Utilizing NFPA 285 Engineering Extensions

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Specifiers have a responsibility to verify that assemblies with foam plastic comply with NFPA 285 when used in Types I-IV construction. Manufacturers of foam plastic have an obligation to clearly communicate to users those assemblies which comply with NFPA 285. The combinations of base walls, sheathing choices, insulation thicknesses, weather resistant barriers, air spaces, and cladding are seemingly limitless, therefore compliance of assemblies cannot be attained through testing of exactly every assembly. Since all foam plastics must assess NFPA 285 assemblies for use in Types I-IV buildings, foam plastic manufacturers have the most complete assembly listings of all the combustible exterior wall components.

The current industry standard for addressing this challenge is:

- Full scale NFPA 285 testing of worse case wall assemblies to establish passing of NFPA 285 with various combustible components in addition to the foam plastic insulation.
- Small scale testing of the foam plastic and other combustible components to define fuel load, flame spread index, and heat release characteristics.
- Examination of small and large scale testing by fire science professionals to compare other available products for substitution in the assembly (Engineering Extensions).
- Independent review of the test reports and the extension by a third party approval agency for creation of approved assembly tables and any limits that must be clearly communicated.
- Publication and distribution of the third party accredited approval report for use by specifiers to avoid non-compliant assemblies.

As part of due diligence, some specifiers request the actual test reports. However, this is not helpful, as the tested assemblies are almost always unrealistically a worse case build that would not be used in the real world. Also, some components are specifically chosen due to being more combustible than counterparts in the market. Revealing these brands could unfairly lead specifiers to avoid the products, despite their successful incorporation in compliant assemblies.

What is meant by a worse case assembly? The following are explanations of each layer of a wall, and how fire science professionals assess the tested assembly versus other commonly available options in the market. NFPA 285-2023 includes Annex B, the consensus “Guide for Extensions of Results from Assemblies that Meet NFPA285 Test Requirements.”

- Base wall – Interior: The worse case interior sheathing for a stud base wall is 1/2" gypsum, but most commonly 5/8" Type X gypsum is tested considering hourly assembly needs. If 5/8” Type X gypsum is tested, then 5/8" Type C gypsum is also allowed, as well as gypsum thicker than 5/8". Also, concrete base walls are less combustible, so testing of a stud wall with interior gypsum allows all concrete and CMU base walls to be approved as well.
- Base wall – Steel Studs: Most testing is constructed with worse case 24" o.c. steel stud spacing with 20 or 25 gauge 3-5/8" deep studs. This produces a worse case for steel thickness and warping of the wall during testing. The fire engineer can then approve thicker gauge studs, narrower stud spacing, or deeper studs based on the tested assembly being weaker. IMPORTANT: IF THE WALL IS TESTED WITH LATERAL BRACING, THEN LATERAL BRACING MUST BE USED IN THE ACTUAL BUILDING ASSEMBLY.

- Base wall – Fibrous Cavity Insulation: When the tested assembly is worse case with no cavity insulation, then approved assemblies include fiberglass, mineral wool – or empty – in addition to 6-mil poly vapor retarder allowed on either side of the studs. Cellulose insulation requires the same material and method (wet applied, dry applied, etc.) to be tested, and may not be extended by testing an empty cavity.
- Base wall – SPF Insulation: Using calorimetry data, the worse case spray foam within a manufacturer's product line may be tested and then extended to less combustible products within that brand. When a base wall containing SPF is tested via NFPA 285 and no flaming on the exterior of the wall is observed, the SPF base wall may be substituted for a base wall that includes other combustible components such as WRB, foam plastics, and cladding that has passed NFPA 285 criteria. Testing full cavity thickness of SPF allows approval of less than full cavity SPF in the approved assembly, but less than full cavity thickness testing of closed cell SPF limits approved assemblies to the same air cavity depth as that tested.
- Floor line fire stops: Most NFPA 285 compliant assemblies require floor line fire stops within the stud cavity, typically 4" high mineral wool the full depth of the stud. When FRT wood studs are used, the floor line fire stop may be FRT blocking. When certain exterior gypsum or concrete sheathings are used, the floor line fire stopping may be waived. When intumescent fire stopping materials are used, the same must be installed as it was tested.
- Exterior Sheathing: The worse case testing is no exterior gypsum with foam insulation thus installed for the test direct to the studs. Such a tested assembly allows approval of assemblies with any gypsum or no gypsum. If regular, Type X, or glass faced gypsum is tested, the tested thickness and any greater thickness of any of these gypsum products are approved for the assembly.
- WRB over Exterior Sheathing: Fire engineers assess multiple mechanical and liquid applied weather resistant barriers and maintain a confidential database of calorimetry and fuel characteristics of each. In this manner, a more combustible WRB is selected to be burned in the NFPA 285 test assembly, allowing less combustible products to be allowed in the approved assembly as well. This is crucial, given the large number of mechanically attached and liquid applied WRB options in the market, and the desire to not restrict the designer to only those WRB tested in the actual NFPA 285 assembly.
- Exterior Foam Plastic Insulation: The maximum thickness of foam plastic insulation tested in the assembly allows thinner product of the same brand and composition to be used in the approved assembly.
- WRB over Exterior Foam Plastic Insulation: A WRB with less combustible characteristics than that which was tested over the foam plastic may be allowed in the approved assembly as well.
- Air Cavity under Cladding: The air cavity from the interior face of the cladding or masonry veneer to the underlying surface of the WRB or foam plastic insulation is tested greater than might be typically used in actual construction, which allows approval of thinner air cavities in the approved assembly.
- Drainage Mats: Non-combustible drainage mats may be used in approved assembles despite not being tested in the NFPA 285 assembly, provided the depth does not exceed the allowed air cavity for the particular cladding. Combustible drainage mats must be tested between the same cladding and underlying layer for which approval is sought.
- Fire Stops in the Cladding Air Cavity: When fire stops are tested under the cladding, the approved assembly must be limited to placement of the firestop in the same configuration as was tested. When no firestops are used under the cladding, as is typical, firestops may NOT be incorporated under the cladding in the approved assembly.
- Cladding: Testing of a brick façade allows approval of similar bulk cementitious claddings such as terra cotta, natural stone, etc. Testing of worse case open joint MCM cladding with joints directly over the window opening of the test assembly provides approval of other light-weight non-combustible claddings such as metal panel, fiber cement, thin brick, etc. Testing of an aluminum faced MCM typically allows approval of higher melting point skins such as titanium, copper, or stainless steel.
- Combustible Claddings: Most other combustible claddings, such as High Pressure Laminates (HPL), Exterior Insulation Finishing Systems, Composite Panels, FRP, or Insulated Metal Panels, require that the assembly be tested with that specific cladding. Typically, thinner versions of the same cladding are approved based on testing a thicker version with more combustion fuel. However, both the thickest and the thinnest HPL claddings must be tested to meet code.

- Composite Cladding Attachment Systems: Some cladding attachments utilize composites, including fiberglass, to limit thermal bridging. These attachment systems must be tested on a base wall to assess initial combustibility in the system.
- Window Perimeter: The tested window rough opening header, jambs, and sill for polyiso foam insulation is typically the C-channel steel studs used in the rest of the wall assembly, normally 20 or 25 gauge. If mineral wool is used to separate the cavity insulation from the window perimeter, or a special header is used, this must be disclosed as a requirement in the approved assemblies. Such additional requirements are more common for XPS and EPS than polyiso, spray foam, or mineral wool exterior insulation.
- Window Perimeter Treatment: Metal flashing is commonly used to bridge the rough window opening framing gap to the exterior cladding, back to the interior drywall. Testing with 0.040" aluminum allows other flashings to be used. Other rules apply for tests with flashings other than aluminum. Generic installation is restricted to horizontal extension to the surface of the cladding, and vertical extension on the interior drywall no more than 2-inches. When aluminum is used, all other metals are approved, as this aluminum perimeter melts off during the test. In some cases, the window perimeter is constructed and tested with specific materials such as stainless steel, gypsum, FRT, or mineral wool in air cavities. The report outlining approved assemblies will specify which systems require specific window perimeter detailing, often this is the case for ACM claddings combined with no exterior gypsum sheathing (polyiso installed direct to steel stud).
- Window Flashing: Combustible tapes and flashings at window openings are not a cause for test failure. For this reason, any flashing material may be used without limit, provided it extends no more than 18-inches out from the window opening. Flashing greater than this would be considered a WRB, and must be listed in the approved WRB list in the approval report.

As outlined above, every layer within a wall assembly is taken into consideration when constructing the NFPA 285 test assembly. Materials, fabrication, and testing of a single assembly ranges from $25,000 to $40,000 and require months to complete. Failures are treated as learning experience and changes incorporated into future testing, balanced against worse case conditions and more conservative commonly employed building practices. The end results are well vetted assembly test reports that are used by fire engineering professionals as the basis for limiting what assembly alternatives are approved and which must be avoided.

Specifiers understand exterior wall assemblies are complex. To date, the most efficient way to address NFPA 285 approved assemblies is for fire engineering professionals to create tables with sections specific to approved options in each layer, and footnotes that denote important restrictions. As an example, a cladding may be approved, but a footnote may clarify that exterior gypsum sheathing must be used in conjunction with the cladding. Or, a cladding may be approved, but is restricted to a maximum air gap underneath. For this reason, it is important to not only check published tables for approved components, but to note any caveats that must be observed when designing the actual building.

Finally, specifiers should exercise caution when confronted with products simply proclaiming "NFPA 285 approved." Compliance is only attained as part of a wall system, and every layer of that wall system must be shown to understand which combinations are compliant with the product. Where a manufacturer has contracted with a third party approval agency to vet and publish the approved wall assemblies, specifiers should feel confident that the information in the table is accurate and much more complete than if they were simply handed a test report. Every year, more cladding, WRB, composite attachment systems, and other wall options are brought to market. NFPA 285 approval reports from foam plastic manufacturers are updated often to keep pace, so always access the most recent third party report for accurate details. See DRJ TER 1306-03 for Atlas approvals.