

Understanding the Use of Air and Water-Resistive Barriers in NFPA 285 Compliant Wall Assemblies

Market demand for insulations, dedicated air and water-resistive barriers, and other combustible envelope materials are at an all-time high due to new building performance, facility life, and occupant health and safety requirements. Consequently, the code-required fire test standard called National Fire Protection Association (NFPA) 285 has become a subject of focus as its relevance has significantly increased with recent International Building Code (IBC) updates and the use of more combustible components in advanced wall systems.

While NFPA 285 *Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components* has actually been around for over 30 years, it is important for building industry professionals to become familiar with the history, relevance, and applicability of this testing requirement. It is also important to understand how the use of combustible air and water-resistive barriers relates to NFPA 285 code requirements.

WHAT IS NFPA 285?

Assembly fire performance is critical for evacuation and life safety purposes in high rise buildings. Fires in high rise buildings are especially dangerous due to limited rescue opportunities. **NFPA 285 is a full assembly test** developed to assess the fire performance of a specific wall assembly as a system. A test of the actual wall assembly such as NFPA 285 is generally required when non-combustible walls contain

combustible materials. Hence, all components of the wall need to be tested together for the entire assembly to pass the test. **As such, the individual components of the wall cannot be considered 'compliant' just because they were part of a tested assembly.**

The NFPA 285 multi-story test includes both interior and exterior burners. Both of these test configurations are needed in order to simulate real conditions as a fire may originate from within the structure or may spread from a nearby structure. Part of the fire testing includes application of a flame to the exterior of the structure focused on a window opening, where fire penetration and wall vulnerability is the greatest. NFPA 285 compliant wall systems will reduce the potential for vertical flame spread by exterior walls.

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
- Wall systems comprised from separately tested individual products or components do not ensure a successful NFPA 285 test result of the combined assembly
- Testing configurations can be extended within limits through the use of Engineering Judgement letters where appropriate

NFPA 285 Fire Test Parameters



No flame propagation in second-floor room



Inside wall assembly, thermocouples shall not exceed 1,000°F during the 35-minute test.



Externally, flames shall not reach 10 feet above the window's top.

Externally, flames shall not reach 5 feet laterally from the window's centerline.

UNDERSTANDING THE USE OF AIR AND WATER-RESISTIVE BARRIERS IN NFPA 285 COMPLIANT WALL ASSEMBLIES

WHAT ARE THE CODE REQUIREMENTS FOR NFPA 285 COMPLIANCE FOR AIR AND WATER-RESISTIVE BARRIERS (WRBs)?

While all wall assemblies with combustible materials (with some exceptions) are required to be tested, the 2012 IBC lists six provisions where NFPA 285 testing is specifically required. Included in *Section 1403.5* is a requirement for testing in accordance with the acceptance criteria of NFPA 285 for combustible water-resistive barriers (WRBs) used in buildings over 40 feet in height above grade plane of Type I, II, III, or IV construction. This WRB NFPA 285 “trigger” was a new addition to the 2012 IBC.

Air and water-resistive barriers (WRBs) referred to in the IBC as water-resistive barriers, can include building wraps, self-adhered building wraps, self-adhered membranes, and fluid-applied membranes. These materials are generally considered combustible. Although this addition to the 2012 IBC led to significant changes in fire testing requirements for WRB manufacturers, significant revisions and exceptions to Section 1403.5 have been included in the 2015 IBC. These revisions are based on material properties pertaining to ASTM E84, *Standard Test Method of Surface Burning Characteristics of Building Materials*, and fuel load potential pertaining to ASTM E1354, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*. The 2015 IBC exceptions exclude the NFPA 285 testing requirement if the WRB is the only combustible material in the exterior wall assembly and other conditions are met. The specific conditions include:

1. WRB is the only combustible wall component and the wall has a non-combustible covering (Table 1405.2)
2. WRB is the only combustible wall component and:
 - ASTM E84 Product Test:
 - flame spread index of 25 or less
 - smoke developed index of 450 or less
 - ASTM E1354 (Cone Calorimeter) Product Test:
 - Incident radiant heat flux of 50 kW/m²
 - Effective Heat of Combustion of less than 18 MJ/kg
 - Peak Heat Release Rate less than 150 kW/m²
 - Total Heat Release of less than 20 MJ/m²
3. Windows and doors, and window/door flashings are exempt

The surface burning characteristics for DuPont™ Tyvek® CommercialWrap® have been tested in accordance with ASTM E84. DuPont™ Tyvek® CommercialWrap® qualifies as Class A building material based on flame spread index and



smoke developed index. (Flame spread index = 10, smoke developed index = 10) and therefore meets the exception requirement for the ASTM E84 Product Test above.

ASTM E1354 is the standard for the cone calorimeter test intended to determine the response of materials when exposed to controlled levels of radiant heating and is based on the principle of oxygen consumption calorimetry. Radiant heat is the major cause of fire spread and this test measures critical factors in predicting the contributions of materials to the growth rate of fire. Specifically, ASTM E1354 was used to determine the peak heat release, total heat release, and effective heat of combustion for DuPont™ Tyvek® CommercialWrap®. Information to support the exception requirement for the ASTM E1354 (Cone Calorimeter) Product Test included in Section 1403.5 is summarized in the Table that follows.

ASTM E1354. Horizontal specimen orientation at radiant heat flux of 50kW/m²

Performance Criteria	DuPont™ Tyvek® CommercialWrap®
Peak Heat Release	Less than 150 kW/m ²
Total Heat Release	Less than 20 MJ/m ²
Effective Heat of combustion	Less than 18 MJ/kg

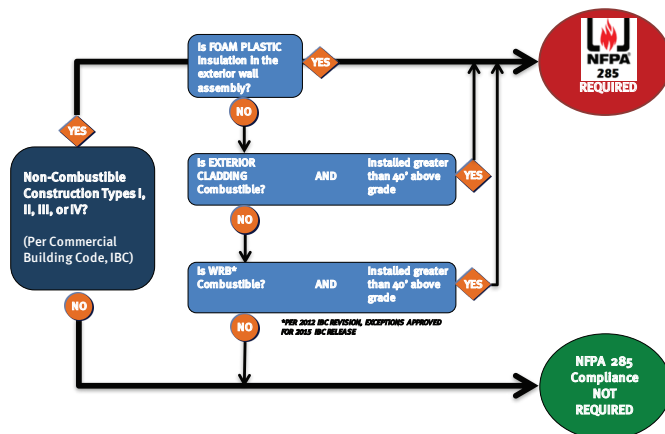


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WHEN IS NFPA 285 TESTING REQUIRED?

NFPA 285 testing is required by the 2012 IBC in walls of non-combustible construction if the exterior wall assembly has foam plastic insulation, combustible cladding, or a combustible WRB with exemptions provided for building height. Specifically, walls of non-combustible construction that are over 40' of Type I, II, III, or IV and include foam plastic insulation, combustible exterior cladding, or a combustible WRB require NFPA 285 testing. Type V wood construction does not require NFPA 285 compliance. The decision tree “flow-diagram” for NFPA 285 compliance is included in the Figure below.

IBC NFPA 285 Testing Requirements



WHAT ABOUT THE USE OF FIRE RETARDANT TREATED (FRT) WOOD?

The fire retardant treatment for FRT wood does not make the wood a non-combustible material. FRT wood is not classified as a non-combustible, but often can be used in specific locations or components of the building as an alternative to non-combustible materials. In addition, the model codes permit the use of FRT wood in cases where combustible materials are not permitted. For example, while Type III construction requires non-combustible materials for exterior walls, FRT wood framing within exterior wall assemblies with a two hour rating is permitted.

NFPA 285 is an **assembly** requirement and the limiting factor for FRT wood framed walls from an NFPA 285 compliance perspective is the wood-framing and not the WRB. The wood framing provides significantly more fuel load during testing than the WRB.

Under the current provisions, when a combustible WRB is installed as part of a non-combustible exterior wall assembly in Types I, II, III and IV construction, the exterior wall assembly is required to satisfy NFPA 285 unless the WRB complies with the exceptions discussed above. The exceptions state that they only apply when the WRB is the **ONLY** combustible component in the wall. However, it is not always the case that the exterior wall assembly is non-combustible as FRT wood can be used in exterior wall assemblies of Types I-IV construction as described above. Therefore, it is important to note that the use of a combustible WRB is a simply a “trigger” for NFPA compliance of the assembly. When a combustible WRB is used with wood framing, NFPA 285 compliance is only required on Type I, II, III or IV construction over 40'.

For additional information about the use of DuPont™ Tyvek® air and water barriers in NFPA 285 compliant wall assemblies, please visit www.weatherization.tyvek.com