Exterior Insulation: Specs with Style

There are 11 Good Reasons Why More and More Architects Are Specifying Exterior Wall Systems

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The exterior wall surface of a building is its most prominent feature. Since the completed structure is continuously exposed to public view, judgments are passed on the exterior appearance of a building almost every day of its existence. The exterior is the first criterion upon which the architectural design of the building is evaluated.

Exterior walls generally represent a relatively small portion of the total cost, material or time invested in a structure. To some, however, the exterior walls are the building. These walls establish the style, the appeal, the aesthetic character of the structure, as well as its critical and public acceptance. Exterior walls may represent the corporate image for the owners or occupants. And, with public identification and acceptance, buildings often become landmarks of sorts. For these reasons, architects and owners are deeply concerned with exterior wall appearance.

As important as aesthetic concerns are, they are certainly not the end of the story. Exterior walls have to be structurally sound. They must be able to resist and withstand continuous or intermittently induced external and internal loads that impose stress. They must serve as the enclosure barrier against changing climatic elements such as wind and water. They must be a fire barrier and provide some reduction in the sound and thermal transfers between the interior and the outside world.

They should provide the desired amount of natural light, security, in-
The Michael Stein Building, Livonia, Mich., includes an exterior insulation system that is seven times lighter than precast concrete or brick. Options for shape, finish and color are unlimited. Photo: STO Industries, Rutland, Vt.

gress and egress. They must be durable and economically maintainable for the useful life of the structure. The exterior building walls must perform all of these functions yet still be pleasing to look at.

The massive masonry structures of the past which consisted basically of natural stone and wood were uncomplicated by such present day necessities to human comfort as air conditioning and heating. They rose usually no more than a few floors so that very little could occur which would induce unsightly or distressing distortions (except perhaps for foundation problems.)

The fact that such buildings leaked was often hidden by their ability to absorb rain without letting it into their interiors. Centuries of experience resulted in the development and common usage of flashing, weep holes, and other devices to catch and divert such water. Windows and other openings were usually relatively small.

**Exterior wall systems today . . .**

In the past 30 years or so there have been many changes in the materials and types of exterior wall systems. Today, as a result of (1) increased knowledge of the strength and behavior of construction materials and (2) the economic necessity of constructing considerably taller, thinner buildings, the framework of these buildings can be made much lighter in weight than in the past and can be capable of spanning greater distances and extending higher while resisting imposed loads.

Although these improvements in technology allow greater heights and lighter weights without collapse, they are not totally trouble-free. While capable of resisting structural loads, they are subject to and experience greater deformation when stressed.

When a structure deforms (moves), any cladding material that is rigidly attached to the frame must either resist the movement, flex, or bend to accommodate the movement; otherwise, the cladding material will break, crack or rupture.

In the transformation period between the old and new structural technology, the more traditional claddings demonstrated an increased difficulty in performing their intended functions due to their insufficient strength or inflexibility.

Near the end of World War II, two new events occurred which would contribute to the development of cladding assemblies or systems more compatible with the emerging new structural technology.

The first event, confined mainly to the United States, was the emergence of the so-called light gauge steel framing and its relative advantages such as weight reduction, inherent strength to weight ratio, dimensional stability,
When first introduced . . . the intended market for the exterior insulating systems was to cover unit masonry and concrete to reduce thermal transfer of heat loss or gain.

noncombustibility, pre-punched openings for mechanical items, and the simplicity and speed of erection or attachment. When coupled with its design flexibility, it has provided the designer with an important tool in matching today’s cladding systems with today’s structural framing.

The second event was the development, basically in West Germany, of the exterior insulating plaster concept. The concept of placing the insulation component of the cladding system outside of the structural frame as well as over the light gauge in-fill or curtain-wall framing was a development whose time of arrival coincided with the rising concern about energy conservation.

When first introduced in the United States, the intended market for the exterior insulating system was to cover unit masonry and concrete to reduce thermal transfer of heat loss or gain.

However, an additional advantage was recognized: By decreasing the temperature change effect on the substrate structure the contraction and expansion of these structural members were also reduced. These lighter weight, larger structures became more stable with respect to deformation that translated into breaking, rupturing and cracking.

These two concepts continued to develop independently of each other and found acceptance, generally in low-rise construction. When steel framing and exterior insulating plaster systems finally found each other and were properly engineered, their place in the construction market was assured, and today their use on large high-rise structures is quite common.

A third event which occurred much later than these first two, impacted on the development of new exterior insulation wall assemblies. This was the increasingly serious oil shortage and the resulting increased concern for conservation of energy in the late 1960s and early 1970s.

As in the case with most, if not all, new materials or concepts in the construction industry, there were instances of attempts to exceed the capabilities of these materials by both designers and installers, unintentionally or deliberately, with the obvious disappointing results.

Not all of these new innovations have been totally successful. Non-performance of exterior walls has been cited as the third most prevalent complaint about new buildings, following roof and heating/ventilating and air-conditioning, in that order.

Non-performance can be defined as a failure to provide a particular performance characteristic. Non-performance of exterior wall assembly systems seldom involve life-threatening situations, with the possible exception of inadequately braced or reinforced walls in areas of severe seismic activity. A “failure,” however, for whatever cause, can be exceedingly expensive and may in some cases destroy the

aesthetics if not the utility of a structure.

**Impact resistance . . .**

An example of deficiency in design is the placement of relatively low impact resistant systems in areas where heavy abuse could logically be expected to occur, such as a loading dock or any portion of a building where there is heavy pedestrian traffic.

To overcome the tendency to overlook the likelihood of high abuse areas and to reduce the necessity to specify more than one system, the manufacturers of exterior insulating systems have developed improved systems that offer the designer a choice or range of impact resistant systems without altering the basic assembly. Today's systems can compare favorably with many competitive systems in terms of damage from impact.

**Stucco and portland cement . . .**

Most architects and specifiers are familiar with stucco as an exterior cladding or skin for many types of structures. It is a versatile facing material that can be applied to any flat or curved surface either inside or outside. It has proven its serviceability in hot and humid, as well as cold and dry climates.

While portland cement-based plaster has a number of desired performance characteristics, like any product or assembly it sometimes suffers from

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Outsulation system can be prefabricated on or off-site, reducing cost, weight and construction time. Details courtesy of Dryvit System Inc., West Warwick, R.I.
certain typical deficiencies. This statement is made in order to illustrate or emphasize the relative advantages of conventional stucco and the newer synthetic or modified cement-based systems.

In the past 20 or so years, there have been many changes in the materials and types of exterior wall systems. Such walls have become taller, thinner, and lighter in weight. Prefabrication and partial prefabrication have increased over in-situ assembly.

A relatively new organization known as the Exterior Insulation Manufacturers Association (EIMA), has come a long way in its few years of existence toward introducing some standardization into the field of exterior insulating plaster wall assemblies.

EIMA, which was established in 1981, has approximately 50 members in its five categories of membership: manufacturers, distributors, users, associates (distributors of raw materials used by manufacturers of the systems), and affiliates. EIMA has produced guide specifications for the use of exterior insulation systems. (Copies are available upon request from EIMA, P.O. Box 75037, Washington, D.C. 20013.)

EIMA has developed and promulgated a classification system for exterior insulations. First they define an exterior insulation finish system (or EIFS) as: “A system of at least two components, one of which provides insulation. When applied as an exterior building envelope, the system must provide weather protection and aesthetics as well as thermal insulation. The protective coatings are essentially wet applied and can be used in combination with conventional insulation methods.”

EIMA classifies the various systems by the protective coatings. The classes and types are as follows:

**CLASSES**
- “PB”—polymer base
- “PM”—polymer modified
- “MB”—mineral base

**TYPES**
- A. external reinforced, cloth, lath
- B. internal reinforced, random fibers
- C. unreinforced

**Insulation component . . .**

The insulation component is unique for each system and is selected from rigid boards or compound mix providing at least R-2 per inch when tested in accordance with ASTM C-236. Typical insulation materials are expanded or extruded polystyrene, polyurethane, isocyanurate, or cement based insulation plasters.

When expanded polystyrene (EPS) is used, it should meet the requirements of ASTM C578, F.S. HH-I-524C Type (I or II) and tested per ASTM E84 or UL723 to establish a flame spread of less than 25.
Exterior insulation systems may be applied over virtually any sound substrate depending on the proper surface preparation and selection of system fastening components. The selection of back-up sheathing over open stud framing must be based on structural considerations and be in compliance with acceptable building codes and fire safety.

## Fasteners . . .

Each manufacturer has specific recommendations on types of mechanical fasteners and/or adhesive fasteners depending on substrate and exposure conditions. Be aware that certain systems do not permit mechanical attachment, and the producers of gypsum sheathing do not stand behind their sheathing unless mechanical attachment is used.

The test criteria established by EIMA for the various systems are:

### Insulation

**EIMA Specifications** (C578m HH-I-524C, E-84, UL 723)

### Coatings

- Flame spread: E84 (UL723)
- Salt spray: ASTM B117
- Mildew: MIL Std. 810 B, Method 508
- Moisture resistance: F.S. 141 A, Method 6201
- Abrasion: FS 141 A, Method 6191, ASTM D-968

### System

- Fire test: E108, Modified for vertical walls
- Impact resistance: ASTM D 3029-78
- Wind load: ASTM E330
- Wind driven rain: F.S. TTC 555B
- Freeze-thaw: 609 cycles in 4 days, 2 hours at -10 degrees C and 2 hours + 20 degrees C

Type A, Class PB and PM systems consist of four parts: (1) the attachment; (2) the insulator; (3) the reinforcement; and (4) the finish.

In a Type A, Class PB system, the attachment can be adhesive, mechanical or a combination of both. The reinforcement is glass cloth embedded in the base coat. The polymer based finish coat is applied over the entire system surface.

Its positive features are elasticity, flexibility, light weight, color, consistency, impact resistance, durability,
weather resistance and continuous (no control joints).

Its limitations include its unsuitability for all impact exposures, allowable substrates and preparation. It is restricted to use only with certain manufacturers’ recommended sealants.

In a Type A, Class PM system, the attachment can be adhesive, mechanical or a combination of both. The glass cloth or lath is embedded in the base coat. The polymer modified finish coat is applied over the entire system surface. Its positive features are durability, light weight, color consistency, as well as weather, impact and puncture resistance.

Its limitations include required use of control joints, and a restriction to use only with certain manufacturers’ recommended sealants.

A Type B, Class PM system consists of three parts: (1) the attachment; (2) the insulator; and (3) the finish.

The attachment can be adhesive, mechanical or a combination of both. The insulator must meet EIMA requirements. The finish coat is polymer modified with internal reinforcement. Its positive features are its durability, color consistency, weather, impact and puncture resistance. It requires control joints and must be used with manufacturers’ recommended sealants.

Why would an architect or specifier consider using these exterior insulation systems instead of some alternative exterior wall?

These systems offer 11 vital advantages over other systems:

(1) Energy Cost Savings. By placing the insulation component outside of the framing components, the insulation is more monolithic. This reduces the expansion-contraction movement of the other components, and in turn this reduces the stresses that can create moisture and thermal breaks in the skin. A more stable temperature inside can result in dramatic energy cost savings.

(2) Space Savings. By placing the insulation material outside of the framing of the interior floor, space can be conserved.

(3) Easier Installation of Mechanical Lines. Because cavity space is free of insulation, mechanical lines can be installed with greater ease and simplicity.

(4) Weight Reduction. Foundation and other structural component requirements may be less because of the weight reduction in these wall systems.

(5) Design Flexibility. Because these wall systems can be attached to practically any surface or shape, they offer tremendous design flexibility.

(6) Cost Competitive. Insulation, finish color and texture are combined under a single installer. That adds up to savings.

(7) Code Acceptance. These systems have been accepted for use by all model code bodies and federal agencies.

(8) National Availability.

(9) Manufacturer-provided Extras. Installation of these wall systems is generally done by contractors trained by the manufacturers themselves, and some manufacturers will provide extended warranties.

(10) Prefabrication. Exterior insulation wall assemblies lend themselves readily to prefabrication and panelization, which generally offers better climatic control and worker supervision as compared to in-situ erection.

(11) Renovation. These systems are an excellent choice for use in retrofit work, combining modernization and energy conservation. Because of these systems, any buildings that would have been demolished have not only been restored to use but made far more attractive and efficient and, therefore more saleable.

One of the most important criteria for success with these exterior insulation systems is to avoid mixing or combining components of more than one system manufacturer.

The concept of unit responsibility is exceptionally applicable. Stay with a single system, follow the instructions of the manufacturer, and insist on the use of qualified applicators, and you should be well satisfied with the end result.