PRIEST & ASSOCIATES CONSULTING, LLC

ENGINEERING EVALUATION

Engineering Extensions based on 15 NFPA 285 Tests

Project No. 10123, Revision 39b – Summary Only

Prepared for:

Carlisle Coatings & Waterproofing Incorporated
900 Hensley Lane
Wylie, TX 75098

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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

Fifteen NFPA 285 test reports on various wall designs have been submitted to determine Engineering Extensions on several aspects of wall designs. These include cavity insulation, exterior sheathing, water resistive barrier (WRB), exterior insulation, exterior WRB, air gaps, claddings, window details and base wall framing. We have determined that engineering extensions on various components of the tested wall designs can meet the criteria of NFPA 285 with specific limitations.

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

September 12, 2019

Reviewed and Approved,

Deg Priest
President

September 12, 2019

Howard Stacy
Senior Scientist

September 12, 2019

INTRODUCTION

Fifteen NFPA 285 tests were conducted on various configurations of exterior wall system designs. The designs incorporated many variables including cavity insulation, exterior sheathing, water resistive barrier (WRB), exterior insulation, exterior WRB, air gaps, claddings, and window details. The purpose of this evaluation is to determine engineering extensions for the components that can meet the requirements of NFPA 285. From the wall systems tested, an analysis is conducted on the components tested. This will form a base wall system from which replacement components can be added. Additionally, several ESR approved competing wall systems incorporate similar features to the submitted wall systems. Some of the engineering extensions of those systems will also be examined in this evaluation.

SUBSTITUTION TABLES

The results of the analysis are presented in the following tables which list the allowable substitutions based on the tests submitted and Engineering Extensions as detailed in the appendix of this report.

Table 1: R2+ SHEATHE Exterior Insulation

Wall Component	
Base Wall – Use either 1, 2, 3 or 4	1) Cast Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⅝" (min.) steel studs spaced 24" OC (max.) a. ⅝" 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.) a. ⅝ in. type X Gypsum Wallboard Interior b. Bracing as required by code
Fire-Stopping at floor lines	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: For items 2, 3, 8, 9, 10 & 11 spray foam may not be used in constructions that utilize a foil faced exterior insulation and do not utilize an exterior sheathing. Items 2, 3, 8, 9, 10 & 11 may only be used with exterior sheathing 2.	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/m^2 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 either 1, 2 or 3	1) None (only with cavity insulation 1, 4, 5 or 6) 2) ½" or thicker exterior gypsum sheathing 3) ½" (min.) FRTW structural panels in Type III construction
WRB Over Base Wall Surface Use 1, 2 or 3	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP, Fire Resist 705 FR-A, Fire Resist Barritech NP (or NP LT), Fire Resist Barritech VP (or VP LT). Fire Resist 705 VP may be used with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives. Fire Resist 705 FR-A may be used with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives

	2) CCW-705 with 702 LV, 702 WB, Cav-Grip, Low VOC Travel-Tack, or 702 adhesive may be used with R2+ SHEATHE, or unfaced noncombustible insulation and cladding options 1-6 3) Other WRB's - See Table 5
Exterior Insulation – Use either 1, 2, 3 or 4 Note: A construction which utilizes no exterior sheathing may not use spray foam cavity insulation	1) 3½" thick (max.) R2+ SHEATHE for all claddings listed 2) 4" thick R2+ SHEATHE for claddings 1-6 3) Any noncombustible insulation (faced or unfaced) 4) Any exterior insulation which has been tested per ASTM E1354 (at a minimum of 20 kW/m^2 heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than those listed above.
WRB Over Exterior Insulation Use 1 or 2	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP (with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives), Fire Resist 705 FR-A (with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives), Fire Resist Barritech VP (or VP LT), Fire Resist Barritech NP (or NP LT) 2) Other WRB's – 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.	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/exterior 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. 15) Glen Gery Thin Tech Elite Series Masonry Veneer, TABS II Panel System with ½" thick bricks using TABS Wall Adhesive or Brick It MCS & CI Panel Systems.

	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

Table 2: R2+ MATTE or R2+ MATTE (Class A) Exterior Insulation

Wall Component	
Base Wall – Use either 1, 2, 3 or 4	1) Cast Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⅝" (min.) steel studs spaced 24" OC (max.) 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.) a. ⅝ in. type X Gypsum Wallboard Interior b. Bracing as required by building code
Fire-Stopping at floor lines	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.	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/m^2 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 1, 2 or 3	1) None (only with claddings 1 – 6, and cavity insulation 1, 2, 3, 4, 5, 6 or 11) – also see note for Cavity Insulation) 2) ½" or thicker exterior gypsum sheathing 3) ½" (min.) FRTW structural panels in Type III construction
WRB Over Base Wall Surface Use 1 or 2	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP, Fire Resist 705 FR-A, Fire Resist Barritech NP (or NP LT), Fire Resist Barritech VP (or VP LT). Fire Resist 705 VP may be used with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives. Fire Resist 705 FR-A may be used with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives 2) Other WRB's - See Table 5
Exterior Insulation – Use either 1, 2, 3 or 4	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) Any noncombustible insulation (faced or unfaced). 4) Any exterior insulation which has been tested per ASTM E1354 (at a minimum of 20 kW/m^2 heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than those listed above.

WRB Over Exterior Insulation Use 1 or 2	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP (with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives), Fire Resist 705 FR-A (with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives), Fire Resist Barritech VP (or VP LT), Fire Resist Barritech NP (or NP LT) 2) Other WRB's – 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.	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/exterior 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 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 or Brick It MCS & CI Panel Systems 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

Table 3: R2+ SILVER Exterior Insulation

Wall Component	
Base Wall – Use either 1, 2, 3 or 4	1) Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⅝" (min.) steel studs spaced 24" OC (max.) 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.) a. ⅝" type X Gypsum Wallboard Interior b. Bracing as required by code
Fire-Stopping at floor lines	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: For items 2, 3, 8, 9, 10 & 11 spray foam may not be used in constructions that utilize a foil faced exterior insulation and do not utilize an exterior sheathing. Items 2, 3, 8, 9, 10 & 11 may only be used with exterior sheathing 2.	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/m^2 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 1, 2 or 3	1) None (only with cavity insulation 1, 4, 5 or 6) 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.
WRB Over Base Wall Surface Use 1 or 2	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP, Fire Resist 705 FR-A, Fire Resist Barritech NP (or NP LT), Fire Resist Barritech VP (or VP LT). Fire Resist 705 VP may be used with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives. Fire Resist 705 FR-A may be used with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives 2) Other WRB's - See Table 5
Exterior Insulation – Use either 1, 2 or 3	1) 4" thick (max.) R2+ SILVER 2) Any noncombustible insulation (faced or unfaced) 3) Any exterior insulation which has been tested per ASTM E1354 (at a minimum of 20 kW/m^2 heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than those listed above. R2+Silver may be used with or without CavClear drainage mat (CavClear insulation system)
WRB Over Exterior Insulation Use 1 or 2	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP (with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives), Fire Resist 705 FR-A (with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives), Fire Resist Barritech VP (or VP LT), Fire Resist Barritech NP (or NP LT) 2) Other WRB's – See Table 5

Exterior Cladding - Use either 1, 2, 3, 4, 5 or 6	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/exterior 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

Wall Component	
Base Wall – Use either 1, 2, 3 or 4	1) Cast Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⅝" (min.) steel studs spaced 24" OC (max.) 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.) a. ⅝" type X Gypsum Wallboard Interior b. Bracing as required by code
Fire-Stopping at floor lines	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.	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/m^2 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 either 1, 2 or 3	1) None (only with cavity insulation 1, 2, 4, 5 or 6) – Also see note for cavity insulation 2) ½" or thicker exterior gypsum sheathing 3) ½″ (min.) FRTW structural panels in Type III construction.
WRB Over Base Wall Surface Use 1 or 2	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP, Fire Resist 705 FR-A, Fire Resist Barritech NP (or NP LT), Fire Resist Barritech VP (or VP LT). Fire Resist 705 VP may be used with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives. Fire Resist 705 FR-A may

	be used with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives 2) Other WRB's - See Table 5
Exterior Insulation – Use either 1, 2, 3 or 4. Items 1 and 2 depend on cladding used.	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) Any noncombustible insulation (faced or unfaced) 4) Any exterior insulation which has been tested per ASTM E1354 (at a minimum of 20 kW/m^2 heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than those listed above
WRB Over Exterior Insulation Use 1 or 2	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP (with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives), Fire Resist 705 FR-A (with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives), Fire Resist Barritech VP (or VP LT), Fire Resist Barritech NP (or NP LT) 2) Other WRB's – 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 9 may use any tested/approved installation technique. Items 10, 11 and 14 may use any standard installation technique.	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/exterior 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. 8) Glen Gery Thin Tech Elite Series Masonry Veneer or TABS II Panel System with ½" thick bricks using TABS Wall Adhesive or Brick It MCS & CI Panel Systems 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

Table 5: Allowable Alternate WRB's for Tables 1-4

WRB Over Base Wall Surface Use 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20 Note – Some WRB's are only allowed with specific systems	1) None 2) GE Momentive SEC 2500 SilShield, Elemax 2600 3) Vaproshield Wrapshield SA, RevealShield SA 4) WR Grace Permabarrier VPS, Perm-A-Barrier NPL (AKA: PAB NP20), Perm-A-Barrier® VPL, Perm-A-Barrier® Aluminum Wall Membrane (AWM), Perm-A-Barrier VPL LT. The following may only be used with claddings 1-6 - Perm-A-Barrier NPL 10, Perm-A-Barrier VPL 50 5) StoGuard Vaporseal 6) 3M 3015 (with Hold Fast 70 adhesive @ 6 mils) 7) Henry Air-Bloc 21S, AB 33MR, AB 31MR, AB 17MR, AB 16MR, AB 32MR (only with R2+ BASE), Blueskin SA (only with R2+ SHEATHE and Claddings 1 - 6). 8) Tyvek CommercialWrap or CommercialWrap D, Fluid Applied WB (only with R2+ BASE) 9) PolyGuard Air Lok Flex VP, FlexGuard, Air Lok Flex (Only with Claddings 1 - 6) 10) Prosoco R-Guard Cat 5, R-Guard Cat 5 Rainscreen, R-Guard VB or R-Guard Spray Wrap MVP 11) Dryvit Backstop NT 12) WR Meadows Air Shield LMP (Gray), Air Shield LMP (Black), Air Shield TMP, Air Shield LSR 13) Any WRB which has been tested per ASTM E1354 (at a minimum of 20 kW/m^2 heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than those listed above 14) Dörken Systems Inc., Delta-Vent SA, Delta-Vent S, Delta-Fassade S, Delta Maxx or Delta Stratus SA 15) Enershield HP or Enershield I 16) Siga Majvest or Majvest 500 SA 17) Soprema Sopraseal Stick VP, Soprasolin HD, LM 204 VP, Soprema Stick 1100T with Mammoth Elastocol 600c Primer (1100T only for use with R2+MATTE, R2+Silver, R2+Base) 18) Pecora XL Perm Ultra VP 19) Sto Gold Coat or Emerald Coat 20) Tremco ExoAir 230 or ExoAir 130
WRB Over Exterior Insulation Use 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16 or 17 Note – Some WRB's are only allowed with specific systems	1) None 2) GE Momentive SEC 2500 SilShield, Elemax 2600 3) Vaproshield Wrapshield SA, RevealShield SA 4) Grace Perm-A-Barrier NPL (AKA: PAB NP20), Perm-A-Barrier® VPL, Perm-A-Barrier® Aluminum Wall Membrane (AWM), Perm-A-Barrier VPL LT, Perm-A-Barrier VPS 5) Henry Air-Bloc 21S, AB 33MR, AB 31MR, AB 17MR, AB 16MR, VP 160 (only with R2+ BASE) 6) Tyvek CommercialWrap 7) PolyGuard Air Lok Flex VP, FlexGuard, Air Lok Flex (only with claddings 1-6) 8) Prosoco R-Guard Cat 5, R-Guard Cat 5 Rainscreen, R-Guard VB or R-Guard Spray Wrap MVP 9) Sto Gold coat or Emerald Coat (only with R2+ BASE) 10) Dryvit Backstop NT

	11) Any WRB which has been tested per ASTM E1354 (at a minimum of 20 kW/m^2 heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than those listed above 12) WR Meadows Air Shield LMP (Gray), Air Shield LMP (Black), Air Shield TMP, Air Shield LSR 13) 3" AlumaGRIP 701 or 4" FG-1402 joint tape may be interchanged. (Hardcast AFT is a rebrand of AlumaGRIP 701) 14) Cosella-Dörken Products Inc., Delta-Vent SA, Delta-Vent S, Delta-Fassade S, Delta Maxx 15) Siga Majvest (for all claddings) or Majvest 500 SA (for claddings 1-6) 16) Soprema Sopraseal Stick VP (with Claddings 1 - 6 – not with R2+Silver), Soprasolin HD 17) Pecora XL Perm Ultra VP

Note 1: CCW LM 800 XL adhesive applied discontinuously at a rate of ⅜" x 3" dabs, 16" OC may be used to adhere exterior insulation to WRB over sheathing, concrete or CMU for those applications requiring this adhesive to be used.

Note 2: The following may be used as gap filler between insulation panels, FOMO HandiFoam FireBlock, and TVM FireBlock.

Note 3: CAV-GRIP™ or Low VOC Travel-Tack may be used as an adhesive (application rate as per mfg. instructions) to attach exterior insulation panels to the WRB surface.

Note 4: The following can be used with Fire Resist Barritech NP (or NP LT)/VP (or VP LT) for detailing window openings, inside/outside corners, transitions, terminations and penetrations:

1) Alumagrip 701 or Fire Resist 705 FR-A or CCW 705 with any of these contact adhesives as surface prep: CCW-702, CCW-702 LV, CCW-702 WB, CAV-GRIP, Low VOC Travel TACK
2) CCW LiquiFiber-W imbedded in Fire Resist Barritech NP (or NP LT)/VP (or VP LT)
3) CCW DCH Reinforcing Fabric imbedded in Fire Resist Barritech NP (or NP LT)/VP (or VP LT)

Note 5: The following may be used for detailing maximum ¼" width exterior gypsum sheathing joints on the base wall assembly with the Fire Resist Barritech NP (or NP LT)/VP (or VP LT) membrane:

1) CCW LM 800 XL or other approved (less flammable than LM 800 XL) polyurethane or latex sealant. Sealant fills sheathing joint, and has a maximum 1" width x ⅜" thickness profile over sheathing joint. Caulking shall be covered with 40 mil dry thickness of Fire Resist Barritech NP (or NP LT)/VP (or VP LT).
2) 4" width maximum CCW DCH Reinforcing Fabric centered over joint and imbedded in Fire Resist Barritech NP (or NP LT)/VP (or VP LT)
3) Maximum 4" wide, self-adhered flashing tape centered over joint. Gypsum sheathing surface may be prepped with any of these contact adhesives to improve bond of the flashing tape: CCW-702, CCW-702 LV, CCW-702 WB, CAV-GRIP, and Low VOC Travel TACK. Flashing tape shall be covered with 40 mil dry thickness of Fire Resist Barritech NP (or NP LT)/VP (or VP LT). The following flashing tapes are allowed:
   a. AlumaGRIP-701
   b. Fire Resist 705 FR-A
   c. Foil-GRIP 1402
   d. Barritape

Note 6: CCW BarriBond may be used in the following applications:

1) As a detail sealant with all CCW membranes (small discontinuous quantities – 1" width X 40 mil ribbon).
2) As a sheathing joint treatment (2" width X 40 mil thick ribbon of sealant, centered over joint)
3) As a liquid flashing (wrapping rough opening and corners) in Barritech VP (or VP LT) and Barritech NP (or NP LT) systems (40 mil thickness, 3" onto wall, all the way into rough opening, 40 mil thick 3" onto each side of corners).
4) As a liquid flashing (wrapping rough opening) in 705 VP systems (40 mil thickness, 3" onto wall, all the way into rough opening)
5) As an insulation adhesive (alternative to LM 800 XL) for attaching R2+ SILVER, R2+ MATTE and R2+ SHEATHE

Note 7: Insulating coating applied over noncombustible substrate can be used for mitigating thermal bridging at wall assembly terminations and penetrations. Coatings applied in these conditions cover a small percentage of the total wall surface area. The following products are allowed:

a) Aerolon 945 tape with primer, by Tnemec
b) Aerolon 971 coating with primer, by Tnemec

Table 6: R2+ Interior Insulation (See Notes 1, 2 & 3)

Wall Component	
Base Wall – Use either 1 or 2	1) Cast concrete walls (min. 8" thick) 2) CMU concrete walls (min. 8" thick)
Exterior Coating - Use either 1, 2, 3 or 4	1) Portland cement or Lime Stucco. 2) Any ASTM E84 Class A Paint or Elastomeric Coating 3) Any ASTM E84 Class A Clear Sealer 4) None
Air/Vapor Barrier Membrane Position 1 Over Base Wall Interior - Use either 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, 11 or 12	1) Fire-Resist 705 VP, Surface Prepared With 702 WB, Cav-Grip or Travel-Tack 2) Fire Resist 705 FR-A surface prepped with CCW 702, 702LV, 702 WB, CAV-Grip, or Low VOC Travel Tack adhesives. 3) Fire-Resist Barritech VP (or VP LT) 4) Fire-Resist Barritech NP (or NP LT) 5) Fire Resist 705 RS 6) Fire Resist Barrithane VP 7) Grace Perm-A-Barrier NPL (AKA: PAB NP20) 8) Grace Perm-A-Barrier® VPL 9) Grace Perm-A-Barrier® Aluminum Wall Membrane 10) CCW-705, Surface Prepared with Cav-Grip, 702, 702 LV or 702 WB 11) Henry Air-Bloc 21S, AB 33MR, AB 31MR, or AB 17MR 12) None
Continuous Insulation Use 1, 2, 3 or 4	1) 3½" Thick (max.) R2+ SHEATHE 2) 3½" thick (max.) R2+ MATTE 3) 3½" thick (max.) R2+ MATTE (Class A) 4) 3½" thick (max.) R2+ SILVER
Air/Vapor Barrier Membrane Position 2 Over Insulation - Use either 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 or 12	1) Fire-Resist 705 VP, Surface Prepared With 702 WB, Cav-Grip Or Travel-Tack 2) Fire Resist 705 FR-A, Surface Prepared With CCW 702, 702LV, 702 WB, CAV-Grip, or Low VOC Travel Tack adhesives 3) Fire-Resist Barritech VP (or VP LT) 4) Fire-Resist Barritech NP (or NP LT) 5) Fire Resist 705 RS 6) Fire Resist Barrithane VP 7) Grace Perm-A-Barrier NPL (AKA: PAB NP20) 8) Grace Perm-A-Barrier® VPL 9) Grace Perm-A-Barrier® Aluminum Wall Membrane 10) Joints Taped With Foil-Grip 1402, 4" Width (max.) 11) Henry Air-Bloc 21S, AB 33MR, AB 31MR, or AB 17MR 12) None
Interior Cladding	⅝" type X Interior Gypsum Sheathing installed directly over R2+ insulation or installed over Metal Hat or Z Furring, 2" depth air gap (max.)

Note 1: left blank per previous revisions
Note 2: CCW Membrane used in Position 1 or Position 2, not both
Note 3: R2+ insulation can be tacked in place with Cav-Grip or Travel-Tack during installation. Follow Instructions on Product Data Sheet

Table 7a - Construction for HPL Claddings

Item	Component
Base Wall	Refer to the local building codes, Trespa or Fundermax or Prodema test reports, and other installation support documents, as applicable, for further guidance on base wall construction.
Exterior Sheathing	½ inch or ⅝ inch thick, exterior type gypsum sheathing per approved base wall for each manufacturer.
WRB over Sheathing or exterior wall surface – Use 1, 2, 3, 4, 5 or 6. Note: Item 1, 2, 3, 5, or 6 must be used with exterior insulation 2 or 3 below. Item 4 may be used with exterior insulation item 1, 2 or 3. Any CCW WRB may be used if the exterior insulation is unfaced 2 inch (min.) thick, 4 pcf (min.) density mineral fiber insulation that meets ASTM E136	1) CCW Fire Resist Barritech NP (or NP LT) 2) CCW Fire Resist Barritech VP (or VP LT) 3) CCW Fire Resist 705 VP 4) CCW Fire Resist 705 FR-A 5) Fire Resist 705 RS 6) Fire Resist Barrithane VP Note: Fire Resist 705 VP may be applied using CCW-702 WB, Travel Tack, or Cav-Grip contact adhesives based on the fact that Fire Resist 705 VP acts as an ignition barrier for adhesives applied as thin films. Fire Resist 705 FR-A may be used with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives. When Exterior Insulation Item 4 is used, any CCW WRB may be used under the insulation (on base wall surface) to include at a minimum any of the following: CCW Barritech NP CCW Barritech VP CCW 705 CCW 705 FR CCW 705 RS CCW 705 VP CCW Barrithane VP CCW Barritech NP 60 CCW 705 FR-A
Exterior Insulation – Use 1, 2 or 3	1) None 2) Unfaced mineral fiber insulation that meets ASTM C612 (min. 1 inch thick) Note Item 2 only for Trespa 3) Unfaced mineral fiber insulation that meets ASTM C612 (min. 2 inch thick) Note: Item 3 only for Fundermax 4) Unfaced 2 inch (min.) thick, 4 pcf (min.) density mineral fiber insulation that meets ASTM E136 Note: Item 4 for Trespa, Fundermax or Prodema.
Cladding Use 1 or 2	1) Trespa - See Tables 7b and 7c below 2) Fundermax – See Table 7d Below 3) Prodema ProdEX IGN Panel (6 mm, 8 mm, 10 mm) – see note Note – Item 3 (Prodema) requires a special firestop (2.5x3.5x1.5 Z Girt) 27 inches above the window opening per Prodema Design Listing w/ Intertek Listing PSA/CWP 30-01. All details per the design listing must be followed for this application (except that CCW WRB's above may be used)

Table 7b – Trespa Panels

Thickness (mm)	décor	Fixing System To Be Used
8	UniColor (F32) / Metallic (F32) / NW/NA (F33+Tran 80)	1 or 2
10	UniColor (F32) / Metallic (F32)	1, 2, 3 or 4
10	NW/NA (F33+Tran 80)	1 or 2
13	UniColor (F32) / Metallic (F32)	1, 2, 3 or 4
13	NW/NA (F33+Tran 80)	1 or 2

Table 7c – Trespa Fixing Systems

Wall Panel Cladding System Components	Fixing System Installation Type
Fixing System – Use either 1, 2, 3 or 4 **Note: The Fixing System specifies the necessary assembly geometry and the required free air cavity.**	1 – TS 110 – 285 2 – TS 110DC - 285 3 – TS 210 - 285 4 – TS 210DC – 285
Exterior Wall Panels	See Table I

Table 7d. Fundermax Panel System

Panel ID	Attachment	Air Gap
10 mm Fundermax Max. Exterior F Quality Panels	Allface F2.10	1 inch

Table 8 - Construction for Noncombustible Cladding with no insulation

Wall Component	Item
Base Wall Use 1, 2 or 3	1) Cast Concrete Walls 2) CMU Concrete Walls 3) 25 GA. min. 3⅝" (min.) steel studs spaced 24" OC (max.) a. ⅝" type X Gypsum Wallboard Interior b. Lateral Bracing every 4 ft c. ½" or thicker exterior gypsum sheathing
Cavity Insulation – Use either: 1, 2, 3, 4, 5, 6 or 7	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/m^2 heat flux) and shown by analysis to be less flammable (improved T_{ign}, Pk. HRR) than Bayer (Covestro) EcoBay CC or BASF Walltite.
WRB Use Item 2 only with cladding 2 and 7	1) Carlisle Fire Resist 705 RS, Fire Resist Barrithane VP, Fire Resist 705 VP, Fire Resist 705 FR-A, Fire Resist Barritech NP (or NP LT), Fire Resist Barritech VP (or VP LT). Fire Resist 705 VP may be used with 702 WB, Cav-Grip, or Low VOC Travel-Tack adhesives. Fire Resist 705 FR-A may be used with CCW 702, 702LV, 702 WB, CAV-Grip, and Low VOC Travel Tack adhesives 2) CCW-705 with 702 LV, 702 WB, Cav-Grip, Low VOC Travel-Tack or 702 adhesive. For systems which require a more durable WRB system, any building wrap or 15# felt that meets requirement #11 in "WRB over Exterior Insulation" in Table 5 can be used as a slip sheet between the WRB/exterior insulation and the lath.

Exterior Insulation	None
Cladding Use 1-16 Use cladding 2 or 7 with No Air-gap when WRB item 2 is used	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/exterior 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. 8) TABS II Panel System with ½" thick bricks using TABS Wall Adhesive or Brick It MCS & CI Panel Systems 9) Any MCM that has successfully passed NFPA 285 10) Uninsulated sheet metal building panels including steel, copper, aluminum 11) Uninsulated fiber-cement siding 12) Stone/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.

~~ End of Summary ~~