PRIEST & ASSOCIATES CONSULTING, LLC

ENGINEERING EVALUATION

Dörken Systems, Inc. WRBs and

Atlas Polyiso Foam Insulation in NFPA 285 Assemblies

Project No. 10750A, Revision 3

Prepared for:

Dörken Systems, Inc.
4655 Delta Way
Beamsville, ON
L0R 1B4

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4607 Verdi Road
Pleasanton, TX 78064
www.priestassociates.com

Solutions for the Building Materials Industry

1-877-505-7743 Office
210-410-8217 Mobile
deg.priest@priestassociates.com

Abstract

Comparative Cone Calorimeter (ASTM E1354) data from Dörken Systems, Inc. *were analyzed to justify allowing specific* Dörken Systems, Inc. *WRBs on the base wall surface (under Atlas polyisocyanurate foam) in the previously evaluated NFPA 285 tables for NFPA 285 compliance referencing Atlas EEV 10226.*

The conclusions reached by this evaluation are true and correct, within the bounds of sound engineering practice. All reasoning for our decisions is contained within this document.

Submitted by,

Javier Trevino
Associate Engineer
210-601-0655

February 20, 2020

Reviewed and Approved,

Deg Priest
President

February 20, 2020

INTRODUCTION

The purpose of this evaluation is to allow use of specific Dörken Systems, Inc. WRBs on the base wall surface (under the Atlas polyiso) in previously evaluated Atlas NFPA 285 assemblies (Ref. 3) that can meet the requirements of NFPA 285 (Ref. 1). Comparative Cone Calorimeter data (Ref. 2) was submitted to compare the flammability of various Dörken Systems, Inc. WRB products to at least one WRB listed in the EEV. The peak Heat Release Rate of the Dörken Systems, Inc. WRBs were shown to be less than the listed product – thus the proposed use is justified.

REFERENCED DOCUMENTS

1) *NFPA 285-12 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-loadbearing Wall Assemblies Containing Combustible Components*
2) *Cone Calorimeter Data for* Dörken Systems, Inc. *- Data Confidential btw the client and Priest & Associates*
3) *Atlas EEV 10126 - NFPA 285 Assemblies*
4) *Babrauskas et al., 10 Years of Heat Release Research NIST Publication https://www.researchgate.net/publication/280309156_Ten_Years_of_Heat_Release_Research_with_the_Cone_Calorimeter*

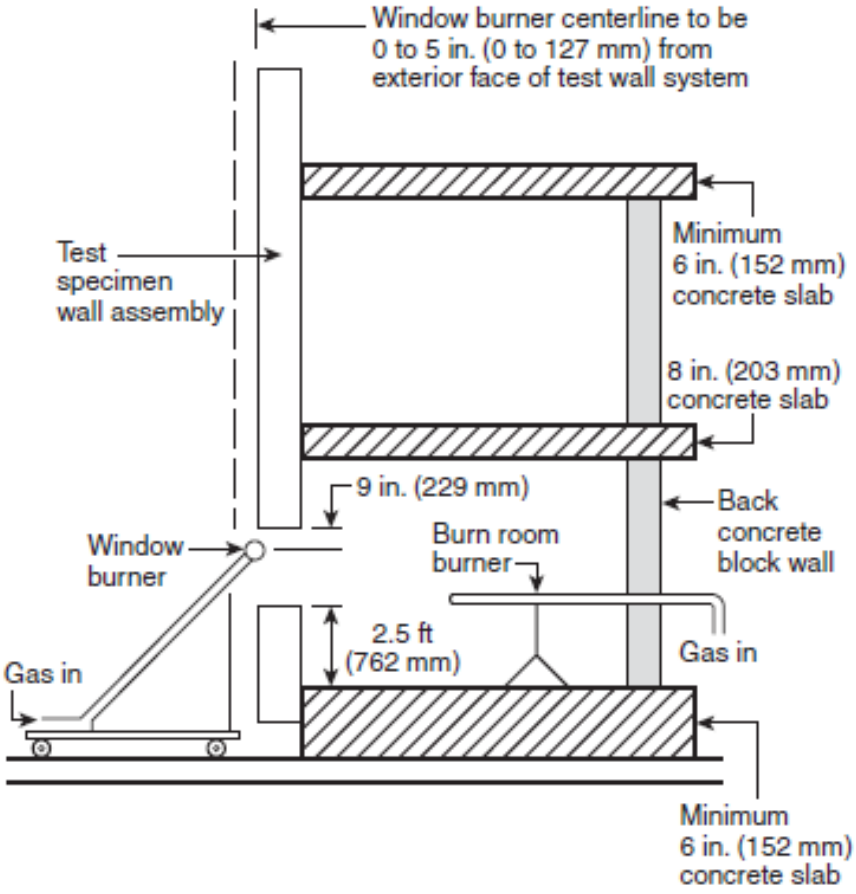
EVALUATION METHOD

NFPA 285 Criteria

The NFPA 285 fire test (Ref. 1) is designed to test the flame spread properties of exterior walls containing combustible components. Two noncombustible rooms are stacked to simulate two stories of a multi-story building. The wall assembly is then attached to the exterior face of the rooms. A typical test wall measures 14 ft x 18 ft with a 30 in. x 78 in. window opening placed on the bottom floor.

During a test, a calibrated fire starts in the bottom room. After 5 minutes, the exterior burner is ignited to produce a specific heat flux/temperature pattern on the exterior of the wall. Both burners remain ignited during the 30 minute test. Personnel monitor flame spread visually during the course of the test. A computer data acquisition system monitors and records the thermocouples temperatures. The criteria for passing (Ref. 1) are as follows (reworded in simple terms for this analysis):

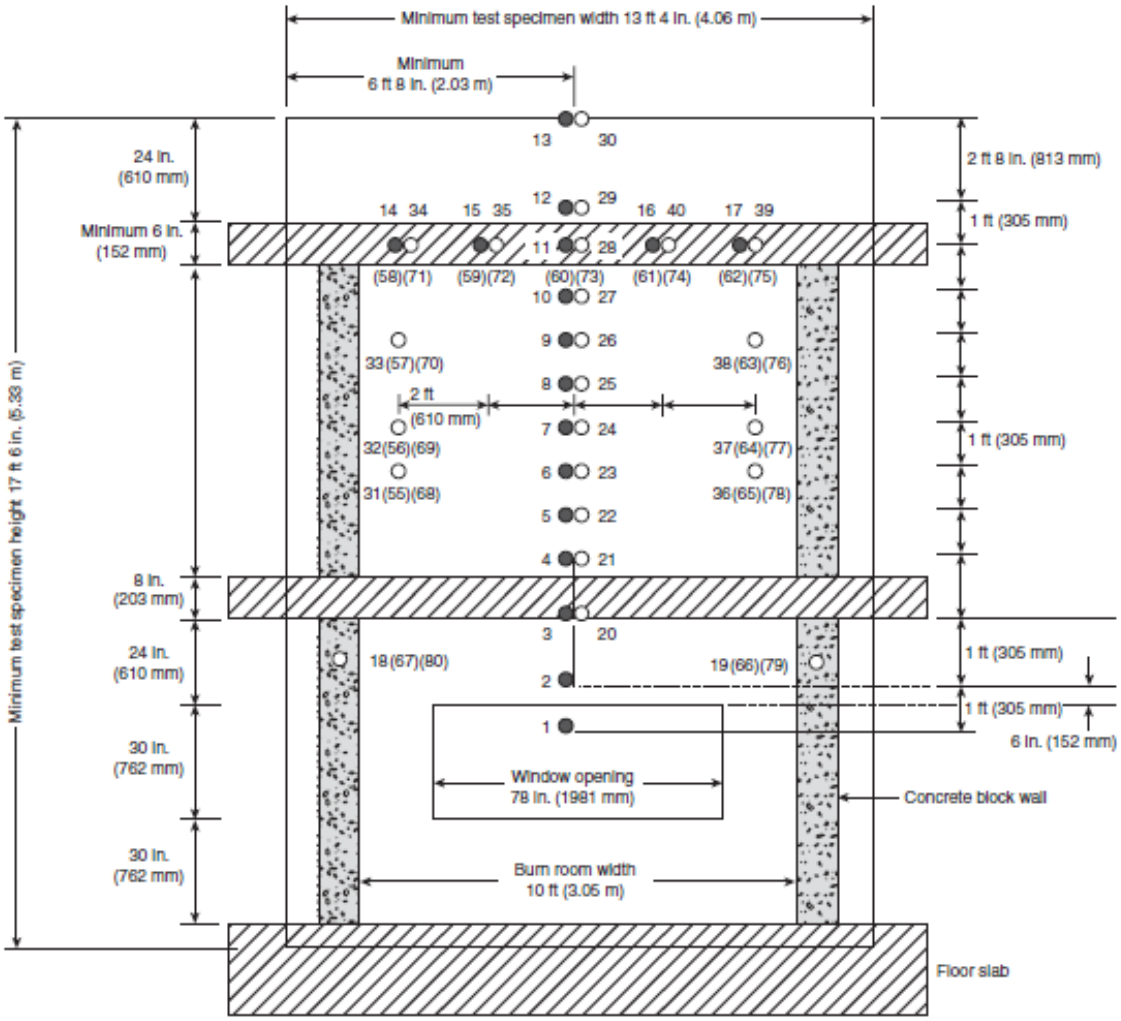
1) Flames shall not spread vertically 10 ft above the window opening as determined visually or by thermocouples located at the 10 ft level. Failure occurs when Thermocouples 11 or 14 - 17 exceed 1000 °F.
2) Flames shall not spread (visually) horizontally 5 ft on either side of the centerline of the window opening.
3) Flames shall not spread inside the wall cavity as determined by thermocouples placed within the wall cavity insulation and air-gaps if present. Failure occurs when Thermocouples 28 or 31 - 40 or 55 - 65 and 68 - 79 exceed 750 °F above ambient.
4) Flames shall not spread horizontally within the wall cavity past the interior room dimension as determined by wall cavity thermocouples. Failure occurs when Thermocouples 18 - 19, or 66 - 67, or 79 - 80 exceed 750 °F above ambient.
5) Flames shall not spread to the second story room as determined by interior wall surface thermocouples. Failure occurs when Thermocouples 49 - 54 exceed 500 °F above ambient.
6) Flames shall not occur in the second story (visually).
7) Flames shall not escape (visually) from the interior to the exterior at the wall/wall intersection of the bottom story room.



Two burners are ignited to produce a specific time-temperature profile in the room and on the exterior face of the wall.

Thermocouples are placed at strategic locations to monitor temperature as an indicator of flame spread.

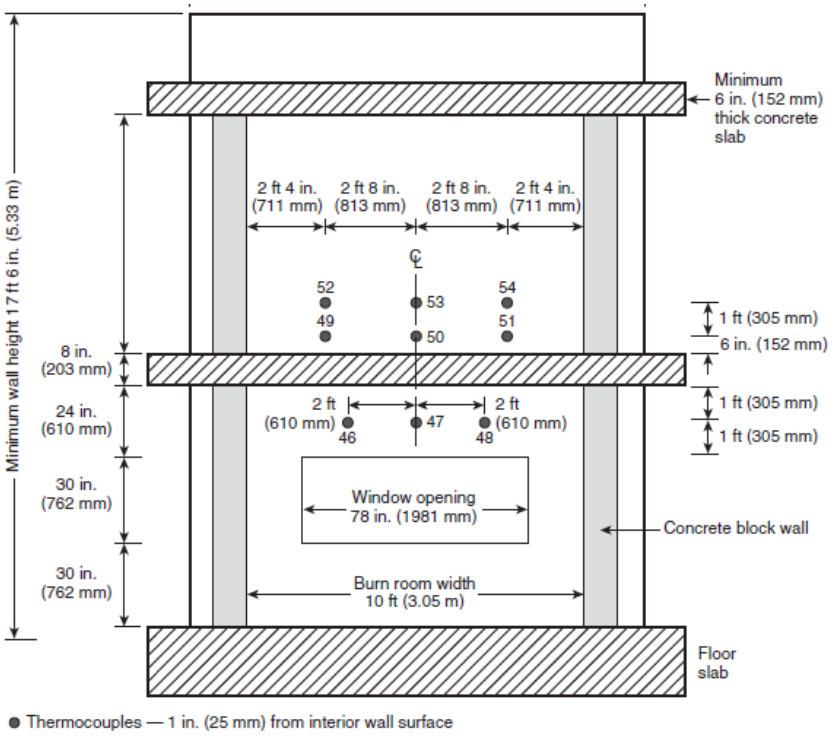
In the depictions below, Thermocouples 1 - 10, and 20 - 27 are not used for compliance purposes. The remainders are used to monitor flame spread.



● Thermocouples — 1 in. (25 mm) from exterior wall surface

○ Thermocouples — in the wall cavity air space or the insulation, or both, as shown in Figure 6.1(b) Details A through I.

( ) Thermocouples — Additional thermocouples in the insulation or the stud cavity, or both, where required for the test specimen construction being tested, as shown in Figure 6.1(b) Details C through I.



WRB Analysis

If an alternate WRB is less flammable than the NFPA 285 approved WRB, it is allowed as an alternate component. Cone calorimeter data (Ref. 2) of Dörken Systems, Inc. was submitted for evaluation.

Flame spread rate is dictated by the peak Heat Release Rate (pk HRR). The pk HRR induces heat flux on unburned material which ignites the unburned material and the process repeats as flames spread along surfaces. An excerpt from Ref. 4 suggests the following:

> "The earliest applications of Cone Calorimeter data have been in the polymers industry. Hitherto, in the US manufacturers typically have relied either on limiting oxygen index (LOI) [14] tests or on UL94 [15]. The latter is a simple Bunsen-burner type test which gives only pass/fail results; it is clear that quantitative information useful for polymer development does not come from such a test. The former, however, does give quantitative results and uses what would appear to be a suitable engineering variable. Again, however, a recent study has clearly demonstrated that the results, while quantitative, are not capable of even correctly rank-ordering according to actual fire behavior [16]. By contrast, it has been shown quite clearly that heat release rate is the single most important variable describing the hazard of the actual fire [17]."

Based on this, when comparing a tested material to an alternate material, the alternate material shall have a lower peak Heat Release Rate (pk HRR) than the tested material when tested per ASTM E1354.

Based on the analysis above, the following is allowed.

WRB	Allowed Location
Dörken Systems Inc. Delta Stratus SA	Under Atlas polyiso insulation (on base wall surface) in EEV 10126
Dörken Systems Inc. DELTA-VENT SA	Under Atlas polyiso insulation (on base wall surface) in EEV 10126
Dörken Systems Inc. DELTA-VENT S	Under Atlas polyiso insulation (on base wall surface) in EEV 10126
Dörken Systems Inc. DELTA®-FASSADE S	Under or Over Atlas Polyiso in EEV 10126

Approved Assemblies

This evaluation is based on the Atlas EEV 10126 (Ref. 3) as the basis document.

NFPA 285 Table of Allowed Constructions

The following table shows the relevant content for specific WRBs for use with Atlas insulation based on the referenced EEV. 4 pcf (min.), 1 inch thick (min.) mineral wool may replace the polyiso since mineral wool is noncombustible.

TABLE OF SUBSTITUTIONS

Wall Component	
Base Wall – Use either 1, 2, 3 or 4	1) 1" min. Cast Concrete Walls 2) 1" min. CMU Concrete Walls 3) 20 GA (min.) 3⅝" (min.) steel studs spaced 24" OC (max.) ⅝ in. type X Gypsum Wallboard Interior 4) FRT wood studs spaced 24 in. OC (max.) with ⅝ in. type X Gypsum Wallboard Interior
Fire-Stopping in Stud Cavity at floor lines – Use 1 or 2	1) None (only with exterior sheathing Option 1 or 2 – gypsum sheathing or concrete) 2) 4 lb/ft^3 mineral wool (e.g., Thermafiber) in each stud cavity at each floor line – attached with Z-clips or equivalent
Cavity Insulation - Use any item 1 - 16 Note: Cavity Insulations 5 - 16 must use floor line fire-stopping compliant with Item 2 and ⅝" exterior gypsum sheathing.	1) None 2) Any noncombustible insulation per ASTM E136 3) Any mineral fiber (Board type Class A ASTM E84 faced or unfaced) 4) Fiberglass (Batt type Class A ASTM E84 faced or unfaced) 5) 5½" (max.) Icynene LD-C-50 spray foam in 6" deep studs (max.) full fill without an air gap 6) 5½" (max.) Icynene MD-C-200, 2 pcf spray foam in 6" deep studs (max.) full fill without an air gap 7) 5½" (max.) Icynene MD-R-210, 2 pcf spray foam in 6" deep studs (max.) full fill without an air gap 8) 6" (max.) SWD Urethane QS 112, 2 pcf spray foam in 6" deep studs (max.) or partial fill with a maximum 2½" air gap 9) 3½" (max.) Gaco Western 183M spray foam in 3⅝" deep studs (max.) 10) Gaco Western F1850 (3½" max.). Use with ⅝" exterior sheathing in 3⅝" deep studs (max.) 11) Demilec Sealection 500 (3⅝" max). Use with ⅝" exterior sheathing in 3⅝" deep studs (max.) 12) Demilec HeatLok Soy 200 Plus (3.4" max). Use with ⅝" exterior sheathing in 3⅝" deep studs (max.) 13) Bayer Bayseal (3" max). Use with ⅝" exterior sheathing. 14) Lapolla FoamLok FL 2000 (3" max). Use with ⅝" exterior sheathing in 3⅝" deep studs (max.) 15) BASF SprayTite 81206 or WallTite (US & US-N) (3⅝" max). Use with ⅝" exterior sheathing in 3⅝" deep studs (max.) 16) Accella (Premium Spray Products) Foamsulate 220 (3⅝ in. max.). Use with ⅝ inch exterior sheathing in 3⅝ in. deep studs (max.).
Exterior Sheathing – Use either 1, 2 or 3	1) ½" or thicker exterior gypsum sheathing 2) 2" precast concrete panels attached to structural elements of building 3) None – when cavity SPF insulation is not used. When SPF is used in stud cavity, exterior sheathing must be used. See specified sheathings above.

WRB – Use 1, 2 or 3 or 4	1) Dörken Systems Inc. Delta Stratus SA 2) Dörken Systems Inc. DELTA-VENT SA 3) Dörken Systems Inc. DELTA-VENT S 4) Dörken Systems Inc. DELTA®-FASSADE S
Exterior Insulation – Use either 1, 2, 3 or 4 Items 1 - 3 may be multiple layers of 1 inch thick (minimum) with facers on each side.	1) 4" (max.) EnergyShield Pro (or Pro2). 2) 4" (max.) RBoard Pro (or EnergyShield CGF Pro) 3) 4¾" (max.) EnergyShield Ply Pro (4" EnergyShield CGF Pro w/ ⅝" or ¾" FRT Plywood). 4) Unfaced mineral wool (minimum 1 inch thick, 4 pcf density) that meets ASTM E136 non-combustible testing.
WRB Over Insulation	Dörken Systems Inc. DELTA®-FASSADE S
Exterior Cladding – Use any Item 1 - 15 Note: Cladding 8 (Zinc) may only be used with EnergyShield Pro or Pro2).	1) Brick a) Brick Veneer Anchors – standard types – installed maximum 24" OC (max.) vertically on each stud b) Maximum 2" air gap between exterior insulation and brick. c) Standard Nominal 4" thick clay brick or veneer 2) Stucco – minimum ¾" thick exterior cement plaster and the lath. A secondary WRB can be installed between the exterior insulation and lath. The secondary WRB shall not be full coverage asphalt or butyl based self-adhering membranes. 3) Limestone – minimum 2" thick 4) Natural Stone Veneer – minimum 2" thick 5) Cast Artificial Stone – minimum 1½" thick complying with ICC-ES AC 51 6) Terra Cotta Cladding – Use any terracotta cladding system in which terracotta is minimum 1¼" thick. Any installation technique can be used (open or non-open joint). 7) Any ACM that has passed NFPA 285 8) Uninsulated sheet metal building panels including aluminum, steel, copper or zinc (see note) 9) Uninsulated fiber-cement cladding panels minimum ¼" thick (open or non-open joint) 10) Stone/Aluminum honeycomb composite building panels that have successfully passed NFPA 285 criteria. 11) Autoclaved-aerated-concrete (AAC) panels minimum 1½" thick. 12) Reynobond Zinc ZCM Zinc metal composite panel 13) Terreal Zephir Evolution Rainscreen System (terra cotta), minimum $^{9}/_{16}$" thick 14) FunderMax M.Look using the manufacturer standard installation technique. The air gap between the cladding and insulation or WRB must not exceed 1½ inches. 15) CERACLAD using the manufacturers standard installation technique with an air gap not exceeding 15mm.

~ End of Report ~