



NFPA 285, Architectural Design and Energy Performance

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The International Code Council's (ICC's) 2012 *International Building Code* (IBC) requirement that exterior wall assemblies of Type I, II, III or IV construction containing certain combustible materials pass the National Fire Protection Association (NFPA) 285 fire test^[1] has had, and will continue to have, a significant impact on the design of exterior walls. Aspects of the problem are:

- The response of manufacturers to the code requirement.
- The difficulty of providing competitive specifications.
- The uncertainty regarding how to make wall assemblies that meet NFPA 285 weather tight.
- The resultant uncertainty regarding fire safety, due to assemblies not being constructed as tested.

Since the early 1980s, the traditional exterior insulation material used in cavity wall construction for non-residential and multifamily residential buildings has been foam plastic insulation. Recent use of lighter, often less fire-resistant claddings with flammable insulation materials is a concern, and designers are uncertain how to respond to the previously unclear regulations and the new enforcement situation. Lack of clarity stemmed from an exception to the NFPA 285 requirement contained in paragraph 2603.9 (2009 IBC): *"Special approval. Foam plastic shall not be required to comply with the requirements of Sections 2603.4 through 2603.7 where specifically approved based on large-scale tests such as, but not limited to, NFPA 286 (with the acceptance criteria of Section 803.1.2.1), FM 4880, UL 1040 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use. Foam plastics that are used as interior finish on the basis of special tests shall*

also conform to the flame spread requirements of Chapter 8. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use."

The problem with this exception is that it appeared to allow the use of these other tests while, at the same time, requiring the samples to match the actual end-use configuration. None of these tests sufficiently address the exterior wall configurations needed, since they do not include a window opening.

In the 2015 IBC, the exception for NFPA 285 was deleted from the Special Approval paragraph, clarifying the regulation. Now, however, architects are struggling to comply with the newly enforced requirements while trying to meet contradictory energy and durability requirements.

Assembly Test Creates Difficulties for Designers

As a result of the code requirements to meet NFPA 285, a design professional must consider one of the following options to remain compliant with the code:

- Design a building using Type V construction. This constraint is unacceptable because most commercial, institutional and multifamily residential construction cannot be accomplished with Type V construction, due to code limitations.
- Design a sprinklered building with only one story above grade plane. This constraint is unacceptable because most of these types of buildings need to be more than one story.
- Design an exterior wall assembly that has no combustible materials. This approach is problematic because the materials that are not combustible often do not perform adequately.

- Design a building using metal composite materials (MCM) or high-pressure laminate (HPL) that is more than five feet from the lot line, less than 40 feet in height and includes no foam insulation or combustible water-resistive barrier. Or, design a building using fiber-reinforced plastic (FRP) that is Type V construction or only one story. These constraints are unacceptable because of the multiple severe restrictions on the design of buildings.
- Select a tested wall assembly from the few assemblies that are available. This constraint is unacceptable because no central resource exists where these assemblies can be found; the number of choices are insufficient to meet the needs of the construction industry; and the bids might become cost-prohibitive.
- Design a wall assembly and have it tested. This constraint is unacceptable because the NFPA 285 test is an assembly test, meaning that every element of the final construction in a project must match what was in the tested assembly. If an architect's design calls for a different material for the cladding, insulation or water-resistive barrier, or if an architect's details of a window opening vary from the tested assembly, the proposed assembly must be tested—at a cost of \$15,000-\$25,000, plus considerable added expense to retain consultants, construct test specimens and conduct multiple tests, if necessary. Potentially, such actions also could delay a

project. The only alternative is to have the design reviewed by an engineer with expertise in this area who can provide a letter stating that the changed products will perform as well as the products actually tested. Under this alternative, however, the amount of variation from the tested assemblies is very limited and the products that can be approved must be very similar to the ones in the tested assembly.

Response from Manufacturers

Unfortunately, some manufacturers of products used in cladding assemblies have taken the opportunity to market their products as meeting NFPA 285. This is misleading: No single product meets NFPA 285; only assemblies meet the code. The only way an assembly

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Actions in Recent Code Hearings

During the recent ICC Code Hearings in Memphis, Tennessee, the Institute submitted two code change proposals to the *International Building Code (IBC)* on behalf of the BETEC Codes and Standards Committee.

FS 146-15 was recommended for approval by the Fire Safety Code Committee to revise Section 1403.5 to clarify the intent of requiring NFPA 285 testing for the water-resistive barrier material and not its accessories. It extends the exception to specifically include flashings that are not associated with fenestration. The modification further clarifies that all water-resistive barriers need to be included in this requirement.

FS 174-15 was submitted to amend Section 2603.5.5 to add an exemption in the requirements for testing under NFPA 285 for other than high-rise buildings. The exception provides: "[in] other than high-rise buildings, buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1."

This exemption was submitted in recognition of the stated scope of NFPA 285, and the success of automatic sprinkler systems and a desire to achieve greater thermal performance in high-rise buildings. This proposal provides a balance for fire protection and increased thermal efficiency in buildings using non-load-bearing curtain wall construction. As noted in the reasoning statement, "The code does not differentiate as to whether there is a potential for such a fire to occur in a building. Flashover fires that would cause the flame to break out of the building will not occur in a building that has a fully operational sprinkler system."

The Fire Safety Committee recommended this proposal for disapproval, stating: "The committee disapproved this proposal, as sprinkler protection generally does not provide enough protection from exterior fire exposure, which will result in flame propagation. Further, alternate testing to NFPA 285 is available (FM 4880)."

Of note is the specific reference for protection from exterior fire exposure. NFPA 285 provides in Section 1.1.2 of the standard "the fire propagation characteristics are determined for post-flashover fire of interior origin."

Further, an examination of the standard notes in Annex A: "This standard addresses fire exposure from interior fires that reach flashover, break exterior windows and expose the building façade. It is not intended to address fire exposure that originates from the building exterior."

During the testimony, opponents described the concerns for fires originating outside of a building. This test method is not intended to address fires originating from the building exterior.

In a paper commissioned by the Alliance for Fire and Smoke Containment and Control, Inc., William E. Koffel, PE noted: "The NFPA data indicates that the commonly stated reliability of automatic sprinkler systems in the range of 96 percent (fails once in every 25 fires) is overstating the reliability of sprinkler systems unless there are assurances that the preventive maintenance on the system is substantially better than that on the average system in a building in which a fire has occurred. When combining the operational effectiveness and performance effectiveness data as published in the August 2005 NFPA report, the overall reliability of automatic sprinkler systems is 91 percent. This value is extremely close to the 90-percent value previously proposed by this author and the value proposed by the British Standard." This information is further validated in a study by John Hall in which it is noted: "When sprinklers operated, they were deemed effective in 96 percent of the fires."

Based on either of these reports, it is clear the reliance on automatic sprinkler systems is used to appropriately control fires and allow for exceptions under the code where it is demonstrated that the proposed exception does not pose a significant hazard. It may be time to rethink this discussion and base the analysis on the science behind the reliability of automatic sprinkler systems, while also balancing the need for thermal efficiency.

—Henry L. Green, Hon. AIA,
President, National Institute of Building Sciences

test can work for the industry is if manufacturers collaborate to test their products and publish those assemblies that meet the test in a directory, similar to Underwriters Laboratories' (UL) directories of fire-rated assemblies for interior construction. However, this has not yet occurred. At the same time, triggers for NFPA 285 testing should be clearer, with prescriptive alternatives.

Lack of Competition

Providing competitive specifications is difficult, if not impossible, due to the lack of available information. In addition, a whole assembly must be specified that meets the test. Finding more than one assembly, let alone three or more (the typical requirement for competitive bids among many owners and governmental jurisdictions), is unlikely, except for assemblies with heavy masonry claddings.

Uncertainty Regarding Weather Tightness

Architects and contractors already had a difficult time designing and building weather-tight assemblies, even before the advent of the NFPA 285 requirements. As an example of the problems, the typical detailing for a self-adhering, rubberized-asphalt-based, water-resistive barrier is to wrap it into the rough opening,

allowing for an internal seal to windows. To date, none of the details for the successfully NFPA 285-tested assemblies incorporate this detail.

Code-Compliance Issues

Code enforcement professionals also are uncertain about fire safety since assemblies are not always constructed as tested. Designers may unknowingly modify tested assemblies to meet other requirements of façades, such as competitiveness/cost, constructability, weather tightness and aesthetics.

Loss of Energy Efficiency and Impact on the Climate

The change from extruded polystyrene foam to mineral wool insulation has resulted in a loss of 16 to 25 percent of the insulating value of the continuous insulation layer of the walls behind claddings that could otherwise be provided with no increase in wall thickness. At the same time, codes are emphasizing the avoidance of thermal bridging that may occur in the stud cavity behind a continuous insulation layer. Therefore, the layer with foam or mineral wool is much more critical.

Attempts to Modify the Code

The National Institute of Building Sciences and its local Building Enclosure

Councils (BECs) submitted code-change proposals to try to affect positive change during the development of the 2015 IBC. The process follows:

- **Task Group Formed.** In fall 2010, the BEC chairs, meeting with the Institute's Building Enclosure Technology and Environment Council (BETEC), formed a Task Group to look into the impact of NFPA 285 and consider ways to ameliorate the impact. That group created a Request for Proposals (RFPs), seeking a consultant to produce a report and recommendations on the issue. The Task Group also provided a preliminary list of possible donors to fund the consultant.
- **Code Change Proposals Submitted.** Institute President Henry L. Green and David Collins, FAIA, NCARB of The Preview Group, Inc., as well as manager of The American Institute of Architects Codes and Standards Program, submitted code-change proposals on behalf of the Task Group, the BEC chairs and BETEC. Changes were proposed for Sections 1403.5 and 2603.5.
- **Actions by the ICC.** 1) Changes proposed in one 1403.5 proposal were accepted (FS147-12), as modified by public comment. The

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second 1403.5 proposal was not accepted (FS148-12). 2) Changes proposed in the 2603.5 proposal (FS187-12) were not accepted. Verbal comments were received from the ICC, indicating more clarity was needed as to why the proposal was to delete (exempt), rather than modify. Since ICC believed the testing protocol (NFPA 285) was well understood and used, they asked for a compromise.

- **Current Actions by the BETEC Code Committee.** The committee gathered information from the nationwide network of BECs on local code-change efforts and proposed some

small scope code changes for the upcoming code development cycle, including the extension of the flashing exception.

Looking Ahead

As the industry moves forward, a number of concerns are under discussion:

- Extension of the exemption of fenestration flashing to other types of flashings, such as through-wall flashings and flashings at doors, louvers, etc.
- Presence of sprinklers as a reason to exempt from NFPA 285.
- Height of ladder trucks (75-100 feet) in fighting fires.

- Fire services' concern about misguided public perception regarding façade fires, which are very visible and threatening to surroundings.
- Infrequent documented façade fires in most building types (other than low-rise residential occupancies).
- Adequacy of construction, particularly in areas outside of the United States where inadequate codes/enforcement may exist.
- The combustibility of interior finishes/furnishings, which prevents a "perfect" fire-safe building.
- Architects' efforts to meet mandates of increased energy efficiency with conflicting code requirements, while not paying sufficient attention to weatherproofing and durability.

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- The work of Henry Green, president of the National Institute of Building Sciences, and David Collins, FAIA, NCARB of The Preview Group, Inc., and manager of The American Institute of Architects Codes and Standards Program.

Conclusions

The uncertainty and disagreements regarding the subject of façade fires will continue for at least three years (until the 2018 IBC is adopted by a significant number of states). This also assumes that future code changes will satisfactorily address the questions raised in this article. More likely, though, is that discussions will attempt to make fire testing even more rigorous.

The international fire protection and insurance communities will continue to press for safer exterior wall assemblies. Without a balanced and reasonable discussion within the construction community about the impact on costs and constraints on creativity, and from the environmental community about the loss of insulating value, the fire protection and insurance communities will continue to control the discussion. **INIBS**

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References:

- ^[1]National Fire Protection Association. Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.



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