

Technical Services Information Bureau

CHAPTER 8 – EIFS (EXTERIOR INSULATION FINISH SYSTEMS)



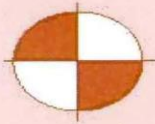
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Chapter 8: EIFS



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INTRODUCTION

EIFS (Exterior Insulation and Finish Systems) were developed for the express purpose to conserve energy and have the aesthetic appearance of stucco. Europe experienced the energy crisis before the United States and the solution to the problem was EIFS. It was discovered that 24 inch by 48 inch foam panels adhesively applied to the exterior of structures provided the continuous insulation (CI) and provided energy savings. A fiberglass mesh embedded into proprietary polymer enriched cement and finished with a proprietary acrylic finish. The lamina provides a strong, yet flexible lamina to protect the foam. In is the primary water-resistive component of the system.

Today, national and state energy code regulations require a more prevalent use of CI that prevents or minimizes the thermal transfer often referred to as “thermal short circuiting” or “thermal bridging”. Designers and contractors are encouraged to consider EIFS to comply with energy code regulations. They provide an excellent protection against thermal transference at an economical cost. These systems are fully tested by each proprietary manufacturer and are now part of the International Building Code. In addition to this generic guide, TSIB recommends visiting www.eima.com and contact EIFS manufacturers listed on the EIMA website for more information.

TYPES OF COMMERCIAL EIFS

Barrier or conventional systems

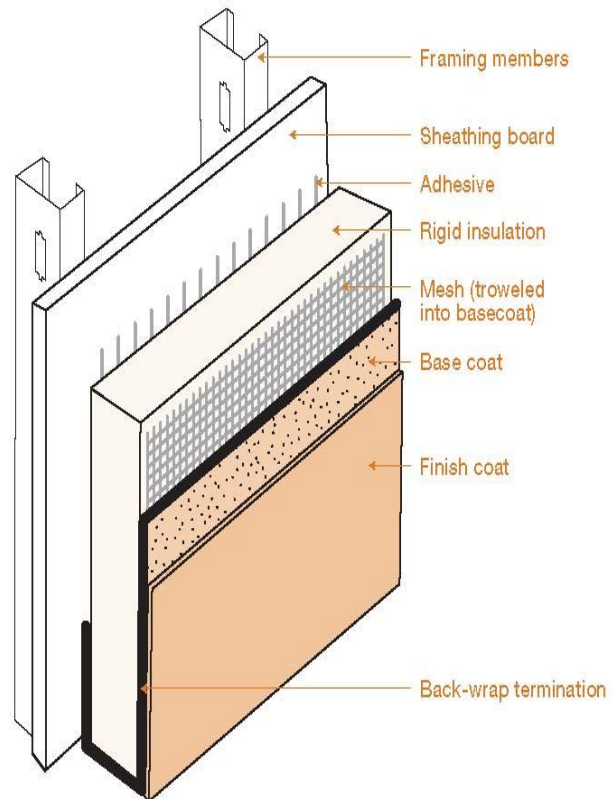
(Classic EIFS or Standard PB system)

- Substrate (not part of system either sheathing or a “mass wall”)
- Adhesive or Mechanical-attached Expanded Polystyrene Board (EPS)
- Basecoat with embedded fiberglass mesh
- Primer (optional but required with some finishes)
- Acrylic finish coat

Barrier system with secondary weather barrier

Conventional EIFS plus a fluid-applied or other “code approved” weather barrier between substrate & insulation.

Figure 1. Proprietary EIFS System



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EIFS with Drainage / “Water-managed EIFS”:

EIFS with drainage is conventional EIFS installed over a water-resistive barrier, with provisions for discharging of incidental water that may enter behind the insulation board. In the event of a breach of the EIFS, the drainage path for moisture exists behind the EIFS to drain water to the exterior. Flashing is required where rainwater may penetrate other components and at the interface of different components.

Drainage System notes:

Fluid-applied Secondary Weather barriers:

Trowel or roller-applied product applied over 100% of the substrate prior to the installation of the EPS Foam. Sheathing Joints may be required to be “taped” and sealed prior to installation of the weather barrier depending on the manufacturer’s requirements.

Light commercial & residential systems:

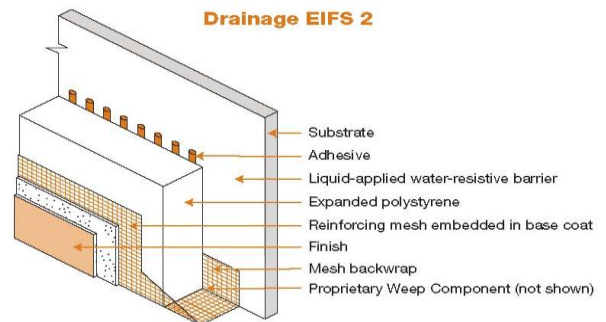
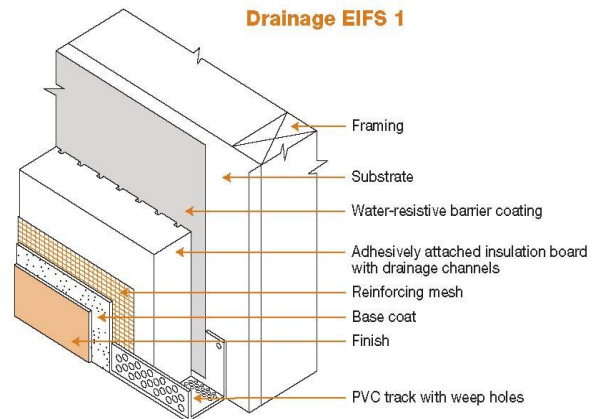
Some systems may use “paper-based” water-resistive barriers and Insulation board is mechanically attached to substrate.

Weep capacity at the base of the system:

Common method is the installation of an exterior-grade PVC casing bead with drainage holes. Often “fire-safing” products are used for fire ratings and to prevent a “chimney effect” with relation to the “drainage plane”. Each manufacturer may have its own design providing the system is tested per code requirements.

Panelized EIFS:

Often used on large-scale projects and utilizing “offsite” construction of the EIFS. EIFS “panelization” is the combining of a structural and non-structural system in a manner that enhances the performance characteristics of each. The system utilizes structural steel studs as a means of support for the EIFS, joined by glass mat sheathing which is screw attached to framing members prior to attachment of EIFS. Pre-fabricated EIFS panels can be quality controlled to exacting standards and installed in an easily-controlled, “offsite” environment.



Note: Other systems exist utilizing other rigid foam products including polymer-modified “PM” and polyiso “PI” systems. Contact your EIFS manufacturer for more details.

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SUBSTRATES: *All EIFS require a solid substrate:*

Framed Walls (wall assembly framing deflection maximum of L/240)

- EXTERIOR GYPSUM SHEATHING (Conforming with ASTM C 1396 and installed per ASTM C 1280)
- GLASS MAT SHEATHING (Conforming with ASTM C 1177/C-1177/M)
- CEMENT BOARD (Conforming with ASTM C 1325)
- PLYWOOD and “OSB” SHEATHING: Consult manufacturer for limitations
- Gypsum wallboard often referred to as “greenboard” should **not** be used as an EIFS substrate.

The sheathing manufacturer's instructions should be followed with respect to handling and installation.

CMU or concrete walls

Insulation board is adhesively attached providing the substrate surface is free of any potential bond-breaking components. A secondary weather barrier or a drainage plane is normally unnecessary and not recommended.

Existing cement plaster (stucco) claddings

EIFS can be installed over existing plaster/stucco claddings as a retrofit or in new construction when plaster assembly is installed as a weather barrier and substrate for EIFS cladding.

Insulation board is adhesively attached providing the plaster surface is free of any potential bond-breaking components. A secondary weather barrier or a drainage plane is normally unnecessary due to the plaster assembly is the weather barrier.

MATERIALS

Insulation Board

Absorbs thermal shock from exterior weather conditions and provides varying degrees of continuous insulation based on foam thickness, density and type of insulation board.

- Nominal 1 lb.pcf. Expanded polystyrene board (EPS) in panels sizes of 24 inches x 48 inches and in compliance with ASTM standard C 578.
- Maximum thickness of the EPS board is 4 inches. Some local jurisdictions will allow “thicker” systems based on energy requirements of a specific project.
- Min thickness: 1” board allows for sanding of the surface but insulation must maintain at least $\frac{3}{4}$ ” The back side of aesthetic reveals “cut” into board must maintain $\frac{3}{4}$ ”.
- “Drainage boards” are such that the back of the EPS board is “grooved” and attach to walls. The grooves or channels act as a drainage plane. Channeled board (Insulation board acting as a drainage plain) minimum thickness is 1½ inches with most systems. Must maintain min $\frac{3}{4}$ inch thickness at channel locations.

Some systems incorporate Extruded Polystyrene board (XPS) or polyisocyanurate (polyiso board) that have higher “R” values per inch than “EIFS-grade” EPS.

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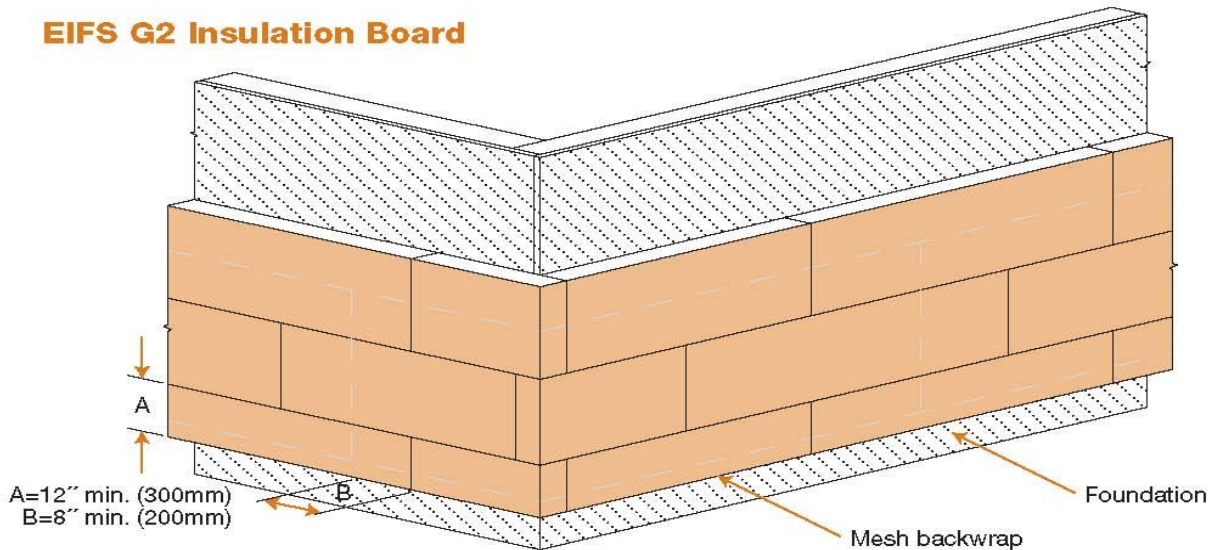
Insulation Board Attachment

Adhesive attachment: The most common and economical attachment of the EPS board. Adhesive is portland cement-based or 100% acrylic products that are applied in vertical or horizontal ribbons with a notched trowel. When ribbons are applied in a vertical orientation, they have proven to work as a functional drainage plane.

A “ribbon & dab” adhesive method is acceptable for application of insulation board to CMC or concrete substrates.

Some proprietary adhesives can also act as a secondary weather barrier and require 100% coverage of the suitable substrate.

Mechanical Fasteners (Used with some light commercial and residential construction) This method is required when paper-type weather barriers are used or substrate is not compatible with EIFS adhesives. (Some systems require specific fastening patterns)



In general, adhesive attachment of EIFS to sound supporting construction provides superior wind load resistance in comparison to mechanical attachment. It is important in an adhesively attached system that the supporting construction is free of surface damage, defects, or contamination.

In the case of frame construction, sheathing must be attached with fasteners and fastener spacing that are capable of resisting wind loads. Independent testing has been performed to determine the ultimate strength of a manufacturer's adhesive to various substrates. The average tensile bond strength was determined to be approximately 20 psi, which converts to 2880 psf.

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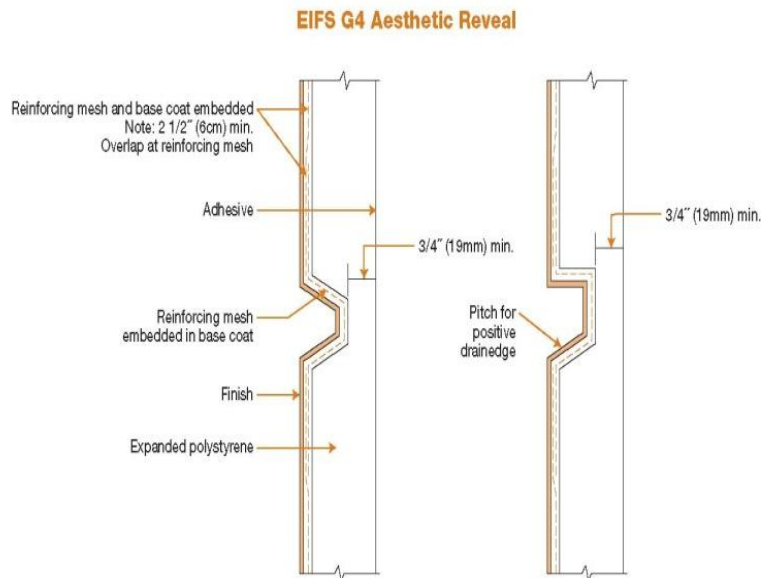
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Basecoats (many basecoats are also used as insulation board adhesive)

- Cement-based or 100% acrylic-based
- Is the primary weather barrier of EIFS.
- “Water-proof” basecoats are available for high moisture areas, certain below-grade applications and other special circumstances.
- Basecoats with lower percentage of polymer to cement ratio as a base for foam shapes (designed to accept cement stucco finishes) should not be confused with “EIFS grade” basecoats.
- Not all base coats are adhesives and vice-versa.

The Manufacturer should always be consulted regarding substrate to adhesive and basecoat to finish compatibility. Always “single source” your EIFS materials.



Fiberglass mesh

(Primary impact protection for EIFS)

Alkali-resistant fiberglass mesh is an integral component of the EIFS that provides impact-resistance based on density of mesh and functions as a gauge for basecoat thickness.

- Standard meshes are overlapped 2 ½ inches and embedded into the wet base coat.
- High or ultra-high impact meshes (15 to 20 oz) are abutted and imbedded into wet base coat and allowed to dry. A subsequent layer of standard impact mesh is overlapped and embedded into a second top layer of base coat to “lock in” the system. Higher-impact meshes should be specified and installed anywhere the EIFS may be subjected to any abuse.
- Meshes should be provided by system manufacturer. “Mixing and Matching” different brands may void any or all warranties.
- Per the EIFS Industry Member Association (EIMA) and ASTM Standard E2486, EIFS meshes are categorized by impact resistance as follows:
 - Standard Impact Resistance (4-5 oz/yd²): 25-49 in-lbs (2.8-5.6 J) Impact Range
 - Medium Impact Resistance (10 oz/yd²): 50-89 in-lbs (5.7-10.1 J) Impact Range
 - High Impact Resistance (14-15 oz/yd²): 90-150 in-lbs (10.2-17.0 J) Impact Range
 - Ultra-High Impact Resistance (20 oz/yd²): >150 in-lbs (>17.0 J) Impact Range

Acrylic Primer

Primer is an **optional** step installed over the dry base coat that enhances performance and color of the finish. Some finish textures (“swirl” “rilled” or “putz”) require its use to eliminate the color of the basecoat “bleeding” through the surface.

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Acrylic Finish:

A pre-mixed 100% acrylic coating to provide a finish color and texture for EIF systems. These finishes can also be applied to properly prepared stucco, masonry or other concrete surfaces. Acrylic finishes may also be used on interior wall surfaces. These finishes vary in texture by utilizing various sized aggregates. Textures can range from a smooth troweled finish (not polished), to heavy sand or “rilled” finishes. Skip trowel and spray/dash finishes can also be achieved. The versatility of this finish allows for specialty looks that can replicate stone, brick, wood or metal.

Cement stucco finishes **should not be used** with EIFS.



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GENERAL NOTES

“BELOW GRADE” APPLICATIONS

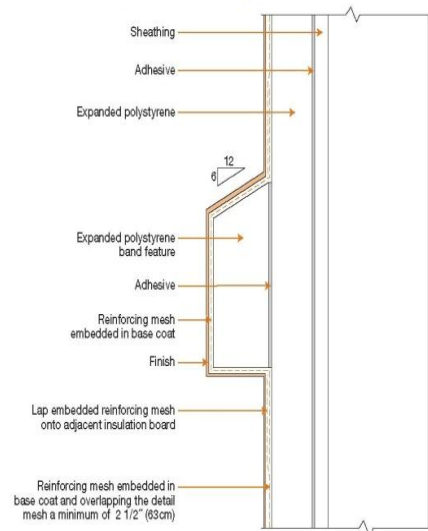
Exterior Insulation and Finish Systems should always be terminated above grade. Damage to the lamina from hydrostatic pressure, moisture intrusion through wicking, and insect infestation are common issues that plague below-grade applications. The EIFS industry recommends that a minimum of 8 inches be maintained above grade (Some slight exceptions can be made with proper approval of the EIFS manufacturer). At cement walkways, concrete patios and other similar hardscape areas adjacent to the wall assembly, a ¼ inch gap will typically be maintained between the system termination and hardscape surface.

ENCAPSULATION OF THE SYSTEM

EIFS foam needs to be fully encapsulated to pass fire tests.. The face and edges of system are fully covered with base coat and mesh and/or termination PVC trims (used only at bottom system). Three methods of encapsulation are:

- Back wrapping: fiberglass mesh is installed onto the substrate, wrapped and embedded with base coat at all edges.

EIFS G5 Small Aesthetic Band/Pop Out



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- Edge wrapping: performed prior to installation of windows, doors, adjoining substrates, the fiberglass mesh is wrapped across termination and adhered to the substrate.
- Installation of PVC Track: Perimeter track can be used at all EIFS bases. "Drainage track" with weep holes can be an integral part of drainage EIFS.

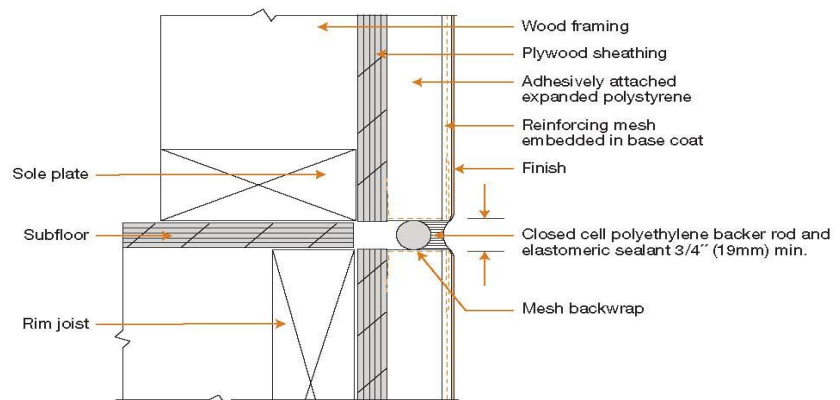
NOTE: Basecoat, mesh and finish are known as the "lamina"

EXPANSION JOINTS & PERIMETER JOINTS

Expansion joints in EIFS are required at the following locations:

- Where they exist in the substrate or supporting construction
- Where the EIFS adjoins dissimilar construction or materials
- At changes in building height or other areas of anticipated building movement
- At floor lines in multi-level wood frame construction
- Where prefabricated panels abut one another
- Where the substrate changes

EIFS T2 Expansion Joint at Floor Line



Exception: Steel framing rigidly attached to CMU substrate may not require expansion joints if proper conditions are met.

The width of an expansion joint is typically $\frac{3}{4}$ inch. Perimeter joints are a minimum of $\frac{1}{2}$ to $\frac{3}{4}$ inch.

Insulation board is terminated at edge of substrate and the "break" is back wrapped. Close-cell backer rod and a manufacturer-approved sealant are used to "span" the void. Sealant should also be attached to base coat.

A "V" groove reveal is aesthetic and cannot be considered a control or expansion joint since a true joint is a "built-in" break in the system where movement is anticipated. Reveals in EIFS are strictly aesthetic joints and are used to provide convenient stopping points for finish application in large wall areas or to add depth to an elevation. If movement relief is necessary, a full expansion joint with sealant is necessary.

Expansion Joint placement is the responsibility of the design professional.

FIRE RATINGS

EIFS alone does not have a fire rating. Testing has been performed to confirm that the fire resistance of an already-rated wall assembly is maintained and is not increased or reduced by the addition of EIFS. Each manufacturer is responsible for conducting fire tests on their proprietary systems. The systems are tested under the standards required by the code and have been tested up to a three hour fire rating. Building codes have a general rule that EPS should not exceed more than 4 inches. However, some manufacturers have approved tests for exceeding this maximum.

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FLASHINGS & MOISTURE MANAGEMENT

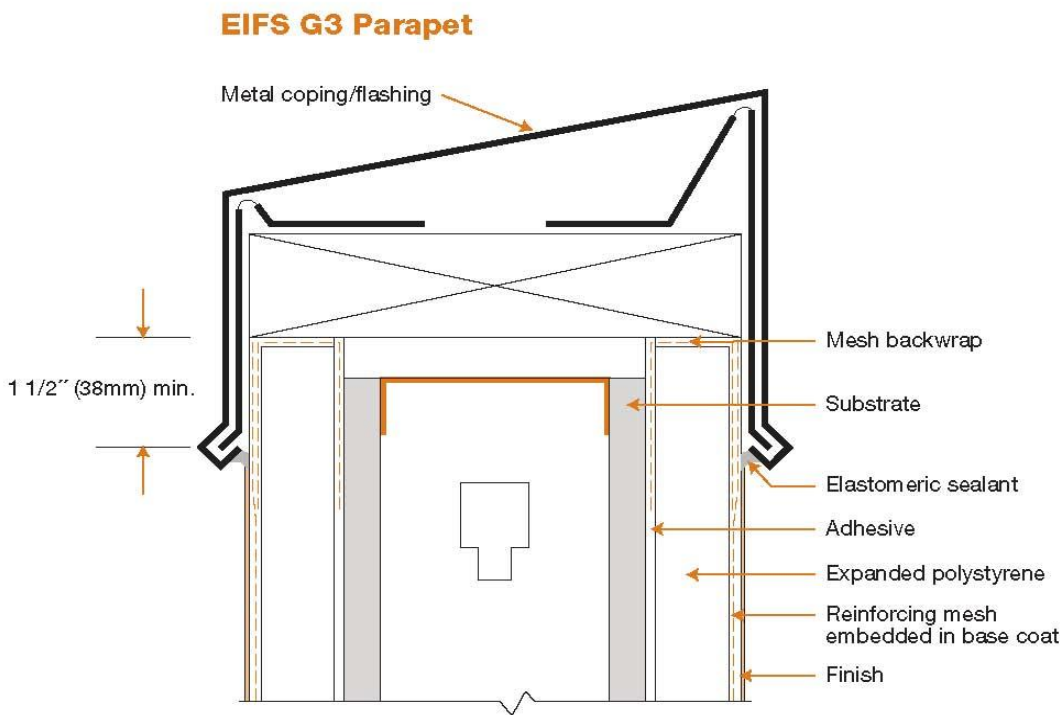
As with all wall cladding, flashing is an important component required by building codes. At points where water can enter the wall it should be directed to the exterior face of the cladding with flashing. Transition areas such as decks or roof/wall intersections are typical areas where flashing must be installed. Openings for windows and similar through-wall penetrations require jamb, head, and sill flashing to direct water to the exterior face of the cladding.

The most common water entry points in a wall are through or around windows, transitions from roof to walls, and transition from wall claddings to doors and chimneys. This coupled with improperly installed or missing flashing and sealants, can allow water to penetrate behind EIFS, or any other cladding, and into the wall cavity, where it can potentially cause moisture damage.

Moisture intrusion is a potential threat to durability of materials in wall construction, regardless of cladding type. Moisture intrusion should be avoided by following sound design and construction practices mandated by building codes.

EIFS is vapor permeable and will allow walls to “breathe,” but depending on the manufacturer and the product selected, the EIFS vapor permeability may vary. When requested, the EIFS manufacturers can perform a Water Vapor Transmission Test or a “Dew Point Analysis” for specific walls to evaluate the tendency for condensation to occur.

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SEALANTS

Always required around windows, doors, all wall penetrations, and at the juncture of dissimilar materials. Sealants are not a part of an EIFS; however, their use in conjunction with the system is a necessity. Moisture damage caused by failure to properly apply sealants at those points just named is not covered by manufacturers' warranties.

These sealant joints serve a critical function; they help keep the structure tight and help in keeping water out of walls. If the sealant is properly installed as specified by the sealant manufacturer, these can give you many years of protection.

Low modulus sealants that maintain their properties with exposure to ultra-violet (UV) light are recommended. In addition, the sealant should comply with ASTM Test Method C1382-97. Of course, in the selection of any sealant, other functional factors must be considered such as anticipated joint movement, substrates to which the sealant will be bonded, exposure to cyclical movement, and exposure to temperature extremes. Always consult with the sealant manufacturer for guidance on suitability, design, and proper use and handling of their product.

Sealants should adhere to EIFS basecoat or PVC trims and not to the finish coat or substrate.

The use of closed cell backer rod (instead of open cell) behind sealants is recommended to prevent premature failure of the sealant joint. Open cell backer rod will absorb and hold water that could affect the sealant/EIFS bond line.

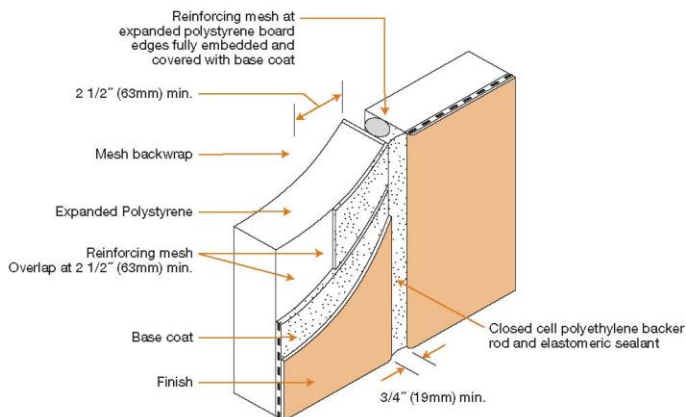
An increasing popular approach is to incorporate a “double caulk joint” or a primary and secondary sealant separated by closed-cell backer rod. The interior “non-exposed” joint should allow to air cure (unless a polyurethane caulk is used that does not require air movement to cure) and installed over an “open cell” backer rod prior to installation of outer joint. “Exposed” joint must be exterior-grade and UV resistant. Many manufacturers recommend silicone caulk for weather-exposed sealant joints.

MAINTAINANCE

Periodic cleaning is suggested to maintain the EIFS appearance. Sometime repair of impact damage or punctures of the EIFS are necessary to restore surface integrity. As with all claddings, abutting elements such as sealant and flashing should be periodically inspected and maintained.

EIFS manufacturers provide procedures for cleaning for specific systems. Periodically EIFS finishes may need to be cleaned to remove dirt, algae (usually green stains on the surface of the finish), or mildew (generally black stains that look like dirt) that can accumulate on the surface. Basically, mild cleaning detergents, and low water pressure cool water, and a soft bristle brush. DO NOT USE THE FOLLOWING: cleaner that is solvent based; high water pressure; hot water; or wire brushes.

EIFS T1 Backwrapped Expansion Joint



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For situations where you might wish to change the color of the building, or paint the building for some other reason, EIFS manufacturers produce several quality paint products (acrylic or elastomeric) to recoat and enhance the existing coating. Other alternatives are to use a quality, high-grade 100% acrylic exterior grade paint. Before recoating, appropriate repairs should be made and the surface should be cleaned to remove any surface contamination.

If properly maintained, the cladding will last the life of the building. EIFS walls have been installed in the United States since the late 1960s and many are still in service today.

SPECIAL INSPECTIONS

The 2009 International Building Code (IBC) now recognizes EIFS and “shall be constructed such that it meets the performance characteristics required in ASTM E 2568” EIFS with drainage is also recognized and should meet the requirements ASTM E 2273. All EIFS installation “shall be in accordance with EIFS manufacturer’s instructions. Section 1704.14 currently requires *special inspections* for all barrier EIFS installations unless an EIFS with drainage system is used over sheathing substrates. If drainage systems are used a special inspection of the secondary water-resistive barrier installation may be required.

WARRANTIES

A variety of warranties is available, depending on the system installed and per the manufacturer’s requirements. Samples of the warranties are available on request from the manufacturer.

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