load resistance.

]3.3.2 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least 200 mm 8 inches. Align drainage channels of integral drainage system or provide polypropylene drainage lath space to provide a path for any water weeped from behind the insulation to escape wall construction. Use L-shaped insulation board pieces at corners of openings. Joints of insulation must be butted tightly. Surfaces of adjacent insulation boards must be flush at joints. Gaps greater than 1.6 mm 1/16 inch between the insulation boards must be filled with slivers of insulation. Uneven board surfaces

with irregularities projecting more than 1.6 mm 1/16 inch must be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board must be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry. However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

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NOTE: For PM systems, specify mechanical fastening of insulation board to the sheathing board. For PB systems mechanical attachment may be specified as an option.

****

[3.3.2.1 Mechanically Fastened Insulation Boards

Fasten with manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than 600 mm 2 feet horizontally and vertically.

][3.3.2.2 Adhesively Fastened Insulation Boards

Apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer’s instructions.

]3.3.3 Base Coat and Reinforcing Fabric Mesh,

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NOTE: Delete the inapplicable system (Class PM or Class PB EIFS).

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[3.3.3.1 Class PB Systems

Allow the adhered insulation board to dry for 24 hours, or longer if necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh. Install reinforcing fabric in accordance with manufacturer's instructions. Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh must not be visible. Provide diagonal reinforcement at opening corners. Back-wrap or edge wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of 60 mm 2.5 inches on previously installed mesh, or butted, in accordance with the manufacturer’s instructions.

][3.3.3.2 Class PM Systems

Mechanically fasten reinforcing fabric mesh to the insulated wall using the type and spacing of fasteners specified in the manufacturer’s instructions. Provide diagonal reinforcement at opening corners. Mix base coat in accordance with manufacturer's instructions. Apply base coat in accordance with manufacturer's instruction to provide a complete, tight

coating of uniform thickness as specified by the manufacturer. Cover all fiberglass reinforcing fabric, including at back wrapped areas at panel joints and at fasteners.

]3.3.4 Finish Coat

The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., must be corrected prior to the application of the finish coat. Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved [sample] [mock-up installation]. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat must be in accordance with the system manufacturer’s current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied.

3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat or base coat with EIFS Manufacturer's color coating. Do not apply sealant to the finish coat.

3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 13 mm 0.5 inch for perimeter seals and 20 mm 0.75 inch for expansion joints. The width must not be less than 4 times the anticipated movement. Check sealant manufacturer's recommendations regarding proper width to depth ratio.

3.4.2 Sealant

Do not apply sealant until all EIFS coatings are fully dry. Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or cannot be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

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NOTE: EIFS is applied in layers where installation deficiencies can be hidden with the application of subsequent layers. Include in Section 01 45 00.00 10, 01 45 00.00 20 or 01 45 00.00 40 QUALITY CONTROL, inspection requirements appropriate to the size and

significance of the project. For all but minor projects, require a full time on-site inspector during the installation of EIFS and its sealing. The inspector should have at least 2 years experience in the installation of the particular manufacturer's EIFS being installed and a total of not less than 3 years of EIFS inspection experience. Some EIFS manufacturers provide field inspection services during installation. Identify the EIFS inspector as a QC Specialist in Section 01 45 00.00 10, 01 45 00.00 20 or 01 45 00.00 40. For all but small jobs, the EIFS inspector should have no other duties than those of inspecting the installation. For major projects, include paragraph 3.5.1 below requiring a third party inspector.

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Throughout the installation, the contractor must establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance must be removed and replaced or corrected in an approved manner. The inspection procedures, from acceptance of deliveries through installation of sealants and final acceptance must be performed by qualified inspector trained by the manufacturer. No work on the EIFS is allowed unless the inspector is present at the job site.

[3.5.1 Third Party Inspection

Provide full time third party inspection during the entire process of installing the EIFS, from examination through cleanup. The third party inspector must be certified by the Exterior Design Institute (EDI), AWCI, or by an equivalent independent party and must be trained in the proper installation of EIFS.

]3.5.2 Inspection Check List

During the installation and at the completion of installation, perform inspections covering at the minimum all applicable items enumerated on the attached check list. The inspector must initial and date all applicable items, sign the check list, and submit it to the Contracting Officer at the completion of the EIFS erection.

CHECK LIST

Item	Description	Appr'd/Date
a.	Materials are handled and stored correctly.	_____
b.	Environmental conditions are within specified limits, including temperature not below 4 degrees C (40 degrees F), and the work is protected from the elements as required.	_____
c.	Preparation and installation is performed by qualified personnel using the correct tools.	_____
d.	Adjacent areas to which EIFS is not to be applied (such as on window and door frames) are protected with masking tape, plastic films, drop cloths, etc.	_____

CHECK LIST

Item	Description	Appr'd/Date_
	to prevent accidental application of EIFS materials.	
e.	Control, expansion and aesthetic joints are installed as indicated or recommended. Accessories are properly installed.	_____ ____
f.	Substrate is in-plane, properly attached, clean, dry, and free of contaminants. Concrete substrate is free of efflorescence.	_____ ____
g.	Materials are mixed thoroughly and in proper proportions.	_____ ____
h.	Adhesive is applied in sufficient quantity with proper-size notched trowel.	_____ ____
i.	Mechanical attachments have proper spacing, layout and fastener depth.	_____ ____
j.	Insulation boards are tightly abutted, in running bond pattern, with joints staggered with the sheathing, board corners interlocked, L-shaped boards around openings, edges free of adhesive, and provision for joints. Gaps are filled and surfaces rasped.	_____ ____
k.	Insulation adhesive must be allowed to dry (a minimum of 24-hours) prior to the application of the base coat.	_____ ____
l.	Reinforcing fabric mesh is properly back-wrapped at terminations.	_____ ____
m.	Reinforcing fabric mesh is fully embedded and properly placed. Corners are reinforced. Openings are diagonally reinforced. Mesh overlaps minimum 65 mm (2-1/2 inches).	_____ ____
n.	Base coat thickness is within specified limits.	_____ ____
o.	The base coat/reinforcing fabric mesh must be allowed to dry (a minimum of 24-hours) prior to the application of the finish coat.	_____ ____
p.	Finish coat is applied with sufficient number of personnel and stopped at suitable points. Floats and methods of texturing are uniform.	_____ ____
q.	All flashings are properly installed.	_____ ____
r.	All joints are properly sealed in their entire length at time and under environmental conditions as specified by the manufacturer.	_____ ____
s.	All scaffolding, equipment, materials, debris and temporary protection are removed from site upon completion.	_____ ____

CHECK LIST

Item	Description	Appr'd/Date_

Name of Inspector:_____ Signed:_____
Date:_____

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --