



**PRIEST & ASSOCIATES
CONSULTING, LLC**

ENGINEERING EVALUATION

Dörken Systems, Inc. WRBs and
Carlisle Polyiso Foam Insulation in NFPA 285 Assemblies

Project No. 10750E

Prepared for:

Dörken Systems, Inc.
4655 Delta Way
Beamsville, ON
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May 1, 2019

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 Carlisle polyisocyanurate foam) in the previously evaluated NFPA 285 tables for NFPA 285 compliance referencing Carlisle EEV 10123.

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,



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May 1, 2019

Reviewed and Approved,



Deg Priest
President

May 1, 2019



INTRODUCTION

The purpose of this evaluation is to allow the use of specific Dörken Systems, Inc. WRBs on the base wall surface (under the Carlisle polyiso) in previously evaluated Carlisle 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) *Carlisle EEV 10123 - 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

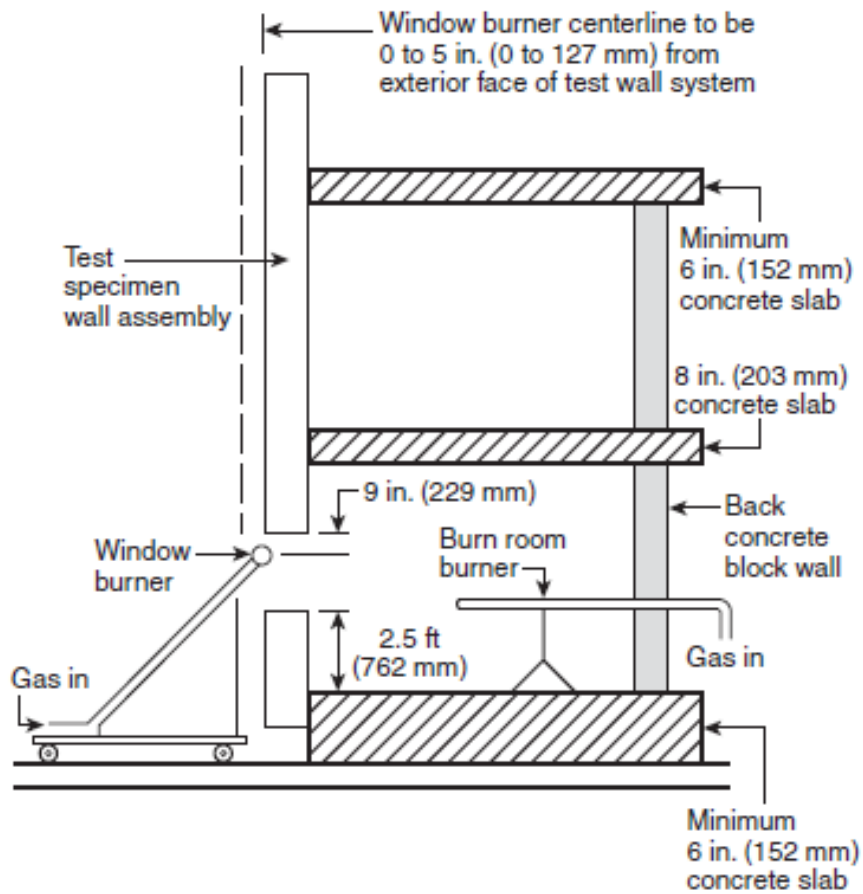
NFPA 285 Criteria

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.



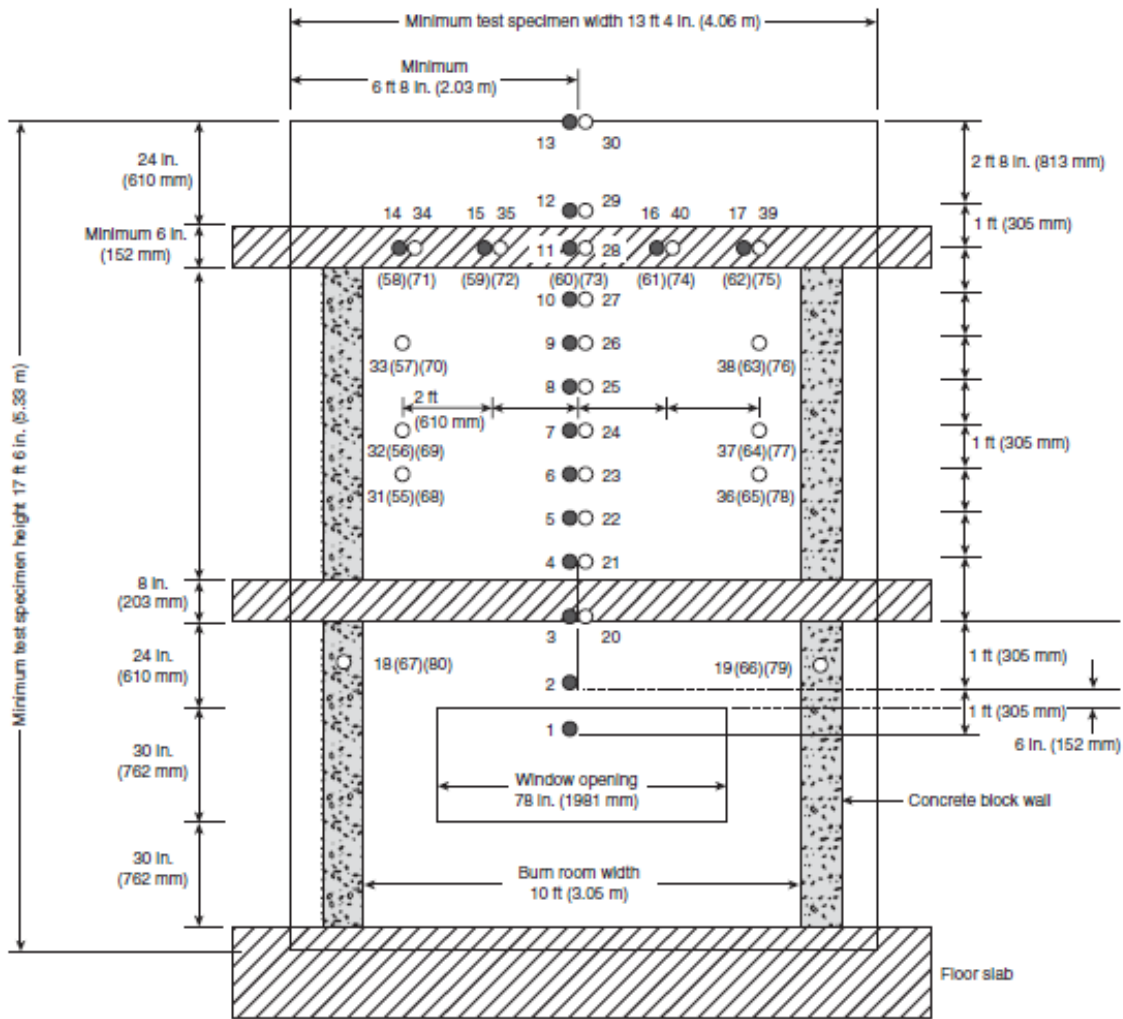


Two burners are ignited to produce a specific time-temperature profile in the room and on the exterior face of the wall.

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

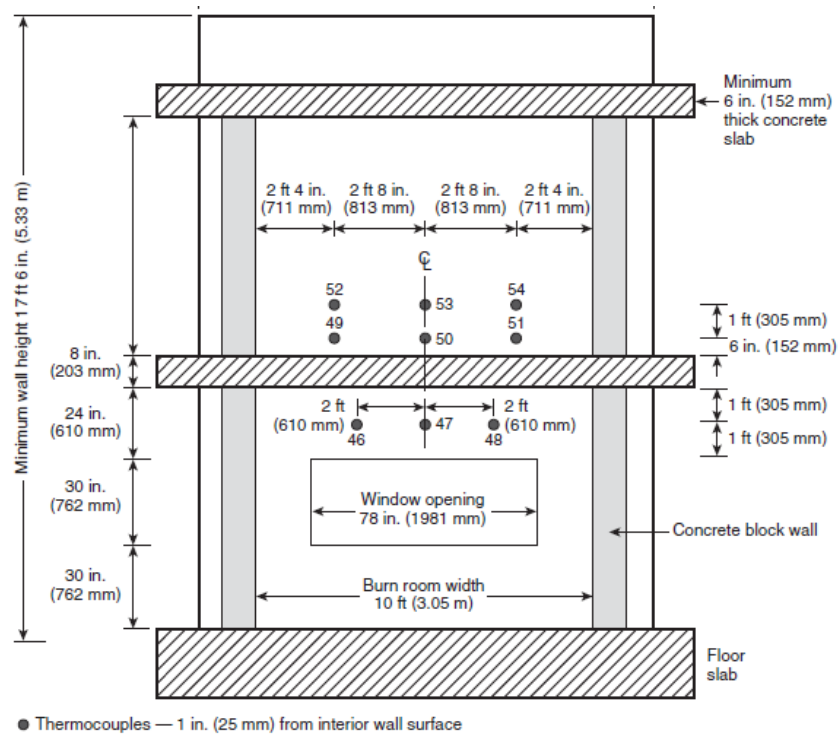
In the depictions below, thermocouples 1 - 10, and 20 - 27 are not used for compliance purposes. The remainders are used to monitor flame spread.





- 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.

A previous Dörken evaluation (Ref. Carlisle EEV 10123) evaluated other Dörken products to be used as well.



Based on the analysis and previous evaluation, the following is allowed.

WRB	Allowed Location
Dörken Systems Inc., Delta-Vent SA, Delta-Vent S, Delta-Fassade S, Delta Maxx, Delta Stratus SA	Under Carlisle polyiso insulation (on base wall surface) in EEV 10123
Dörken Systems Inc., Delta-Vent SA, Delta-Vent S, Delta-Fassade S, Delta Maxx	Over Carlisle polyiso insulation in EEV 10123

Approved Assemblies

This evaluation is based on the Carlisle EEV 10123 (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 Carlisle insulation based on the referenced EEV. The modified table does not allow “None” since a substrate is needed for WRB’s on the base wall surface.

4 pcf (min.), 1 inch thick (min.) mineral wool may replace the polyiso since mineral wool is noncombustible. If no insulation is used, only the WRBs allowed for use over the insulation may be used on the base wall surface.

Table 1: R2+ SHEATHE Exterior Insulation

Wall Component	
Base Wall – Use either 1, 2, 3 or 4	<ol style="list-style-type: none"> 1) Cast Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⁵/₈" (min.) steel studs spaced 24" OC (max.) <ol style="list-style-type: none"> a. 5⁸/₈" type X Gypsum Wallboard Interior b. Lateral Bracing every 4 ft 4) FRTW (Fire-retardant-treated wood) studs: min. nominal 2 x 4 dimension, spaced 24" OC (max.) <ol style="list-style-type: none"> a. 5/8 in. type X Gypsum Wallboard Interior b. Bracing as required by code
Fire-Stopping at floor lines	<ol style="list-style-type: none"> 1) Any approved mineral fiber based safing insulation in each stud cavity at floor line. Safing thickness must match stud cavity depth. 2) Solid FRTW fire blocking at floor line in accordance with building code requirements for Type III construction.
Cavity Insulation – Use either: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11. Note: Items 2, 3, 8, 9, 10 & 11 may only be used with exterior sheathing 2.	<ol style="list-style-type: none"> 1) None 2) 1½" (min.) of Bayer (Covestro) EcoBay CC SPF (up to full cavity thickness) 3) 1½" (min.) of BASF Walltite SPF (up to full cavity thickness) 4) Any noncombustible insulation per ASTM E136 5) Any Mineral Fiber (Board type Class A ASTM E84 faced or unfaced) 6) Any Fiberglass (Batt Type Class A ASTM E84 faced or unfaced) 7) Any foam plastic insulation (SPF or board type) which has been tested per ASTM E1354 (at a minimum of 20 kW/m² heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than Bayer (Covestro) EcoBay CC or BASF Walltite.



	<ol style="list-style-type: none"> 8) NCFI InsulBloc SPF (up to full cavity thickness) 9) Icynene Proseal up to 5½ inches (only with ½ in. (min.) exterior gypsum sheathing) 10) SWD Urethane Quick-Shield 112 up to 6 inches in 6 inch (max.) stud cavities with an air gap not exceeding 2½ inches. 11) 1½" (min.) ThermoSeal 2000 (up to full cavity thickness)
Exterior Sheathing – Use either 2 or 3	<ol style="list-style-type: none"> 1) None (not allowed since WRB must have a substrate) 2) ½" or thicker exterior gypsum sheathing 3) ½" (min.) FRTW structural panels in Type III construction
WRB over Base Wall Surface	See Table 5
Exterior Insulation – Use either 1, 2, 3 or 4	<ol style="list-style-type: none"> 1) 3½" thick (max.) R2+ SHEATHE for all claddings listed 2) 4" thick R2+ SHEATHE for claddings 1-6 3) Unfaced mineral wool (minimum 1 inch thick, 4 pcf density) that meets ASTM E136 non-combustible testing. 4) None (only with the WRB list below (WRB over insulation) with the WRB applied direct to base wall surface)
WRB over Exterior Insulation	<ol style="list-style-type: none"> 1) See Table 5
Exterior Cladding - Use either 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,13, 14, 15, 16 or 17. Item 7 may use any tested/approved installation technique. Items 8, 9 and 12 may use any standard installation technique.	<ol style="list-style-type: none"> 1) Brick – Nominal 4" clay or concrete brick or veneer with maximum 2" air gap behind the brick. Brick Ties/Anchors 24" OC (max.) 2) Stucco – minimum ¾" thick exterior cement plaster and lath. For systems which require a more durable WRB system, any building wrap or 15# felt that meets requirement #11 in "WRB over Exterior Insulation" can be used as a slip sheet between the WRB/external insulation and the lath. 3) Limestone – minimum 2" thick using any standard non-open joint installation technique such as shiplap 4) Natural Stone Veneer – minimum 2" thick using any standard non-open joint installation technique such as grouted/mortared stone 5) Cast Artificial Stone – minimum 1½" thick complying with ICC-ES AC 51 using any standard non-open joint installation technique such as shiplap 6) Terra Cotta Cladding – minimum 1¼" thick (solid or equivalent by weight) using any standard non-open joint installation technique such as shiplap 7) Any MCM that has successfully passed NFPA 285 8) Uninsulated sheet metal building panels including steel, copper, aluminum or zinc 9) ¼ inch (min.) uninsulated fiber-cement siding or porcelain or ceramic tile mechanically attached 10) Stone, porcelain, ceramic/aluminum honeycomb composite building panels that have successfully passed NFPA 285 criteria 11) Autoclaved-aerated-concrete (AAC) panels that have successfully passed NFPA 285 criteria 12) Terra Cotta Cladding – Any Rain-screen Terra Cotta (min. ½" thick) with ventilated shiplap 13) ½ inch Stucco – Any one coat stucco (½ inch min.) which meets AC11 acceptance criteria or is approved for use in Type I-IV construction or has been tested per NFPA 285 or stays in place when tested per ASTM E119 (stucco exposed to fire) for at least 30 minutes 14) Thin brick/cultured stone set in thin set adhesive and metal lath that has been tested to ASTM E119 (brick exposed to furnace) and remains in place for a minimum of 30 minutes, or has passed an NFPA 285 test. Minimum ¾". For these systems which require a more durable WRB system, any building wrap or 15# felt that meets requirement #11 in "WRB over Exterior Insulation" can be used as a slip sheet between the WRB/AVP and the lath.



	<ul style="list-style-type: none"> 15) Glen Gery Thin Tech Elite Series Masonry Veneer or TABS II Panel System with ½" thick bricks using TABS Wall Adhesive 16) Natural Stone Veneer – minimum 1¼" thick using any standard installation technique. 17) FunderMax M.Look Grey Core – minimum ¼ inch thick using any standard installation technique
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Table 2: R2+ MATTE or R2+ MATTE (Class A) Exterior Insulation

Wall Component	
Base Wall – Use either 1, 2, 3 or 4	<ul style="list-style-type: none"> 1) Cast Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⅝" (min.) steel studs spaced 24" OC (max.) <ul style="list-style-type: none"> a. ⅝" type X Gypsum Wallboard Interior b. Lateral Bracing every 4 ft 4) FRTW studs: min. nominal 2 x 4 dimension, spaced 24" OC (max.) <ul style="list-style-type: none"> a. ⅝ in. type X Gypsum Wallboard Interior b. Bracing as required by building code
Fire-Stopping at floor lines	<ul style="list-style-type: none"> 1) Any approved mineral fiber based safing insulation in each stud cavity at floor line. Safing thickness must match stud cavity depth. 2) Solid FRTW fire blocking at floor line in accordance with building code requirements for Type III construction
Cavity Insulation – Use either: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 Items 3, 8, 9, 10 & 11 may only be used with exterior sheathing 2.	<ul style="list-style-type: none"> 1) None 2) 1½" (min.) of Bayer (Covestro) EcoBay CC SPF (up to full cavity thickness) 3) 1½" (min.) of BASF Walltite SPF (up to full cavity thickness) 4) Any noncombustible insulation per ASTM E136 5) Any Mineral Fiber (Board type Class A ASTM E84 faced or unfaced) 6) Any Fiberglass (Batt Type Class A ASTM E84 faced or unfaced) 7) Any foam plastic insulation (SPF or board type) which has been tested per ASTM E1354 (at a minimum of 20 kW/m² heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than Bayer (Covestro) EcoBay CC or BASF Walltite. 8) NCFI InsulBloc SPF (up to full cavity thickness) 9) Icynene Proseal up to 5½ inches (only with ½ in. (min.) exterior gypsum sheathing) 10) SWD Urethane Quick-Shield 112 up to 6 inches in 6 inch (max.) stud cavities with an air gap not exceeding 2½ inches 11) 1½" (min.) ThermoSeal 2000 (up to full cavity thickness)
Exterior Sheathing Use 2 or 3	<ul style="list-style-type: none"> 1) None (not allowed since WRB must have a substrate) 2) ½" or thicker exterior gypsum sheathing 3) ½" (min.) FRTW structural panels in Type III construction
WRB over Base Wall Surface	See Table 5
Exterior Insulation – Use either 1, 2, 3 or 4	<ul style="list-style-type: none"> 1) 3½" thick (max.) R2+ MATTE or R2+ MATTE (Class A) for all claddings listed 2) 4" thick (max) R2+ MATTE or R2+ MATTE (Class A) for claddings 1-6 3) Unfaced mineral wool (minimum 1 inch thick, 4 pcf density) that meets ASTM E136 non-combustible testing. 4) None (only with the WRB list below (WRB over insulation) with the WRB applied direct to base wall surface)
WRB over Exterior Insulation	See Table 5
Exterior Cladding - Use either 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,	<ul style="list-style-type: none"> 1) Brick – Nominal 4" clay or concrete brick or veneer with maximum 2" air gap behind the brick. Brick Ties/Anchors 24" OC (max.) 2) Stucco – minimum ¾" thick exterior cement plaster and lath. For systems which require a more durable WRB system, any building wrap or 15# felt



<p>12, 13, 14, 15, 16 or 17</p> <p>Item 7 may use any tested/approved installation technique.</p> <p>Items 8, 9 and 12 may use any standard installation technique.</p>	<p>that meets requirement #11 in "WRB over Exterior Insulation" can be used as a slip sheet between the WRB/external insulation and the lath</p> <ol style="list-style-type: none"> 3) Limestone – minimum 2" thick using any standard non-open joint installation technique such as shiplap 4) Natural Stone Veneer – minimum 2" thick using any standard non-open joint installation technique such as grouted/mortared stone 5) Cast Artificial Stone – minimum 1½" thick complying with ICC-ES AC 51 using any standard non-open joint installation technique such as shiplap 6) Terra Cotta Cladding – minimum 1¼" thick (solid or equivalent by weight) using any standard non-open joint installation technique such as shiplap 7) Any MCM that has successfully passed NFPA 285 8) Uninsulated sheet metal building panels including steel, copper, aluminum 9) ¼ inch (min.) uninsulated fiber-cement siding or porcelain or ceramic tile mechanically attached 10) Stone, porcelain, ceramic/aluminum honeycomb composite building panels that have successfully passed NFPA 285 criteria 11) Autoclaved-aerated-concrete (AAC) panels that have successfully passed NFPA 285 criteria 12) Terra Cotta Cladding – Any Rain-screen Terra Cotta (min. ½" thick) with ventilated shiplap. 13) ½ inch Stucco – Any one coat stucco (½ inch min.) which meets AC11 acceptance criteria or is approved for use in Type I-IV construction or has been tested per NFPA 285 or stays in place when tested per ASTM E119 (stucco exposed to fire) for at least 30 minutes 14) Thin brick/cultured stone set in thin set adhesive and metal lath that has been tested to ASTM E119 (brick exposed to furnace) and remains in place for a minimum of 30 minutes, or has passed an NFPA 285 test. Minimum ¾". For these systems which require a more durable WRB system, any building wrap or 15# felt that meets requirement #11 in "WRB over Exterior Insulation" can be used as a slip sheet between the WRB/AVP and the lath. 15) Glen Gery Thin Tech Elite Series Masonry Veneer or TABS II Panel System with ½" thick bricks using TABS Wall Adhesive 16) Natural Stone Veneer – minimum 1¼" thick using any standard installation technique. 17) FunderMax M.Look Grey Core – minimum ¼ inch thick using any standard installation technique
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Table 3: R2+ SILVER Exterior Insulation

Wall Component	
<p>Base Wall – Use either 1, 2, 3 or 4</p>	<ol style="list-style-type: none"> 1) Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⅝" (min.) steel studs spaced 24" OC (max.) <ol style="list-style-type: none"> a. ⅝" type X Gypsum Wallboard Interior b. Lateral Bracing every 4 ft 4) FRTW studs: min. nominal 2 x 4 dimension, spaced 24" OC (max.) <ol style="list-style-type: none"> a. ⅝" type X Gypsum Wallboard Interior b. Bracing as required by code
<p>Fire-Stopping at floor lines</p>	<ol style="list-style-type: none"> 1) Any approved mineral fiber based safing insulation in each stud cavity at floor line. Safing thickness must match stud cavity depth. 2) Solid FRTW fire blocking at floor line in accordance with building code requirements for Type III construction.
<p>Cavity Insulation – Use either: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11.</p>	<ol style="list-style-type: none"> 1) None 2) 1½" (min.) of Bayer (Covestro) EcoBay CC SPF (up to full cavity thickness) 3) 1½" (min.) of BASF Walltite SPF (up to full cavity thickness)



<p>Note: Items 2, 3, 8, 9, 10 & 11 may only be used with Exterior Sheathing 2.</p>	<ol style="list-style-type: none"> 4) Any noncombustible insulation per ASTM E136 5) Any Mineral Fiber (Board type Class A ASTM E84 faced or unfaced) 6) Any Fiberglass (Batt Type Class A ASTM E84 faced or unfaced) 7) Any foam plastic insulation (SPF or board type) which has been tested per ASTM E1354 (at a minimum of 20 kW/m² heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than Bayer (Covestro) EcoBay CC or BASF Walltite. 8) NCFI InsulBloc SPF (up to full cavity thickness) 9) Icynene Proseal up to 5½ inches (only with ½ in. (min.) exterior gypsum sheathing) 10) SWD Urethane Quick-Shield 112 up to 6 inches in 6 inch (max.) stud cavities with an air gap not exceeding 2½ inches. 11) 1½" (min.) ThermoSeal 2000 (up to full cavity thickness)
<p>Exterior Sheathing Use 2 or 3</p>	<ol style="list-style-type: none"> 1) None (not allowed since WRB must have a substrate) 2) ½" or thicker exterior gypsum sheathing 3) ½" (min.) FRTW structural panels in Type III construction allowed in place of gypsum sheathing when combustible cavity insulation is not used.
<p>WRB over Base Wall Surface</p>	<p>See Table 5</p>
<p>Exterior Insulation – Use either 1, 2 or 3</p>	<ol style="list-style-type: none"> 1) 4" thick (max.) R2+ SILVER 2) Unfaced mineral wool (minimum 1 inch thick, 4 pcf density) that meets ASTM E136 non-combustible testing. 3) None (only with the WRB list below (WRB over insulation) with the WRB applied direct to base wall surface) <p>R2+Silver may be used with or without CavClear drainage mat (CavClear insulation system)</p>
<p>WRB over Exterior Insulation</p>	<p>See Table 5</p>
<p>Exterior Cladding - Use either 1, 2, 3, 4, 5 or 6</p>	<ol style="list-style-type: none"> 1) Brick – Nominal 4" clay or concrete brick or veneer with maximum 2" air gap behind the brick. Brick Ties/Anchors 24" OC (max.) 2) Stucco – minimum ¾" thick exterior cement plaster and lath. For systems which require a more durable WRB system, any building wrap or 15# felt that meets requirement #11 in "WRB over Exterior Insulation" can be used as a slip sheet between the WRB/external insulation and the lath. 3) Limestone – minimum 2" thick using any standard non-open joint installation technique such as shiplap 4) Natural Stone Veneer – minimum 2" thick using any standard non-open joint installation technique such as grouted/mortared stone 5) Cast Artificial Stone – minimum 1½" thick complying with ICC-ES AC 51 using any standard non-open joint installation technique such as shiplap 6) Terra Cotta Cladding – minimum 1¼" thick (solid or equivalent by weight) using any standard non-open joint installation technique such as shiplap

Table 4: R2+ BASE Exterior Insulation

<p>Wall Component</p>	
<p>Base Wall – Use either 1, 2, 3 or 4</p>	<ol style="list-style-type: none"> 1) Cast Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⅝" (min.) steel studs spaced 24" OC (max.) <ol style="list-style-type: none"> a. ⅝" type X Gypsum Wallboard Interior b. Lateral Bracing every 4 ft 4) FRTW studs: min. nominal 2 x 4 dimension, spaced 24" OC (max.) <ol style="list-style-type: none"> a. ⅝" type X Gypsum Wallboard Interior b. Bracing as required by code



<p>Fire-Stopping at Floor Lines</p>	<ol style="list-style-type: none"> 1) Any approved mineral fiber based safing insulation in each stud cavity at floor line. Safing thickness must match stud cavity depth. 2) Solid FRTW fire blocking at floor line in accordance with building code requirements for Type III construction
<p>Cavity Insulation – Use either: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11. Note: Items 3, 8, 9, 10 & 11 may only be used with Exterior Sheathing 2.</p>	<ol style="list-style-type: none"> 1) None 2) 1½" (min.) of Bayer (Covestro) EcoBay CC SPF (up to full cavity thickness) 3) 1½" (min.) of BASF Walltite SPF (up to full cavity thickness) 4) Any noncombustible insulation per ASTM E136 5) Any Mineral Fiber (Board type Class A ASTM E84 faced or unfaced) 6) Any Fiberglass (Batt Type Class A ASTM E84 faced or unfaced) 7) Any foam plastic insulation (SPF or board type) which has been tested per ASTM E1354 (at a minimum of 20 kW/m² heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than Bayer (Covestro) EcoBay CC or BASF Walltite. 8) NCFI InsulBloc SPF (up to full cavity thickness) 9) Icynene Proseal up to 5½ inches (only with ½ in. (min.) exterior gypsum sheathing) 10) SWD Urethane Quick-Shield 112 up to 6 inches in 6 inch (max.) stud cavities with an air gap not exceeding 2½ inches. 11) 1½" (min.) ThermoSeal 2000 (up to full cavity thickness)
<p>Exterior Sheathing – Use either 2 or 3</p>	<ol style="list-style-type: none"> 1) None (not allowed since WRB must have a substrate) 2) ½" or thicker exterior gypsum sheathing 3) ½" (min.) FRTW structural panels in Type III construction.
<p>WRB over Base Wall Surface</p>	<p>See Table 5</p>
<p>Exterior Insulation – Use either 1, 2, 3 or 4. Items 1 and 2 depend on cladding used.</p>	<ol style="list-style-type: none"> 1) 4.25" (max.) R2+ BASE (3.5 inch foam max., ¾ inch FR Plywood max.) with all claddings listed 2) 4¾ inch (max) R2+ BASE (4" foam max, ¾" FR Plywood max) may be used with claddings 1-6 3) Unfaced mineral wool (minimum 1 inch thick, 4 pcf density) that meets ASTM E136 non-combustible testing. 4) None (only with the WRB list below (WRB over insulation) with the WRB applied direct to base wall surface)
<p>WRB over Exterior Insulation</p>	<p>See Table 5</p>
<p>Exterior Cladding - Use either 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 or 17 Item 9 may use any tested/approved installation technique. Items 10, 11 and 14 may use any standard installation technique.</p>	<ol style="list-style-type: none"> 1) Brick – Nominal 4" clay or concrete brick or veneer with maximum 2" air gap behind the brick. Brick Ties/Anchors 24" OC (max.) 2) Stucco – minimum ¾" thick exterior cement plaster and lath. For systems which require a more durable WRB system, any building wrap or 15# felt that meets requirement #11 in "WRB over Exterior Insulation" can be used as a slip sheet between the WRB/external insulation and the lath 3) Limestone – minimum 2" thick using any standard non-open joint installation technique such as shiplap 4) Natural Stone Veneer – minimum 2" thick using any standard non-open joint installation technique such as grouted/mortared stone 5) Cast Artificial Stone – minimum 1½" thick complying with ICC-ES AC 51 using any standard non-open joint installation technique such as shiplap. 6) Terra Cotta Cladding – minimum 1¼" thick (solid or equivalent by weight) using any standard non-open joint installation technique such as shiplap 7) Thin brick/cultured stone set in thin set adhesive and metal lath that has been tested to ASTM E119 (brick exposed to furnace) and remains in place for a minimum of 30 minutes, or has passed an NFPA 285 test. Minimum ¾". For these systems which require a more durable WRB system, any building wrap or 15# felt that meets requirement #11 in "WRB over Exterior Insulation" can be used as a slip sheet between the WRB/AVP and the lath.



	<ul style="list-style-type: none"> 8) Glen Gery Thin Tech Elite Series Masonry Veneer or TABS II Panel System with ½" thick bricks using TABS Wall Adhesive 9) Any MCM that has successfully passed NFPA 285 10) Uninsulated sheet metal building panels including steel, copper, aluminum 11) ¼ inch (min.) Uninsulated Fiber-cement siding or porcelain or ceramic tile mechanically attached 12) Stone, porcelain, ceramic/aluminum honeycomb composite building panels that have successfully passed NFPA 285 criteria 13) Autoclaved-aerated-concrete (AAC) panels that have successfully passed NFPA 285 criteria 14) Terra Cotta Cladding – Any Rain-screen Terra Cotta (min. ½ " thick) with ventilated shiplap 15) ½ inch Stucco – Any one coat stucco (½ inch min) which meets AC11 acceptance criteria or is approved for use in Type I-IV construction or has been tested per NFPA 285 or stays in place when tested per ASTM E119 (stucco exposed to fire) for at least 30 minutes 16) Natural stone veneer – minimum 1¼" thick using any standard installation technique. 17) FunderMax M.Look Grey Core – minimum ¼ inch thick using any standard installation technique
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Table 5: Allowable WRB's for Tables 1 - 4

<p>WRB over Base Wall Surface Use any of Items 1 - 6</p>	<ul style="list-style-type: none"> 1) None 2) Dörken Systems Inc., Delta-Vent SA, 3) Dörken Systems Inc. Delta-Vent S, 4) Dörken Systems Inc. Delta-Fassade S, 5) Dörken Systems Inc. Delta Maxx, 6) Dörken Systems Inc. Delta Stratus SA
<p>WRB over Exterior Insulation Use any of Items 1 - 5</p>	<ul style="list-style-type: none"> 1) None 2) Dörken Systems Inc. Delta-Vent SA, 3) Dörken Systems Inc. Delta-Vent S, 4) Dörken Systems Inc. Delta-Fassade S, 5) Dörken Systems Inc. Delta Maxx

~ End of Report ~

