

NFPA 285: Air/Water-Resistive Barriers (WRB) and Foam Plastic Insulation

Market demand for insulation, air and water-resistive barriers (WRB), as well as other combustible building envelope materials, is at an all-time high due to increased importance of high performance buildings, improved building and energy codes, longer building service life, and occupant health and safety requirements. Although high rise fires in other parts of the world have raised fire safety concerns, the U.S., through a rigorous public hearing process, has developed building and fire codes to regulate and address innovation in exterior wall materials, assemblies, and construction methods. NFPA 285 is a commercial wall assembly test that's designed to determine if an exterior wall assembly that contains combustible components meets an acceptable level of fire performance for use in non-combustible construction Building Types. This Technical Bulletin is designed to further explain the NFPA 285 fire performance assembly test and help you to understand the rigorous performance requirements DuPont products meet in order to qualify for use in a variety of assemblies.

NFPA 285 in the International Building Code

The International Building Code (IBC) is recognized as the model building code for commercial construction, which is then adopted by states and jurisdictions^[1]. A critical component of the 2018 IBC is the emphasis on fire performance of exterior walls, which are evaluated using *NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components*.^[2] In the U.S., NFPA 285 has been included in the IBC and its predecessor codes for over 30 years and its effectiveness has contributed to overall building fire safety.^[3]



The 2018 IBC regulates the fire safety of exterior walls containing combustible claddings, WRBs (Chapter 14, Exterior Walls), and foam plastic insulation (Chapter 26, Plastic). Generally, NFPA 285 testing is required for exterior wall assemblies installed on Types I, II, III, and IV buildings, containing combustible cladding, foam plastic insulation, or combustible WRBs. Please consult the IBC for exceptions. Type V wood construction does not require NFPA 285 testing. (See Figure 2).

IBC Building Types

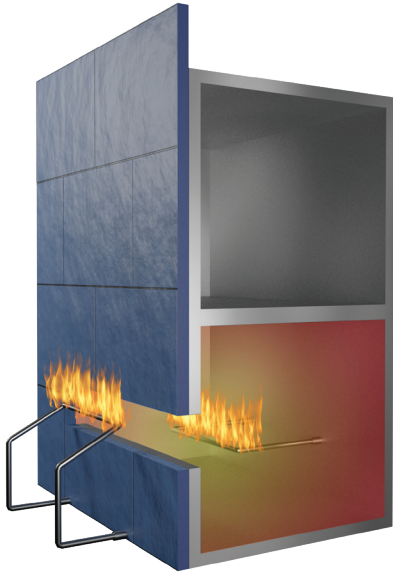
- **Types I and II** – the various building elements are made up of non-combustible materials.
- **Type III** – exterior walls are made of non-combustible materials and the interior building materials are of any material permitted by the IBC.
- **Type IV** heavy timber (HT) – exterior walls are made of non-combustible materials, and the interior elements are made of solid or laminated wood without concealed spaces.
- **Type V** – structural elements for both exterior and interior walls are of any materials permitted by the IBC—usually combustible construction.

^[1] Please refer to your local jurisdiction for specific code requirements.

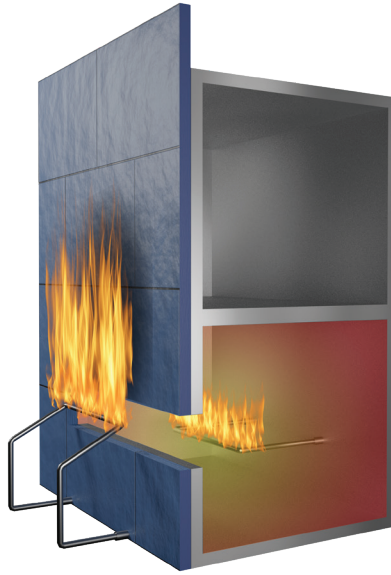
^[2] The 2021 IBC contains *NFPA 285-19 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components*

^[3] White, N. and Delichatsios, M., "Fire Hazards of Exterior Wall Assemblies Containing Combustible Components" (University of Ulster, UK, and CSIRO, Australia, for FPRF), Document Number: EP142293, Date: 01 June 2014

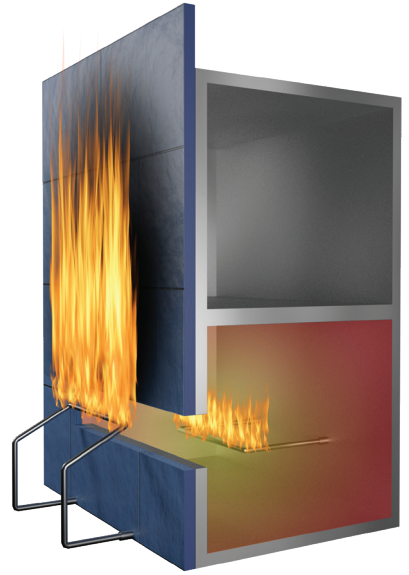
Figure 1. NFPA 285 Fire Test Parameters and Pass Criteria



No flame progression in second floor room



Inside wall assembly, thermocouples shall not exceed 1,000°F during the 30 minute test



Externally, flames shall not reach 10 feet above the window's top, or 5 feet laterally from the window's centerline

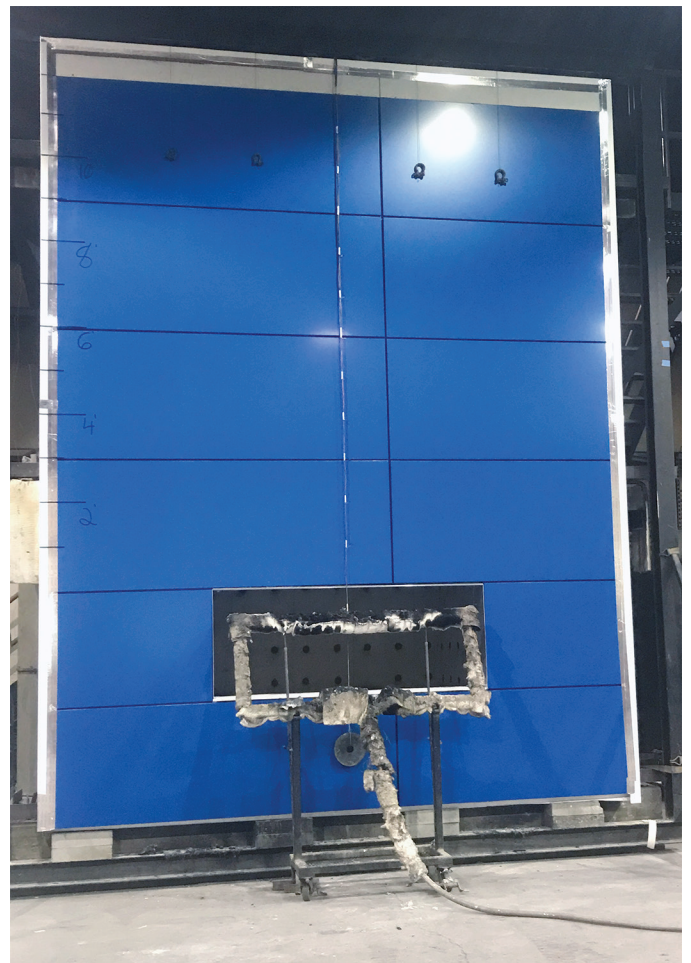
NFPA 285 Testing Protocols

NFPA 285 testing evaluates the flammability characteristics of exterior, non-load-bearing wall assemblies/ panels that contain combustible components, including foam plastic insulation, air, and WRB's. The multi-story test assembly measures:

- Flame propagation over exterior wall surface
- Vertical flame propagation within the combustible core or components
- Vertical flame propagation over the interior surface from one floor to the next
- Lateral flame propagation to adjacent compartments

The fire sources are two gas burners (one room burner located inside the first floor, and another window burner on the exterior side). Both of these burners are needed in order to simulate real conditions where a fire may originate from within the structure, all interior materials are burning (flashover), and the fire suppression system has failed. The pass criteria (Figure 1) provides assurance that NFPA 285 compliant wall systems will reduce the potential for vertical and lateral flame spread on exterior walls.

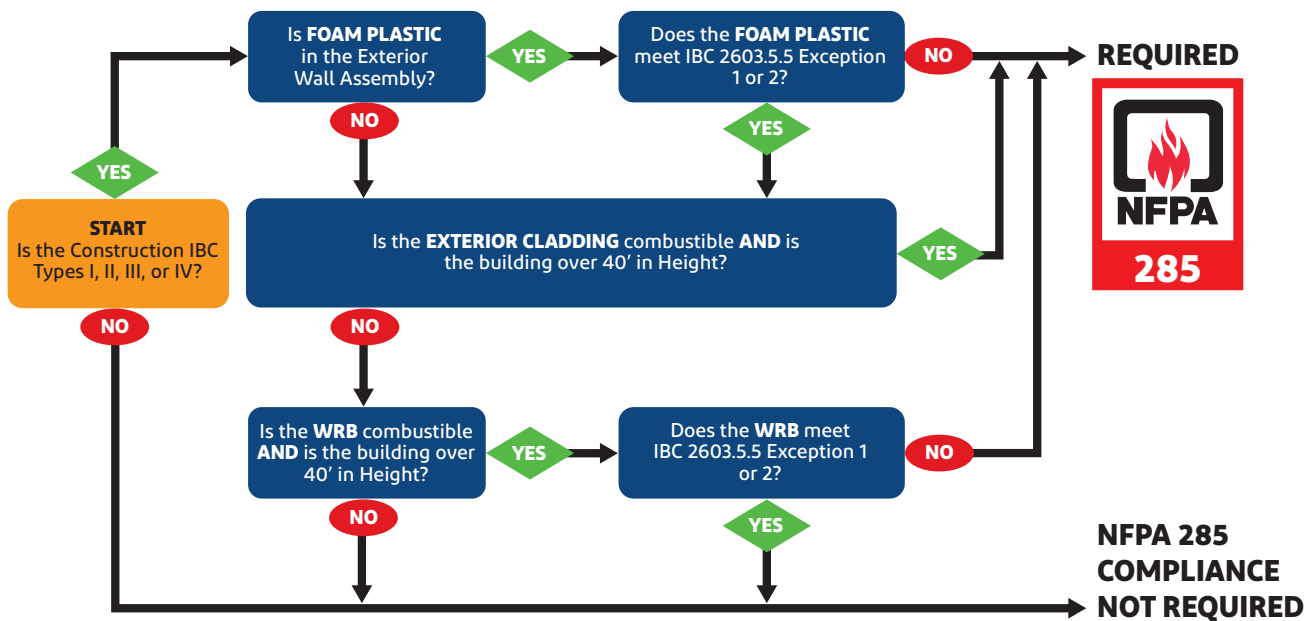
NFPA 285 is a full assembly test developed to assess the fire performance of a specific exterior wall assembly, where all components of the wall are detailed. In addition to an NFPA 285 test report, substitutions of component or construction configurations may be addressed through an engineering judgement or test extension letter based on the original NFPA 285 test. This compliance pathway is described in more detail.



When Is NFPA 285 Testing Required?

The decision tree “flow-diagram” for NFPA 285 compliance is included in Figure 2.

Figure 2. NFPA 285 Compliance Paths



The most direct approach to demonstrate compliance with the IBC NFPA 285 requirement is by testing an exact wall assembly at an accredited testing laboratory. The testing lab will issue a test report describing all components and installation details. The test applies to a specific assembly, any changes in materials or configurations may alter test results.

Additional compliance considerations include the following:

- Substitutions of one material for another in the wall assembly can affect the test results
- Addition of combustibles (insulation, water-resistive barriers), etc. can affect the test results
- Changes in configurations (air gaps, attachment systems, etc.) can cause different results
- Wall systems comprised from separately tested individual products or components do not ensure a successful NFPA 285 test result of the combined assembly

Considering the variables in types of foam plastic insulation, claddings, attachment methods, framing, etc., the number of tests will quickly escalate. Due to a limited number of accredited testing laboratories performing NFPA 285 tests, the time involved in building and testing each wall, and the expense incurred by the manufacturer for each test, it would be unfeasible to test every possible wall combination.

This situation is remediated through the use of engineering analysis, which results in an [engineering judgment letter](#) or extension letter that is issued by a third-party code and fire test expert. The use of engineering analysis in the commercial built environment is standard practice as similar types of analysis are used to design structural steel elements, HVAC, and electrical systems on projects regularly. Engineering analyses are specifically allowed by the IBC per Section 104.11 *Alternative materials, design and methods of construction and equipment*. The basis for any EJ will always be a NFPA 285 tested and passed wall assembly. A code and fire expert will evaluate how changes in materials or configurations to the NFPA 285 tested and passed wall assembly will affect the fire performance of a new wall configuration. The question that any fire expert is looking to answer is; does a different wall configuration still provide a wall assembly that exhibits similar fire performance as the original NFPA 285 tested and passed wall assembly? If the answer is ‘yes’ in the professional opinion of the code and fire expert, the new wall configuration is incorporated into the resulting EJ.

Therefore, design professionals and local code officials can both be confident in the use of EJ’s on projects they are involved with. They can be assured that an EJ affords them greater design freedom on exterior wall assemblies while offering the assurance that any wall combination designed from an appropriate EJ will provide a similar level of fire performance as the original NFPA 285 tested and approved wall assembly.



DuPont™ Tyvek® CommercialWrap® complies with IBC Section 1402.5; Exemption 2. Tyvek® CommercialWrap® qualifies as Class A building material per ASTM E84, and meets the test requirements of ASTM E1354 (cone calorimeter).

Water-Resistive Barriers in Exterior Wall Assemblies

Water-resistive barriers, referred to as WRBs in the IBC, can include building wraps, self-adhered building wraps, self-adhered membranes, and fluid-applied membranes intended to resist liquid water that has penetrated behind the exterior wall cladding from intruding further into the exterior wall assembly. Although Section 1402.5 of the 2018 IBC requires NFPA 285 testing for walls over 40 ft in height that contains a WRB, there is an important exemption where the WRB is the only combustibile in the exterior wall assembly, and the following conditions apply:

1. Walls in which the water-resistive barrier is the only combustibile component and the exterior wall has a wall covering of brick, concrete, stone, terra cotta, stucco or steel with minimum thicknesses in accordance with Table 1404.2.
2. Walls in which the water-resistive barrier is the only combustibile component and the WRB has
 - Class A-(ASTM E84^[1]) – Flame spread index of 25 or less and a smoke developed index of 450 or less and,
 - (ASTM E1354^[2]), Cone Calorimeter)-Peak heat release rate less than 150 kW/m², Total Heat Release of less than 20 MJ/m² and an Effective Heat of Combustion of less than 18 MJ/kg

Thus, if a wall assembly uses an exterior cladding listed in IBC 1402.5 Exception 1 and DuPont™ Tyvek® CommercialWrap® is the only combustibile component, then NFPA 285 testing is not required.



DuPont™ Thermax™ Sheathing and **Thermax™ XARMOR™ (ci) Exterior Insulation** have been tested and have met the requirements of NFPA 268, having been tested without an exterior veneer or cladding. For more information, follow this link: <https://www.dupont.com/content/dam/dupont/amer/us/en/performance-building-solutions/public/documents/en/ej-thermax-nfpa-268-analysis-nfpa-285-43-D100783-enUS.pdf>

DuPont™ Styrofoam™ Brand Insulation meets the requirements of NFPA 268 by complying with Section 2603.5.7 and applicable exceptions.

Foam Plastic Insulation in Exterior Wall Assemblies

Foam plastic insulation can be rigid extruded polystyrene, polyiso or expanded polystyrene boardstock, or open-cell and closed-cell spray polyurethane foam. Chapter 26 of the 2018 IBC regulates plastics used in construction, including foam plastic insulation in many applications. The use of foam plastic insulation in exterior walls is specifically addressed in Section 2603.5 which outlines provisions for the assembly containing foam insulation as well as the foam insulation itself. Generally, exterior wall assemblies containing foam plastic insulation of any height must be tested in accordance with NFPA 285 per Section 2603.5.5. However, there are two exceptions to this provision; a one story building with metal insulated panels, or where the foam insulation is covered on each side with at least 1" thick masonry or concrete and there is no air space between the foam and the concrete or masonry. If there is an airspace of 1" or less, the foam insulation must have a flame spread of 25 or less when tested by ASTM E84. Other requirements of 2603.5 must also be met if applicable.

In addition to the general NFPA 285 test requirement, foam plastic in exterior walls is also regulated by these IBC Sections:

- 2603.5.1 Fire-resistance-rated wall
- 2603.5.2 Thermal barrier
- 2603.5.3 Potential heat
- 2603.5.4 Flame spread smoke developed indices
- 2603.5.5 Vertical and lateral fire propagation
- 2603.5.6 Label required
- 2603.5.7 Ignition

The DuPont Commitment to Building Fire Safety

DuPont is actively involved in building fire safety through its participation in codes and standards development, along with offering continuing education opportunities for architects, code officials and others in the construction community regarding NFPA 285 requirements. Please contact your local DuPont Commercial Representative to schedule an educational event. Our Building Knowledge Center is available to help with more detailed information about the extensive fire testing of exterior wall assemblies with DuPont products. Please visit www.dupont.com/building/NFPA285 or call 1-833-338-7668 for the most current NFPA 285 listings featuring DuPont Building Envelope Solutions Products.

To learn more about Testing of Combustible Facades, visit <https://www.youtube.com/watch?v=vJE28Z-R9Eo>

Always comply with local building code regulations, which may vary from the model codes described in this document. Consult the local jurisdiction for their specific requirements.



For more information please contact your local DuPont Commercial Representative or call 1-833-338-7668 or visit us at building.dupont.com

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