



Understanding the Hazard

Exterior Wall Assemblies

Construction

Exterior wall assemblies are subject to damage from wind pressure, impact from windborne debris, and hail and leakage at penetrations of the protective weather coating. Exterior walls that contain combustible components also can present a fire hazard.

UTH topic categories:

- ▶ **Construction**
- Equipment
- Fire Protection
- Human Element
- Natural Hazards
- Process Hazards

This series of publications is designed to help you understand the everyday hazards present at your company's facilities. For more information on how you can better understand the risks your business and operations face every day, contact FM Global.



The Hazard

Some wall assemblies consist of an interior lateral support system and substrate covered by insulation and a protective weather coating. In many cases, exterior walls use combustible insulation, including expanded polystyrene (EPS), extruded polystyrene (XPS), polyethylene (PE), polyisocyanurate (ISO) and polyurethane foam (PUF). These walls may be categorized as exterior insulation and finish systems (EIFS), metal composite material (MCM), insulated metal panels (IMP), cavity walls (CW) and rain screen (RS) assemblies. This type of construction may be used to build entire walls or only a portion of them. Actual fire performance depends on the details of the entire assembly.

Buildings that use combustible insulation in exterior walls are often multistory; they may use combustible insulation such as EPS in thicknesses of several inches. In some cases, EPS can be from 1 to 3 ft. (0.3 to 0.9 m) thick, particularly when used as decorative architectural detailing, such as cornice moldings and faux columns and beams used to accent EIFS assemblies.

The use of combustible insulation is particularly hazardous during construction when many ignition sources are present and large areas of insulation are exposed before being covered with the protective layer. Once construction is complete, an exposure fire to a wall containing combustible insulation can allow fire to spread into the building through windows or other openings and introduce smoke into the building's ventilation system, or allow fire to spread into the building through unprotected or unsealed openings.

In addition to the fire hazard during and after construction, walls and other architectural details are susceptible to wind damage, especially if the substrate was inadequately attached to the lateral support system during installation, or inadequate sealing was provided at window openings. This is a particularly severe hazard along coastal areas where windstorms are common; but even non-hurricane winds can cause damage, particularly in multistory structures, because wind forces intensify as building height increases.

Science of the Hazard

An understanding of the construction of wall assemblies is helpful in recognizing their potential hazards. It can be difficult to tell the difference between similar-looking wall constructions simply by looking at them.

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What You Can Do at Your Facility

Now:

- Inspect the integrity of your exterior wall construction at least annually and after any major weather event. Look for punctures, voids, or signs of shrinkage or cracking in the sealant around doors, windows, vents and other penetrations that could allow water to enter or exposed combustible insulation to be ignited. Make repairs as needed and replace sealant as it nears the end of its life span.
- Inspect electrical components along exterior walls that contain combustible components, such as wiring and lighting, to ensure they are not potential ignition sources.
- Control ignition sources during routine maintenance shutdowns by using a hot work permit system.
- Ensure outside contractors involved in maintenance or repair use a hot work permit system, and audit workers to make sure the system is enforced.
- Place all trash receptacles (skips) at least 35 ft. (11 m) away from exterior building walls that contain combustible insulation.

For example, MCM panels are usually 1/4 in. (6 mm) in total thickness and have a flat, thin metal facing on both surfaces. Typically, the facing is aluminum. Some have a polyethylene core, but others have a mineral fiber core with a smaller amount of polyethylene used as a binder.

EIFS walls and stucco are very similar in appearance. Stucco, however, consists of cement plaster (reinforced with metal lath) up to 3/4 in. (19 mm) thick. The coating used in EIFS is usually a polymer-modified cement reinforced with fiber-glass mesh and is only about 1/16 in. (1.6 mm) thick.

There are various levels of impact resistance needed depending on normal exposure, potential hail exposure and susceptibility to windborne debris. The makeup of the assembly's outer protective layer can affect the impact-resistance rating. Increasing the number of layers and density of mesh reinforcement can considerably increase the impact resistance of EIFS.

Older installations of EIFS may be more subject to damage. These systems used polystyrene insulation adhered to paper-faced gypsum board as a substrate. When moisture penetrates the system, the paper becomes wet and consequently weakens, leading to failure in a wind event. Glass-faced, water-resistant-core gypsum board has been recommended by manufacturers in recent years.

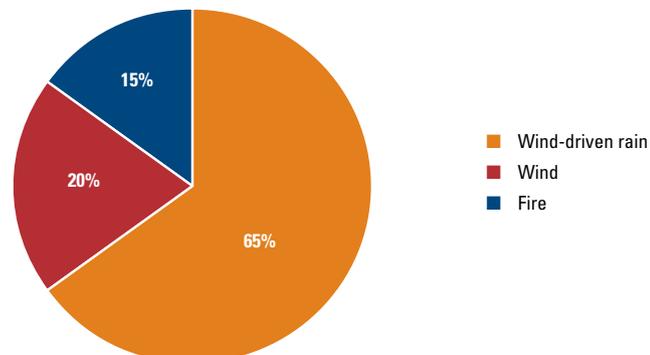
Older EIFS systems also failed to provide a mechanism for draining away moisture that penetrated the assembly. Modern systems have this capability, which helps prevent the formation of mold and mildew.

In any exterior wall construction, the seals around doors, windows, vents and other penetrations are key sources of moisture infiltration. In some cases of leakage, the sealant may have been inadequately applied during construction. In other cases, the life span of the sealant may have expired and penetrations need to be resealed. Sealant life spans vary from five to 20 years. Wind-driven rain can penetrate inadequate window seals, particularly during tropical storms. Loss of electrical power, and resulting loss of air-conditioning, is common during such storms, and can result in extensive interior mold growth.

Loss Experience

A study of FM Global client losses involving EIFS construction over a recent 10-year period shows the most significant causes (based on cost) were wind-driven rain, wind damage and fire.

Losses by Cause (percentage of cost)



Source: FM Global clients

What You Can Do at Your Facility

Soon:

- Develop a prefire plan with the public fire service to ensure hose streams and water supplies are adequate and accessible for the location, arrangement and position of the building. Provide additional hydrant protection as needed.
- Replace deteriorated exterior wall construction where practical.
- Under no circumstances should the amount of combustible insulation used be greater than that which has been satisfactorily fire tested.
- Ensure new construction complies with the manufacturer's recommendations, and the installation conforms to that of assemblies having been satisfactorily tested for fire, wind, water penetration and impact resistance.

While specific loss details are not available, outside the United States numerous fires have damaged high-rise building facades made of polyethylene-core MCM panels. Such panels do not meet U.S. fire code requirements for high-rise buildings.

Loss Examples

Example 1

A new, seven-story office building using an EIFS as an exterior cladding was located 20 feet (6.1 meters) from a 300-ft. (91-m) long, brick-walled structure. The adjacent brick building was four stories high with windows occupying approximately 25 to 30 percent of the wall area. A fire started on the fourth floor and was fought by 174 firefighters for two hours when the wall appeared to weaken. At that point it was necessary to move firefighters out of the alley between the two buildings. Within 20 minutes, the fire flashed from the burning structure across the entire length of the upper portion of the exposed office building.

Fortunately, the upper floors of the office building had not been furnished yet, and thus did not contain combustible drapes, carpets, furnishings, etc., so firefighters were able to control the fire. Nevertheless, the fire caused considerable damage to the EIFS façade and extensive smoke and water damage to the office building.

Example 2

A 27-story hotel with EIFS exterior walls was hit by a hurricane with wind speeds equal to the design wind speeds for that location. Inadequate sealing around windows allowed rainwater to enter. As commonly occurs in a tropical storm, electrical power and air conditioning were lost for about one week. This resulted in interior mold growth and required replacement of drapes, carpeting, wall board and interior furnishings on about half of the floors.

Example 3

A fire started on a corner balcony of the fifty-first floor of a high-rise apartment building. Exterior walls were reportedly constructed of polyethylene-core MCM panels. The fire spread vertically along that corner of the building to the top of the 86th floor. Burning debris was aided by the wind and spread the fire to the adjacent corner of the thirtieth floor. The fire in that corner then spread vertically for approximately two dozen floors.

But What About...

...our construction schedule?

A fire involving combustible insulation can cause lengthy delay in a construction project. Poor workmanship may go undetected until wind and moisture problems arise after the building is completed. This could result in even longer interruptions to your business.

... codes and standards that permit the use of various types of exterior wall construction?

Building and fire codes are usually minimum standards created by consensus and primarily focused on life safety; they do not necessarily provide the best property loss prevention advice. Not all fire tests used for exterior wall assemblies use

Need more information?

Ask your FM Global engineer or client service team about the following:

- How to determine the level of risk your facility is exposed to as a result of your exterior wall construction
- Potential exposures to exterior wall construction that should be addressed as part of a property loss prevention program
- FM Global Property Loss Prevention Data Sheet 1-12, *Ceilings and Concealed Spaces*
- FM Global Property Loss Prevention Data Sheet 1-57, *Plastics in Construction*

Ordering Information

For additional copies of *Understanding the Hazard* publications, contact your FM Global engineer or client service team.

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a severe enough ignition source or the correct geometry to represent actual fire conditions, yet they are considered acceptable by many codes and standards. For instance, an intermediate-scale multistory apparatus (ISMA) fire test (such as NFPA 285) is considered acceptable by most codes. This test uses a fire exposure that is much less severe than that used in the ANSI/FM 4880 fire test. Also, the ISMA test sample is flat, which is not representative of many buildings that have a re-entrant corner (90° angle as measured on the exterior side between exterior walls).

In addition, some tested assemblies may not include the extra thickness of foam polystyrene used in actual building details, such as cornices and faux columns and beams. Such use adds fuel in an area where horizontal or vertical fire spread is more likely to occur. Faux beams on outside walls can also collect burning material, providing a secondary exposure to the wall assembly and windows above.

Vertical fire spread is faster than horizontal fire spread, so the use of combustible wall components on high-rise buildings may be extremely hazardous.

... our corporate architectural standards that specify a type of construction?

Corporate standards are usually created to promote brand recognition rather than loss prevention. In spite of the hazards associated with certain types of exterior wall construction, they are commonly used on commercial buildings. Fire, wind and moisture resistance can be enhanced, but these hazards cannot always be eliminated entirely.

Don't Let This Happen to You



Combustible wall construction allowed fire to spread up the corner of this building.