

TECHNICAL WHITE PAPER



Insulated Metal Panels and NFPA 285

Introduction

An Insulated Metal Panels (IMP) is a panel assembly comprised of a rigid foam plastic insulation core sandwiched between two sheets of coated metal facers. IMPs can be formed in a variety of sizes and shapes and are typically used on walls and roofs. This article will focus on the use of IMPs on exterior wall assemblies. Figure 1 provides a cut-away view of an IMP.



IMPs generally use a foamed-in-place or laminated, polyisocyanurate foam plastic insulation and this material provides an approximate R-value of 7 per inch. Typical thicknesses of the foam plastic insulation range from 2- to 4-inches. **Figure 1** IMPs generally use coated steel facers and these materials provide a barrier to water and vapor migration through the wall. The typical thicknesses of the steel facers are 26-ga. on the interior side and 22-ga. on the exterior side.

In typical exterior wall applications, IMPs provide the exterior cladding of the wall assembly as well as providing insulation, air, water and vapor barrier capabilities. The panels are typically installed either vertically or horizontally over the exterior wall framing system.

In some instances, the IMPs can be used as a back-up panel when covered by another exterior veneer system.

The attachment techniques of the IMPs to the exterior of the building will vary depending on the construction requirements that are specified for the particular building.

Code Requirements

Since IMPs contain foam plastic insulation and when used as or on exterior walls of Type I, II, III, or IV construction, the flammability characteristics of the IMPs are regulated by Section 2603.5 of the International Building Code.

The primary fire test requirement for this application is NFPA 285 “Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.” This fire test evaluates the vertical and lateral flame-propagation potential of wall systems that contain combustible components, typically foam plastic insulation. The common type of wall system that is evaluated is non-load-bearing, exterior curtain wall construction. This test exposes an exterior wall assembly to a “typical” fire scenario. The fire scenario is one in which a fire occurs inside a room, the fire

vents through a window opening and the exterior wall is exposed both from the interior fire and to a flame plume exiting the window.

The test measures the following parameters:

- Vertical and lateral flame propagation over the exterior face of the wall assembly
- Vertical and lateral flame propagation within the combustible core or within combustible components
- Vertical and lateral flame propagation from the compartment of fire origin to adjacent compartments.

During the 30-minute test, these parameters are measured by visual observations and temperature measurements at locations on and within the wall assembly. While some fire propagation is allowed, the acceptance criteria limit fire propagation on and within the test wall assembly.

NFPA 285 testing and IMPs

Historically, the IMP industry was one of the leading proponents for the development of NFPA 285 and its precursor the Large-scale Multi-story fire test (UBC 26-4). IMPs were originally tested in both of these test methods and demonstrated successful fire performance.

NFPA 285 requires that a complete wall assembly be evaluated. This means that both an IMP panel and its method of attachment are evaluated. Additionally, other wall system components or features are also evaluated. The following is a listing of the various variables that should or should not be addressed during NFPA 285 testing:

1. Foam plastic core insulation – Due to formulation variations, albeit minor in the foam plastic core, each manufacturer’s foam plastic core must be evaluated. Additionally, testing should be performed on the maximum density and thickness contemplated for use. This provides a “worst case” for the maximum amount of combustible material in the IMP. Upon successful NFPA 285 testing, any lesser thickness of the foam plastic core would be allowed.
2. Facings – The facings of the IMP should be evaluated using the minimum thicknesses contemplated for use. Again, this provides a “worst case” situation and upon successful testing, a thicker facing on either side of the IMP would be allowed. Additionally, the metal type of the facers must also be considered. For example, if steel is the facer of choice, then steel is tested. However, if the facers were to change to aluminum, then additional testing with the aluminum would be required since in the NFPA 285 test, aluminum facers may melt whereas the steel facers will not.
3. Size of IMP panels – In general, the length of the IMP panel should be such that it is either the full height (vertical panel orientation) or full width of the test wall assembly with a vertical joint located within 1-ft. of the assembly’s centerline (horizontal panel orientation). The module width of the IMP panels can vary depending on the job requirements. Generally, a “middle of the road” width is tested and these are typically 24-inch to 30-inch widths. These widths provide a good cross-section of the typical panel modules while also incorporating a sufficient number of joints for evaluation.
4. Orientation of the IMP panels - IMP panels can be installed both vertically and horizontally as required. Both orientations must be evaluated in NFPA 285 since the attachment system of each orientation will likely be different.

5. Profiles of IMPs – Typically for exterior wall applications, a flat profile is evaluated in NFPA 285. Other profiles would be acceptable based on the testing of a flat profile assuming the thickness of the foam plastic core insulation remains below the maximum tested and the joint system is similar.
6. Joints of the IMP panels – IMP panel joints should be tested as contemplated for use. The typical joints for exterior walls are overlapping joints with concealed fasteners, clips and caulk. Minor variations from the tested assembly are allowable and would be expected to provide the same or similar fire performance in NFPA 285.
7. Attachment system for the IMP – The attachment system used to install the IMPs to the substrate structure is an important variable in NFPA 285 testing. The reason is that an attachment system with fewer direct fasteners may perform differently than an attachment system with more fasteners. For example, if the IMP is applied over a light gauge metal steel frame system, then panel fasteners will be applied as required at some spacing distance along the studs. If the IMP panels are attached only at floor girt angles and reinforced with outriggers, the overall number of fasteners will probably be less. This may lead to additional warpage, etc. when the IMP panels are heated by the test fires. Since not every attachment system can be tested, in today’s construction practices, the use of the light gauge metal steel frame system appears to be the most common and thus be the one selected for testing. If a completely different attachment system is then proposed for use, an engineering evaluation or additional testing may be required.
8. Window / trim details - In the NFPA 285 test a “simulated” window opening is installed in the test wall assembly. The window header, jambs and the sill must be sealed so that the foam plastic core is not directly exposed as would be the case in actual installations. While an actual window frame is not used in the NFPA 285 test, the typical closure materials would be the same facer material at a thinner or equivalent thickness. Once this is evaluated, other profiles or changes in the header, jamb or sill closure details would be acceptable. This assumes that the type of metal, etc. of the closure details remain the same.
9. Use of thermal barrier - If a thermal barrier, typically ½-inch thick gypsum wallboard, is used on the interior side of the wall assembly in the NFPA 285 test, it cannot be eliminated in actual installation. Additionally, the thermal barrier must be installed over the full height of the wall assembly and it cannot stop in what would be the space above a drop ceiling. If a thermal barrier will not be installed or only partially installed in the actual installation, then the NFPA 285 test must be conducted without the thermal barrier installed.
10. Use of cavity insulation – Typically with light gauge metal steel frame systems, the NFPA 285 is conducted without any cavity insulation. Again, this provides a “worst case” configuration. Based on successful testing, any noncombustible, faced or unfaced insulation would be allowed. Any type of foam plastic insulation would not be allowed however without further NFPA 285 testing.

As described above, the premise of NFPA 285 testing is to evaluate a “worst case” wall assembly and then allow changes that will provide a more enhanced wall system from a fire performance perspective. Since it is not possible to test every potential variation of the wall system, small variation of minor components such as caulk, trim, etc. are not of major concern. The primary concern is the fire performance of the “basic” IMP panels and their attachment.

Based on limited test data and my experience with IMP panels in NFPA 285 tests, in general, IMPs have very good fire performance. While there have been failures, these tests have provided guidance as to better panel designs that can meet the NFPA 285.

IMPS as Back-up Panels

New applications of IMPs have been developed whereas the IMPs are not the exterior veneer but rather are used as back-up panels with other types of veneers installed over them. This presents a different wall assembly than that used when the IMP panels are the exterior veneers.

Assuming that the IMP panels have successfully passed a NFPA 285 test and are installed in a similar manner as tested, a couple of general guidelines can be provided and they are:

- The use of a noncombustible exterior veneer over the IMP panels can be used and will result in the same or similar fire performance. This assumes that the free air cavity between the IMPs and the exterior veneer is less than approximately 2-inches. Greater air cavities may influence the fire performance. Additionally, no combustible water-resistive barrier or other combustible is installed over the IMP or behind the noncombustible veneer.
- The use of combustible exterior veneers over the IMP panels is not allowed unless the combination of IMPs and exterior veneer is evaluated per NFPA 285.

Alternative Testing Of IMPs

Section 2603.5 of the IBC requires that NFPA 285 testing be conducted on wall assemblies that contain foam plastic insulation on any height building of Type I, II, III, or IV construction. This test evaluates a wall assembly under a specific fire scenario whereby the wall assembly is exposed to fire from both sides simultaneously. This fire exposure scenario was developed to address the specific use of foam plastic in exterior walls and the acceptance of this application of foam plastic insulation by the Code is predicated on this test.

No other fire test referenced in the IBC performs this same exposure. The use of fire tests described in Section 2603.10 (2012 edition IBC) “Special Approvals” such as NFPA 286, FM 4880, etc. do not provide the same exposure conditions and thus they cannot be used in lieu of NFPA 285 evaluations. In the past however, there have been some interpretations of Section 2603.10 whereby this would be acceptable.

In order to clarify this issue, the 2015 edition of the IBC will state that Section 2603.10 does not apply to requirements in Section 2603.5 and thus, no other type of fire test can be used in lieu of NFPA 285.

Engineering Judgments

As stated earlier, since not every conceivable variation of a wall system can be tested nor is it necessary. Primarily significant changes in materials or construction from a tested assembly will necessitate additional analysis to determine if the proposed change(s) can be encompassed by a tested assembly. In some cases it can and in some cases it may not be appropriate.

Section 104.11 of the IBC (2012 edition) entitled “Alternative materials, design and methods of construction and equipment” allows the Code official the capability to evaluate submitted information, test results, etc. and

determine if an alternative construction technique, material, etc. meets the intent of the Code and thus allow its use on a specific project.

Additionally, Section 703.3 Item 4, of the IBC (2012 edition) allows an engineering judgment to be made with respect to fire-resistance ratings of assemblies. In a like manner, a proposed wall system and the respective components can be compared to the assemblies tested according to NFPA 285 and a judgment rendered.

This process has been successfully used in the past, but it must be remembered that it is the Code official's prerogative to accept or reject any engineering judgment.

Summary

In summary, IMP panels are required to be tested in accordance with NFPA 285 and specific IMPs have been tested and meet the conditions of acceptance of NFPA 285. Since every variation of a wall system cannot be tested, and based on the discussions above, if the "basic" IMP panel system meets NFPA 285, minor variations in items such as caulks, trim, window details, and joints can be allowed without retesting or an analysis.

When required, an engineering judgment can be used to evaluate the NFPA 285 fire performance of variations from a tested system when it is appropriate. These engineering judgments have been accepted by building code officials and the authorities having jurisdiction (AHJ) for many years on a variety of projects throughout the USA.

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