Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

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Carlisle SynTec Systems VacuSeal™ Vent Secured Roofing System

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CSI Designations:

DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION

Section: 07 05 00 - Membrane Roofing

Section: 07 07 00 - Roof Accessories

1 Innovative Product Evaluated[1]

1.1 VacuSeal Vent Secured Roofing System

2 Product Description and Materials

2.1 The innovative product evaluated in this report is shown in **Figure 1**.

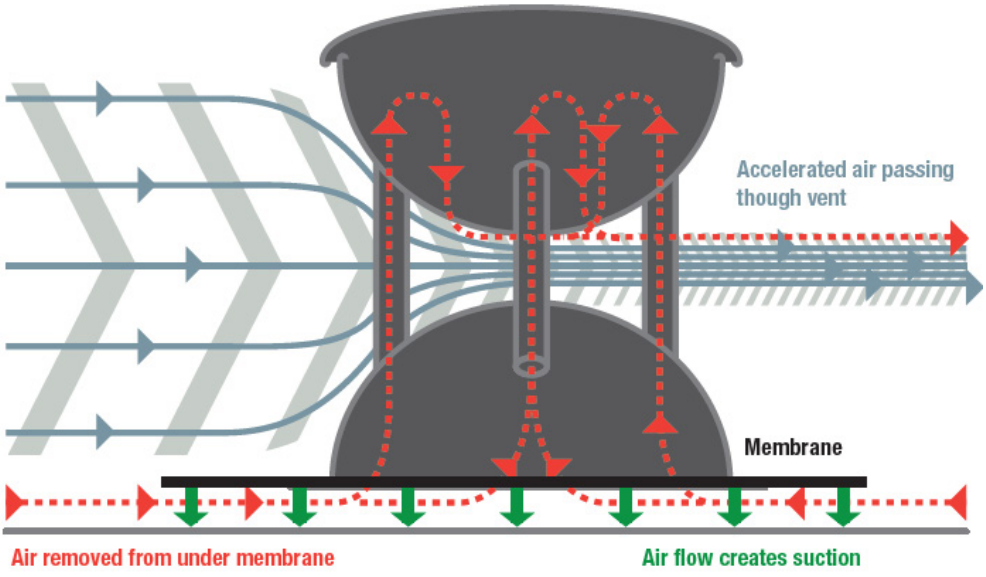


Figure 1. Schematic of VacuSeal Vent Secured Roofing System Operation

2.2 *VacuSeal Vent Secured Roofing System Description*

2.2.1 VacuSeal Vent Secured Roofing System is a roof anchoring system for single-ply roof membranes.

2.2.2 VacuSeal Vent Secured Roofing System is a patented technology under U.S. Patent Nos. 7001266 and 7607974.

2.2.3 VacuSeal Vent Secured Roofing System draws air from under the roof membrane to create a negative pressure (suction) that prevents the membrane from lifting off the roof deck.

2.2.4 VacuSeal Vent Secured Roofing System uses the Bernoulli Principle and the Venturi effect, as shown in **Figure 1**, to create the negative pressure beneath the roof membrane.

2.2.4.1 The Bernoulli Principle states that an increase in the speed of a fluid (air) causes a decrease in the fluid pressure.

2.2.4.2 The Venturi effect is an application of the Bernoulli Principle, which states that a fluid flowing through a constricted section of a tube undergoes an increase in velocity and a decrease in pressure.

2.2.5 As the wind blows through the narrow gap, it accelerates which lowers the pressure and creates suction.

2.2.6 The three hollow legs, which support the upper dome above the lower dome, allow the suction to draw air from under the roof membrane to a port located on the bottom of the upper dome, as shown in **Figure 1**.

2.2.7 Distribution strips are placed immediately beneath the roofing membrane to allow airflow to the VacuSeal Vent Secured Roofing System. The strips connect the vents to the perimeter and corners of the roof to ensure air under the membrane can be removed (see **Figure 2**).

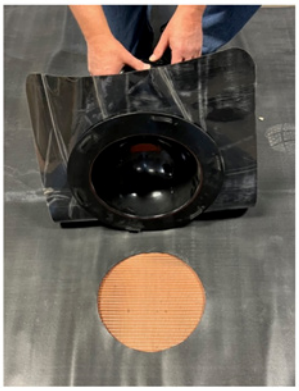
2.2.8 VacuSeal Vent Secured Roofing Systems are placed over the intersection of distribution pathways at openings cut in the membrane (**Figure 2**).

2.2.9 The lower hemisphere of the VacuSeal Vent Secured Roofing System has a flange for attaching the roof membrane to the vent (see **Figure 2**).

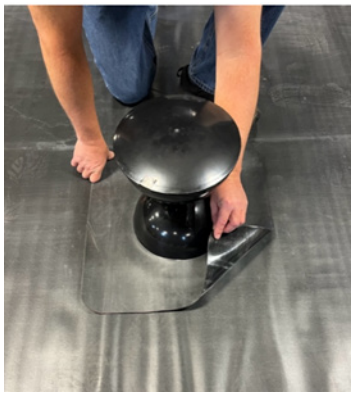
2.2.10 VacuSeal Vent Secured Roofing Systems are located according to a layout plan provided for each project. To achieve the highest level of efficiency, the VacuSeal Vent Secured Roofing Systems should be positioned a sufficient distance from perimeter edge to ensure that they receive airflow at a wind velocity value that is high enough to enable the adequate operation of the VacuSeal Vent Secured Roofing System (**Figure 2**).

Distribution Strips Connect the Roof Perimeter to the VacuSeal Vent Secured Roofing System

Roof Membrane is Placed Over the Distribution Strips



An Opening is Cut in the Roof Membrane for the VacuSeal Vent Secured Roofing System



Skirt on the VacuSeal Vent Secured Roofing System is Adhered Using Double-Sided Butyl Tape or hot air welded, depending on the skirt material, to the Roofing Membrane

Position of VacuSeal Vent Secured Roofing Systems are Staggered to Accommodate Variations in Wind Speed on a Completed Roof Application

Figure 2. Photos of VacuSeal Vent Secured Roofing System

2.3 *Materials*

2.3.1 *VacuSeal Vent Secured Roofing Systems:*

2.3.1.1 VacuSeal Vent Secured Roofing Systems are manufactured from UV-resistant PVC.

2.3.2 *Distribution Strips:*

2.3.2.1 The distribution strip is a 10" wide polypropylene mesh mat that allows unrestricted airflow under the membrane.

2.3.3 *Roofing Membrane:*

2.3.3.1 VacuSeal Vent Secured Roofing Systems are used with Carlisle SynTec Systems approved membranes.

2.3.4 *Termination Bar:*

2.3.4.1 The termination bar used for securing the edges of the roof membrane shall be tested for resistance in accordance with Test Methods RE-1, RE-2, and RE-3 of ANSI/SPRI ES-1 per IBC Section 1504.6.[2]

2.4 As needed, review material properties for design in **Section 6** and the regulatory evaluation in **Section 8**.

3 Definitions[3]

3.1 New Materials[4] are defined as building materials, equipment, appliances, systems, or methods of construction, not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.[5] The design strength and permissible stresses shall be established by tests[6] and/or engineering analysis.[7]

3.2 Duly authenticated reports[8] and research reports[9] are test reports and related engineering evaluations that are written by an approved agency[10] and/or an approved source.[11]

3.2.1 These reports utilize intellectual property and/or trade secrets to create public domain material properties for commercial end-use.

3.2.1.1 This report protects confidential Intellectual Property and trade secretes under the regulation, 18.US.Code.90, also known as Defend Trade Secrets Act of 2016 (DTSA).[12]

3.3 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is accredited and listed in the ANAB directory.

3.4 An approved source is *"approved"* when a professional engineer (i.e., Registered Design Professional, hereinafter RDP) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[13]

3.5 Testing and/or inspections conducted for this duly authenticated report were performed by an ISO/IEC 17025 accredited testing laboratory, an ISO/IEC 17020 accredited inspection body, and/or a licensed RDP.

3.5.1 The Center for Building Innovation (CBI) is ANAB[14] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[15] the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing[16] stating the nonconformance and the path to its cure.

3.7 The regulatory authority shall accept duly authenticated reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs, or methods of construction.[17]

3.8 ANAB is an International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) signatory. Therefore, recognition of certificates and validation statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA with the appropriate scope shall be approved.[18] Thus, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent,[19] and can be used in any country that is an MLA signatory found at this link: https://iaf.nu/en/recognised-abs/

3.9 Approval equity is a fundamental commercial and legal principle.[20]

4 Applicable Local, State and Federal Approvals; Standards; Regulations[21]

4.1 *Local, State, and Federal*

4.1.1 Approved in all local jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes the following featured local jurisdictions and is not limited to: Austin, Baltimore, Broward County, Chicago, Clark County, Dade County, Dallas, Detroit, Denver, DuPage County, Fort Worth, Houston, Kansas City, King County, Knoxville, Las Vegas, Los Angeles City, Los Angeles County, Miami, Nashville, New York City, Omaha, Philadelphia, Phoenix, Portland, San Antonio, San Diego, San Jose, San Francisco, Seattle, Sioux Falls, South Holland, Texas Department of Insurance, and Wichita.[22]

4.1.2 Approved in all state jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes the following featured states, and is not limited to: California, Florida, New Jersey, Oregon, New York, Texas, Washington, and Wisconsin.[23]

4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[24] and Part 3280[25] pursuant to the use of ISO/IEC 17065 duly authenticated reports.

4.1.4 Approved means complying with the requirements of local, state, or federal legislation.

4.2 *Standards*

4.2.1 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*

4.2.2 *UL 1897: Uplift Tests for Roof Covering Systems*

4.3 *Regulations*

4.3.1 *IBC – 15, 18, 21, 24: International Building Code®*

4.3.2 *IRC – 15, 18, 21, 24: International Residential Code®*

4.3.3 *IECC – 15, 18, 21, 24: International Energy Conservation Code®*

4.3.4 *FBC-B—20, 23: Florida Building Code – Building[26] (FL 42724)*

4.3.5 *FBC-R—20, 23: Florida Building Code – Residential[26] (FL 42724)*

5 Listed[27]

5.1 Equipment, materials, products, or services included in a List published by a nationally recognized testing laboratory (i.e., CBI), an approved agency (i.e., CBI and DrJ), and/or and approved source (i.e., DrJ), or other organization(s) concerned with product evaluation (i.e., DrJ), that maintains periodic inspection (i.e., CBI) of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

6 Tabulated Properties Generated from Nationally Recognized Standards

6.1 *Structural Applications*

6.1.1 The VacuSeal Vent Secured Roofing System is used as a hold-down device to resist wind uplift forces on single-ply membrane systems and has been tested in accordance with UL 1897 per IBC Section 1504.4.1.[28]

6.1.2 The VacuSeal Vent Secured Roofing System is used as an alternative attachment method to a mechanically attached or fully adhered roof membrane.

6.1.3 VacuSeal Vent Secured Roofing System can also be used for recovering existing roof or as a reroofing application in accordance with **Section 6.2**.

6.1.4 *Design:*

6.1.4.1 **Table 1** lists the allowable uplift resistance for the VacuSeal Vent Secured Roofing System.

Table 1. Nominal Uplift Resistance for the VacuSeal Vent Secured Roofing System[1,2,3]

Model	Nominal Wind Uplift Resistance (psf)
VacuSeal Vent Secured Roofing System	195

SI: 1 psf = 0.0479 kN/m^2

1. Tested in accordance with UL 1897.
2. Design wind loads shall be in accordance with ASCE 7.
3. Perimeter enhancements are additive to the allowable wind uplift resistance in accordance with **Section 6.1.4.2**.

6.1.4.2 The uplift resistance provided by the fasteners in the termination bar (see **Figure 3**) around the roof perimeter and at penetrations can be added to the uplift resistance of the VacuSeal Vent Secured Roofing System given in **Table 1**.

6.1.4.3 The total allowable uplift resistance provided by the VacuSeal Vent Secured Roofing System and the mechanical fasteners shall be greater than the design wind pressures calculated in accordance with **Section 6.1.6**.

6.1.4.4 The factor of safety for the VacuSeal Vent Secured Roofing System shall be calculated as the total nominal uplift resistance provided by the VacuSeal Vent Secured Roofing Systems and the mechanical fasteners in pounds divided by the total wind uplift force in pounds.

6.1.4.4.1 The nominal (ultimate) uplift resistance for the VacuSeal Vent Secured Roofing Systems in pounds is determined by multiplying the nominal uplift resistance of the VacuSeal Vent Secured Roofing System in **Table 1** by the total area of the roof.

6.1.4.4.2 The nominal uplift resistance for the mechanical fasteners is determined as the number of fasteners in the termination bar around the roof perimeter and at penetrations times the nominal uplift capacity per fastener given in the manufacturer literature.

6.1.4.4.3 The total wind uplift force in pounds is calculated as the sum of the design wind pressures for the field, perimeter, and corners of the roof calculated in accordance with **Section 6.1.6** multiplied by the area of the field, perimeter, and corners of the roof, respectively.

6.1.5 The layout of the VacuSeal Vent Secured Roofing Systems must meet the following minimum requirements:

6.1.5.1 The first row of VacuSeal Vent Secured Roofing Systems around the perimeter of the roof shall be staggered.

6.1.5.2 The first row of VacuSeal Vent Secured Roofing Systems from the perimeter edge shall be located, at a minimum, in accordance with the following:

6.1.5.2.1 **Table 2** for roofs with a 10,000 ft^2 area

6.1.5.2.2 **Table 3** for roofs with a 25,000 ft^2 area

6.1.5.2.3 **Table 4** for roofs with a 50,000 ft^2 area

6.1.5.2.4 **Table 5** for roofs with a 100,000 ft^2 area

6.1.5.2.5 For roofs over 100,000 ft^2 and/or greater than 150 ft in height, the minimum placement distance from the parapet wall to the vent is 9'.

6.1.5.2.6 For roof areas less than what is shown in the tables, use of the next highest value in the table is permitted (i.e., for a 20,000 ft^2 roof, use 25,000 ft^2).

6.1.5.2.7 *"Max"* values listed in the following tables represent the distance from the roof perimeter where the wind velocity approaches a maximum speed.

6.1.5.3 See **Figure 3** for an example of VacuSeal Vent Secured Roofing System layout.

Table 2. Minimum Required Distance From Perimeter Edge to VacuSeal Vent Secured Roofing System and Distance From the Roof Perimeter Where Wind Velocity Approaches its Maximum Speed, 10,000 Ft^2 Roof Area

Building Height[3] (ft)	Parapet Height (ft)	Ultimate Wind Speed[1,2] (mph)									
		70		100		120		160		200	
		Min Distance from Perimeter to Vent / Distance for Max Wind Speed (ft)									
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
75	0	9	45	9	45	9	45	9	45	9	45
	1	9	27	9	27	9	27	9	27	9	27
	3	9	36	9	36	9	36	9	36	9	36
	6	9	36	9	36	9	36	9	36	9	36
	10	9	45	9	45	9	45	9	45	9	45
100	0	9	45	9	45	9	45	9	45	9	45
	1	9	36	9	36	9	36	9	36	9	36
	3	9	45	9	45	9	45	9	45	9	45
	6	9	54	9	54	9	54	9	54	9	54
	10	9	54	9	54	9	54	9	54	9	54
125	0	9	36	9	36	9	36	9	36	9	36
	1	9	36	9	36	9	36	9	36	9	36
	3	9	36	9	36	9	36	9	36	9	36
	6	9	45	9	45	9	45	9	45	9	45
	10	9	45	9	45	9	45	9	45	9	45
150	0	9	45	9	45	9	45	9	45	9	45
	1	9	36	9	36	9	36	9	36	9	36
	3	9	45	9	45	9	45	9	45	9	45
	6	9	63	9	63	9	63	9	63	9	63
	10	9	54	9	54	9	54	9	54	9	54

SI: 1" = 25.4 mm, 1 mph = 1.61 km/h

1. Linear interpolation is permitted.
2. Ultimate wind speeds are based on ASCE 7-16 and ASCE 7-22. Ultimate wind speeds, V_{ult}, can be converted to nominal wind speeds, V_{asd}, using the equation, $V_{asd} = V_{ult} \sqrt{0.6}$.
3. For building heights less than 75', the minimum distance from the perimeter edge to the vent is 9'.

Table 3. Minimum Required Distance From Perimeter Edge to VacuSeal Vent Secured Roofing System and Distance From the Roof Perimeter Where Wind Velocity Approaches its Maximum Speed, 25,000 Ft² Roof Area

Building Height[3] (ft)	Parapet Height (ft)	Ultimate Wind Speed[1,2] (mph)									
		70		100		120		160		200	
		Min Distance from Perimeter to Vent / Distance for Max Wind Speed (ft)									
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
75	0	9	54	9	54	9	54	9	54	9	54
	1	9	27	9	27	9	27	9	27	9	27
	3	9	45	9	45	9	45	9	45	9	45
	6	9	18	9	18	9	18	9	18	9	18
	10	9	63	9	63	9	63	9	63	9	63
100	0	9	45	9	45	9	45	9	45	9	45
	1	9	36	9	36	9	36	9	36	9	36
	3	9	45	9	45	9	45	9	45	9	45
	6	9	72	9	72	9	72	9	72	9	72
	10	9	27	9	27	9	27	9	27	9	27
125	0	9	72	9	72	9	72	9	72	9	72
	1	9	114	9	114	9	114	9	114	9	114
	3	9	81	9	81	9	81	9	81	9	81
	6	9	18	9	18	9	18	9	18	9	18
	10	9	72	9	72	9	72	9	72	9	72
150	0	9	54	9	54	9	54	9	54	9	54
	1	9	54	9	54	9	54	9	54	9	54
	3	9	63	9	63	9	63	9	63	9	63
	6	9	81	9	81	9	81	9	81	9	81
	10	9	36	9	36	9	36	9	36	9	36

SI: 1" = 25.4 mm, 1 mph = 1.61 km/h

1. Linear interpolation is permitted.
2. Ultimate wind speeds are based on ASCE 7-16 and ASCE 7-22. Ultimate wind speeds, V_{ult}, can be converted to nominal wind speeds, V_{asd}, using the equation, $V_{asd} = V_{ult} \sqrt{0.6}$.
3. For building heights less than 75', the minimum distance from the perimeter edge to the vent is 9'.

Table 4. Minimum Required Distance From Perimeter Edge to VacuSeal Vent Secured Roofing System and Distance From the Roof Perimeter Where Wind Velocity Approaches its Maximum Speed, 50,000 Ft² Roof Area

Building Height[3] (ft)	Parapet Height (ft)	Ultimate Wind Speed[1,2] (mph)									
		70		100		120		160		200	
		Min Distance from Perimeter to Vent / Distance for Max Wind Speed (ft)									
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
75	0	9	45	9	45	9	45	9	45	9	45
	1	9	45	9	45	9	45	9	45	9	45
	3	9	72	9	72	9	72	9	72	9	72
	6	9	27	9	27	9	27	9	27	9	27
	10	9	36	9	36	9	36	9	36	9	36
100	0	9	111	9	111	9	111	9	111	9	111
	1	9	135	9	135	9	135	9	135	9	135
	3	9	81	9	81	9	81	9	81	9	81
	6	9	99	9	99	9	99	9	99	9	99
	10	9	72	9	72	9	72	9	72	9	72
125	0	9	99	9	99	9	99	9	99	9	99
	1	9	135	9	135	9	135	9	135	9	135
	3	9	63	9	63	9	63	9	63	9	63
	6	9	36	9	36	9	36	9	36	9	36
	10	9	36	9	36	9	36	9	36	9	36
150	0	9	63	9	63	9	63	9	63	9	63
	1	9	135	9	135	9	135	9	135	9	135
	3	9	72	9	72	9	72	9	72	9	72
	6	9	54	9	54	9	54	9	54	9	54
	10	9	45	9	45	9	45	9	45	9	45

SI: 1" = 25.4 mm, 1 mph = 1.61 km/h

1. Linear interpolation is permitted.
2. Ultimate wind speeds are based on ASCE 7-16 and ASCE 7-22. Ultimate wind speeds, V_{ult}, can be converted to nominal wind speeds, V_{asd}, using the equation, $V_{asd} = V_{ult} \sqrt{0.6}$.
3. For building heights less than 75', the minimum distance from the perimeter edge to the vent is 9'.

Table 5. Minimum Required Distance From Perimeter Edge to VacuSeal Vent Secured Roofing System and Distance From the Roof Perimeter Where Wind Velocity Approaches its Maximum Speed, 100,000 Ft^2 Roof Area

Building Height[3] (ft)	Parapet Height (ft)	Ultimate Wind Speed[1,2] (mph)									
		70		100		120		160		200	
		Min Distance from Perimeter to Vent / Distance for Max Wind Speed (ft)									
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
75	0	9	54	9	54	9	54	9	54	9	54
	1	9	27	9	27	9	27	9	27	9	27
	3	9	54	9	54	9	54	9	54	9	54
	6	9	102	9	102	9	102	9	102	9	102
	10	9	72	9	72	9	72	9	72	9	72
100	0	9	102	9	102	9	102	9	102	9	102
	1	9	54	9	54	9	54	9	54	9	54
	3	9	36	9	36	9	36	9	36	9	36
	6	9	54	9	54	9	54	9	54	9	54
	10	9	54	9	54	9	54	9	54	9	54
125	0	9	54	9	54	9	54	9	54	9	54
	1	9	54	9	54	9	54	9	54	9	54
	3	9	54	9	54	9	54	9	54	9	54
	6	9	54	9	54	9	54	9	54	9	54
	10	9	81	9	81	9	81	9	81	9	81
150	0	9	36	9	36	9	36	9	36	9	36
	1	9	102	9	102	9	102	9	102	9	102
	3	9	54	9	54	9	54	9	54	9	54
	6	9	54	9	54	9	54	9	54	9	54
	10	9	81	9	81	9	81	9	81	9	81

SI: 1" = 25.4 mm, 1 mph = 1.61 km/h

1. Linear interpolation is permitted.
2. Ultimate wind speeds are based on ASCE 7-16 and ASCE 7-22. Ultimate wind speeds, V_{ult}, can be converted to nominal wind speeds, V_{asd}, using the equation, $V_{asd} = V_{ult} \sqrt{0.6}$.
3. For building heights less than 75', the minimum distance from the perimeter edge to the vent is 9'.

6.1.5.4 The maximum spacing between the VacuSeal Vent Secured Roofing Systems along the perimeter of the roof is 50' o.c (see **Figure 3**).

6.1.5.5 If the roof spans 200' or more between perimeter edges in both directions, a second row of VacuSeal Vent Secured Roofing Systems around the perimeter of the roof must be provided.

6.1.5.5.1 The maximum spacing between the VacuSeal Vent Secured Roofing Systems in the second row is 125' o.c.

6.1.5.6 The dimensions of the roof shall be sufficient to allow a minimum of two (2) VacuSeal Vent Secured Roofing Systems to be placed along each side.

6.1.5.7 If the roof is separated by interior parapets, expansion joints, roof area dividers, etc., each portion of the roof shall be designed as a separate roof.

6.1.6 Wind load pressures on the roof membrane that are to be resisted by the VacuSeal Vent Secured Roofing System shall be determined in accordance with ASCE 7 per IBC Section 1504.4[29] and IBC Section 1609.6.[30]

6.1.6.1 The roof membrane shall be designed to resist the design wind load pressures for components and cladding in accordance with ASCE 7 Chapter 30.

6.1.6.2 The design wind speeds shall be for the Risk Category determined from the applicable building code, unless a higher Risk Category is specified on the Construction Documents.

6.1.6.2.1 For roofs designed in accordance with the recommendations of FM LPDS 1-28, the design wind speeds shall be for Risk Category III-IV, regardless of the actual Risk Category for the building.

6.1.6.3 The effective wind area of the roof membrane shall be determined in accordance with ASCE 7, unless a smaller effective wind area is specified on the construction documents.

6.1.6.3.1 For roofs designed in accordance with the recommendations of FM LPDS 1-28, the wind pressures shall be based on a maximum 10 ft^2 effective wind area, regardless of the actual effective area of the roof membrane.

6.1.7 See **Appendix A. Example Design Layout** of this report for a design example with the wind pressure and factor of safety calculations, along with a roof layout for the VacuSeal Vent Secured Roofing Systems.

6.2 *Roof Recovering*

6.2.1 The VacuSeal Vent Secured Roofing System may be installed without first removing the existing layers of roof coverings in accordance with Exception 3 of IBC Section 1512.2.[31]

6.2.1.1 VacuSeal Vent Secured Roofing Systems create a suction force, which transmits the wind uplift forces directly to the structural system of the roof without relying on attachment to the existing roof or roof covering by means of adhesives or mechanical fasteners.

6.2.1.2 Since mechanical fasteners are not used by the VacuSeal Vent Secured Roofing System, the ability of the existing roof deck to serve as a nailing base and the depth of the existing layers of roof coverings are not of concern.

6.2.2 The VacuSeal Vent Secured Roofing System may be used to recover an existing roof without first removing the existing layers of roof coverings if the following conditions are met:

6.2.2.1 The existing roof deck and structural components shall be capable of supporting the additional uplift and/or gravity loads due to added layers of roof covering material in accordance with IBC Section 3301.3.[32]

6.2.2.2 The existing roof deck and structural components shall also be capable of supporting the additional loads due to the construction activities.

6.2.2.3 The existing roof covering shall not be wood shake, slate, clay, cement, or asbestos-cement tile.

6.3 Where the application falls outside of the performance evaluation, conditions of use, and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science, and fire science.

7 Certified Performance[33]

7.1 All construction methods shall conform to accepted engineering practices to ensure durable, livable, and safe construction and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.[34]

7.2 The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.[35]

8 Regulatory Evaluation and Accepted Engineering Practice

8.1 VacuSeal Vent Secured Roofing System complies with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 This report examines the ability of the VacuSeal Vent Secured Roofing System to resist wind uplift forces for the following conditions:

8.1.1.1 Performance of VacuSeal Vent Secured Roofing System used with single-ply roof membranes installed on low-slope roofs.

8.2 Any building code, regulation and/or accepted engineering evaluations (i.e., research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ, which is an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP or approved sources. DrJ is qualified[36] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[37] respectively.

8.3 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope of expertise, which is also its areas of professional engineering competence.

8.4 Any regulation specific issues not addressed in this section are outside the scope of this report.

9 Installation

9.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report, and the applicable building code.

9.2 In the event of a conflict between the manufacturer installation instructions and this report, contact the manufacturer for counsel on the proper installation method.

9.3 A copy of the published manufacturer installation instructions shall be available at all times on the jobsite during installation.

9.4 All contractors using the VacuSeal Vent Secured Roofing System must be certified by Carlisle SynTec Systems.

9.5 Installation of the roofing membrane shall be in accordance with the roofing membrane manufacturer specifications and the approved construction documents.

9.6 The roof shall have flashing installed in accordance with IBC Section 1503.2 and the flashing manufacturer installation instructions.

9.7 *Installation Procedures*

9.7.1 Depending on the roof application, the roof surface may need to be sealed to ensure that air infiltration is minimized in all areas of the roof.

9.7.1.1 All equipment, curb, and parapet wall penetrations in the roofing deck structure need to be sealed for optimal performance of the VacuSeal Vent Secured Roofing System.

9.7.1.2 Openings in the deck shall be air sealed with appropriate materials to achieve the intended purpose.

9.7.2 If two (2) layers of insulation are installed over the roof deck, the joints should be staggered in both directions to decrease air movement. Roof cover boards should be applied when appropriate.

9.7.3 Distribution strips shall be installed over the roof deck or insulation board to create a pathway for airflow under the roofing membrane. The strips shall be tacked into position with bonding adhesive or fastened using plates and screws. The layout of the distribution strip shall be as shown on the drawings provided for the project.

9.7.3.1 Around the roof perimeter, three (3) distribution strips shall connect each VacuSeal Vent Secured Roofing System to the perimeter edge: one (1) distribution strip shall run perpendicular to the perimeter edge to the VacuSeal Vent Secured Roofing System, and the other two (2) distribution strips shall run diagonally from the VacuSeal Vent Secured Roofing System to the point on the perimeter edge midway between the VacuSeal Vent Secured Roofing Systems.

9.7.3.2 See **Figure 3** for an example of the distribution strip layout for the perimeter VacuSeal Vent Secured Roofing Systems.

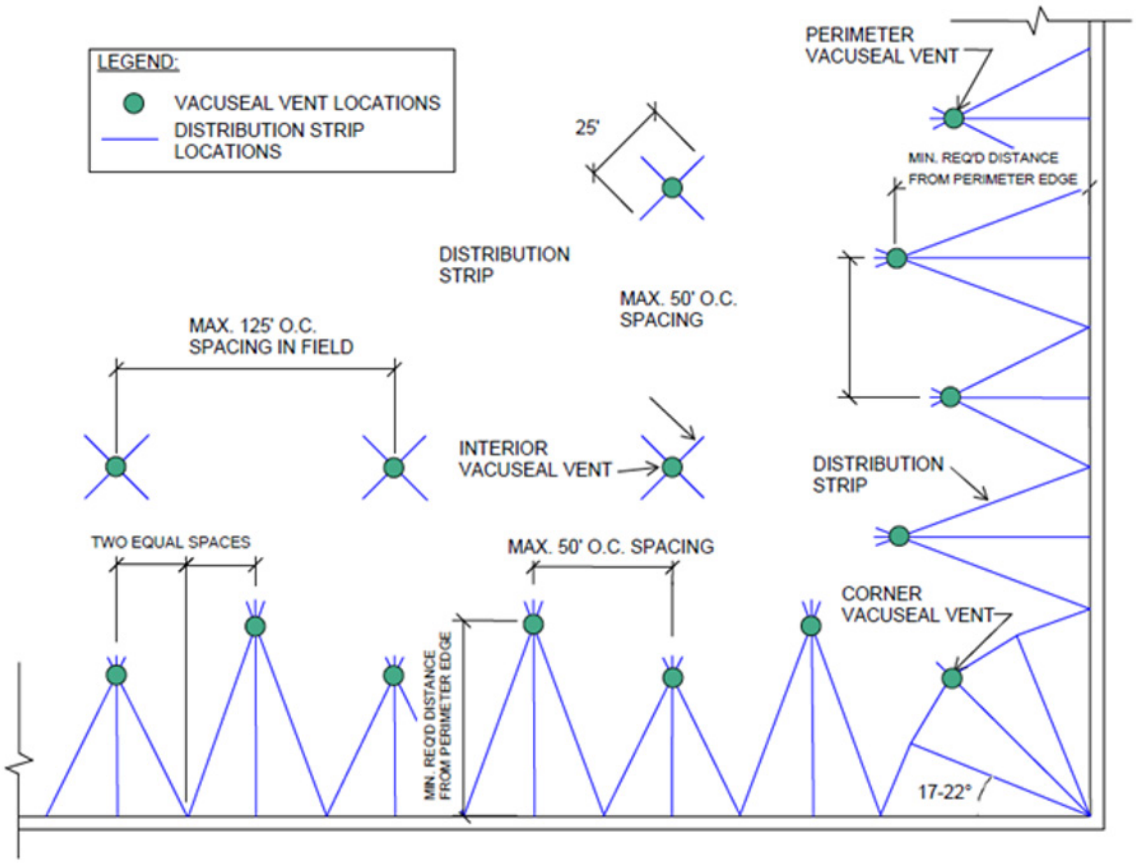


Figure 3. Distribution Strip Layout for VacuSeal Vent Secured Roofing Systems

9.7.3.3 At re-entrant roof corners, three (3) distribution strips shall radiate from the corner.

9.7.3.3.1 The center strip shall be at an angle of approximately 45° to each of the perimeter edge and connect directly to the VacuSeal Vent Secured Roofing System. The remaining two (2) distribution strips shall radiate from the corner at an angle of approximately 17° - 22° to the perimeter edge.

9.7.3.3.1.1 Where obstructions occur on the roof such as HVAC equipment locations, place the vents and strips so that the angle of the center strip is as close to 45° to each of the perimeter edge as possible, and the angle of the remaining distribution strips are as close to 17° - 22° to the perimeter edge as possible.

9.7.3.4 At interior vent locations, two (2) 25' long distribution strips shall be laid out in an *"X"* pattern with the VacuSeal Vent Secured Roofing System at the center, as shown in **Figure 3**.

9.7.3.5 The distribution strips shall be routed around any openings/obstructions in its path.

9.7.4 All intersections of the distribution strips where the VacuSeal Vent Secured Roofing Systems are to be located shall be marked by placing an object at the intersection to create a rise in the membrane once it is rolled out.

9.7.5 The roofing membrane is loose laid on top of the roof deck or insulation boards and distribution strips. During placement, edges of the roofing membrane can be welded temporarily to keep rain or external elements from getting beneath the roofing membrane.

9.7.6 A 10" diameter opening is cut in the membrane at the locations identified by the markers, and the objects used as markers are removed.

9.7.7 VacuSeal Vent Secured Roofing Systems are located over the intersection of distribution pathways at the openings cut in the membrane. A skirt on the VacuSeal Vent Secured Roofing System is welded or adhered with pressure sensitive butyl adhesive, to the roofing membrane.

10 Substantiating Data

10.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

10.1.1 Full-scale building testing at the Institute for Business and Home Safety (IBHS) Research Center

10.1.2 Uplift resistance testing in accordance with UL 1897

10.1.3 Full-scale wind tunnel testing at NASA Langley Research Center

10.1.4 Wind tunnel testing at Virginia Tech

10.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies, approved sources, and/or an RDP. Accuracy of external test data and resulting analysis is relied upon.

10.3 Where applicable, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as being equivalent to the regulatory provision in terms of quality, strength, effectiveness, fire resistance, durability, and safety.

10.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, or duly authenticated reports from approved agencies and/or approved sources provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this duly authenticated report, may be dependent upon published design properties by others.

10.5 *Testing and Engineering Analysis:*

10.5.1 The strength, rigidity, and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.[38]

10.6 Where additional condition of use and/or regulatory compliance information is required, please search for VacuSeal Vent Secured Roofing System on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, VacuSeal Vent Secured Roofing System has performance characteristics that were tested and/or meet applicable regulations. In addition, they are suitable for use pursuant to its specified purpose.

11.2 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, VacuSeal Vent Secured Roofing System shall be approved for the following applications:

11.2.1 Data and engineering analysis review has found that the VacuSeal Vent Secured Roofing System, as described in this report, conforms to the requirements of the code references listed in **Section 4**.

11.3 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from Carlisle SynTec Systems.

11.4 IBC Section 104.2.3 (IRC Section R104.2.2 and IFC Section 104.2.3[39] are similar) in pertinent part state:

> **104.2.3 Alternative Materials, Design and Methods of Construction and Equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative is not specifically prohibited by this code and has been approved.

11.5 **Approved:**[40] Building regulations require that the building official shall accept duly authenticated reports.[41]

11.5.1 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited.

11.5.2 An approved source is *"approved"* when an RDP is properly licensed to transact engineering commerce.

11.5.3 Federal law, Title 18 US Code Section 242, requires that, where the alternative product, material, service, design, assembly, and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

11.6 DrJ is a licensed engineering company, employs licensed RDPs and is an ANAB Accredited Product Certification Body – Accreditation #1131.

11.7 Through the IAF Multilateral Arrangement (MLA), this duly authenticated report can be used to obtain product approval in any jurisdiction or country because all ANAB ISO/IEC 17065 duly authenticated reports are equivalent.[42]

12 Conditions of Use

12.1 Material properties shall not fall outside the boundaries defined in **Section 6**.

12.2 As defined in **Section 6**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

12.3 When required by adopted legislation and enforced by the building official, also known as the Authority Having Jurisdiction (AHJ) in which the project is to be constructed:

12.3.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an approved source, shall be approved when signed and sealed.

12.3.2 This report and the installation instructions shall be submitted at the time of permit application.

12.3.3 This innovative product has an internal quality control program and a third-party quality assurance program.

12.3.4 At a minimum, this innovative product shall be installed per **Section 9**.

12.3.5 The review of this report by the AHJ shall comply with IBC Section 104.2.3.2 and IBC Section 105.3.1.

12.3.6 This innovative product has an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.7.2, IBC Section 110.4, IBC Section 1703, IRC Section R104.7.2, and IRC Section R109.2.

12.3.7 The application of this innovative product in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2, and any other regulatory requirements that may apply.

12.4 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, *"the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.2.3"*, all of IBC Section 104, and IBC Section 105.3.

12.5 Design loads shall be determined in accordance with the regulations adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (i.e., owner or RDP).

12.6 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

13 Identification

13.1 The innovative product listed in **Section 1.1** is identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number, and other information to confirm code compliance.

13.2 Additional technical information can be found at www.carlislesyntec.com.

14 Review Schedule

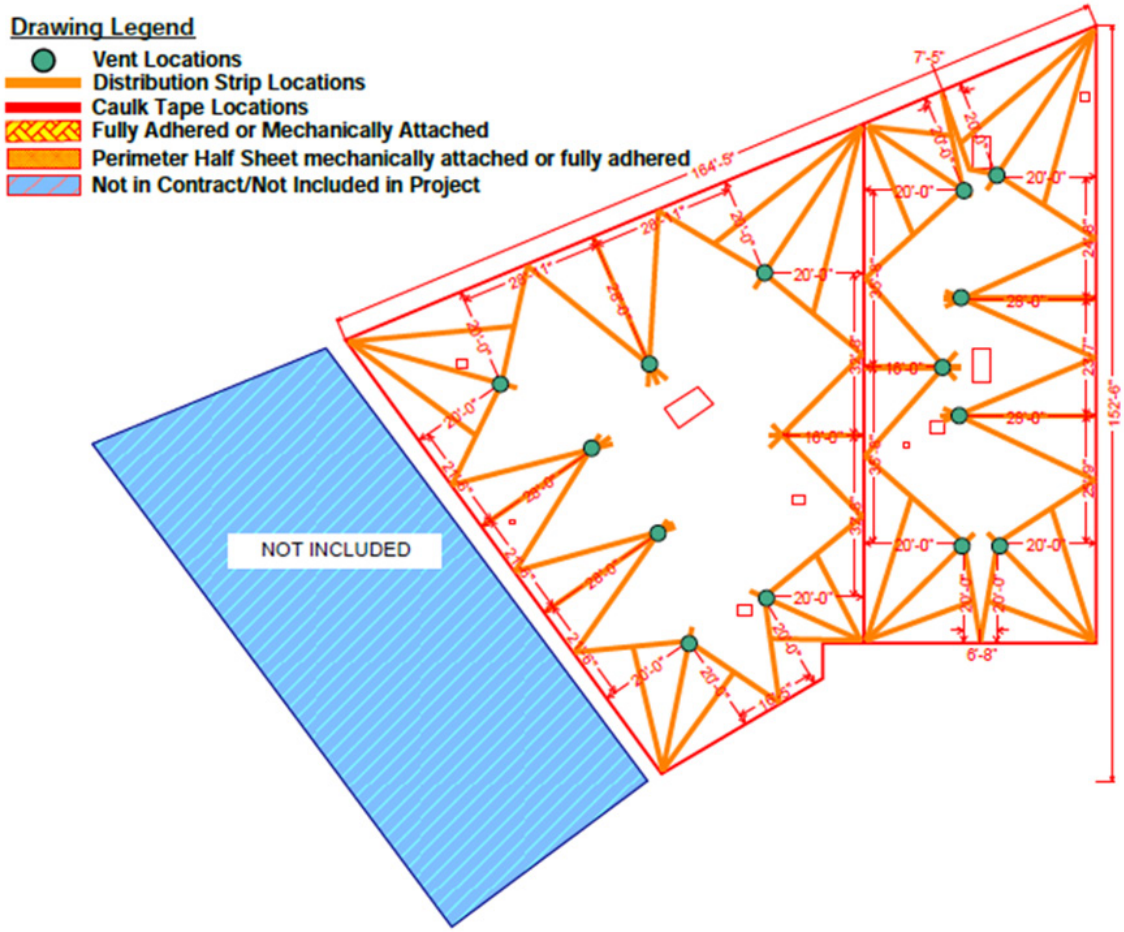
14.1 This report is subject to periodic review and revision. For the latest version, visit www.drjcertification.org.

14.2 For information on the status of this report, please contact DrJ Certification.

Appendix A

Example Design Layout

The roof Layout for VacuSeal Vent Secured Roofing System:



Issue Date: October 16, 2023
Subject to Renewal: July 1, 2026

FBC Supplement to Report Number 1401-02

REPORT HOLDER: Carlisle SynTec Systems

1 Evaluation Subject

1.1 VacuSeal Vent Secured Roofing System

2 Purpose and Scope

2.1 Purpose

2.1.1 The purpose of this Report Supplement is to show VacuSeal Vent Secured Roofing System, recognized in Report Number 1401-02, has also been evaluated for compliance with the codes listed below as adopted by the Florida Building Commission.

2.2 *Applicable Code Editions*

2.2.1 *FBC-B—20, 23: Florida Building Code – Building (FL 42724)*

2.2.2 *FBC-R—20, 23: Florida Building Code – Residential (FL 42724)*

3 Conclusions

3.1 VacuSeal Vent Secured Roofing System, described in Report Number 1401-02, complies with the FBC-B and FBC-R and is subject to the conditions of use described in this supplement.

3.2 Where there are variations between the IBC and IRC and the FBC-B and FBC-R applicable to this report, they are listed here:

3.2.1 FBC-B Section 104, Section 110.4 are reserved.

3.2.2 FBC-R Section R104 and Section R109 are reserved.

3.2.3 FBC-B Section 104.6 is reserved and replaces IBC Section 104.4.

3.2.4 FBC-B Section 104.11 replaces IBC Section 104.2.3 and Section 104.2.3.2.

3.2.5 FBC-B Section 105.3 replaces IBC Section 105.3.

3.2.6 FBC-B Section 105.3.1 replaces IBC Section 105.3.1.

3.2.7 FBC-B Section 110.3 replaces IBC Section 110.3.

3.2.8 FBC-B Section 1503.2 replaces IBC Section 1503.2.

3.2.9 FBC-B Section 1504.4 replaces IBC Section 1504.4.

3.2.10 FBC-B Section 1504.3.1 replaces IBC Section 1504.4.1.

3.2.11 FBC-B Section 1504.5 replaces IBC Section 1504.6.

3.2.12 FBC-B Section 1511.3.1 is reserved and replaces IBC Section 1512.2.

3.2.13 FBC-B Section 1707.1 replaces IBC Section 1707.1.

3.2.14 FBC-B Section 2306.1 replaces IBC Section 2306.1.

3.2.15 FBC-B Section 2306.3 replaces IBC Section 2306.3.

4 Conditions of Use

4.1 VacuSeal Vent Secured Roofing System, described in Report Number 1401-02, must comply with all of the following conditions:

4.1.1 All applicable sections in Report Number 1401-02.

4.1.2 The design, installation, and inspections are in accordance with additional requirements of FBC-B Chapter 16 and Chapter 17, as applicable.

Notes

1 For more information, visit drjcertification.org or call us at 608-310-6748.

2 2018 IBC Section 1504.5

3 Capitalized terms and responsibilities are defined pursuant to the applicable building code, applicable reference standards, the latest edition of TPI 1, the NDS, AISI S202, US professional engineering law, Canadian building code, Canada professional engineering law, Qualtim External Appendix A: Definitions/Commentary, Qualtim External Appendix B: Project/Deliverables, Qualtim External Appendix C: Intellectual Property and Trade Secrets, definitions created within Design Drawings and/or definitions within Reference Sheets. Beyond this, terms not defined shall have ordinarily accepted meanings as the context implies. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

4 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1702

5 Alternative Materials, Design and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review https://www.justice.gov/atr/mission and https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3

6 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.2:~:text=the%20design%20strengths%20and%20permissible%20stresses%20shall%20be%20established%20by%20tests

7 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice. https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.1:~:text=Conformance%20to%20Standards-,The%20design%20strengths%20and%20permissible%20stresses,-of%20any%20structural

8 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20make%2C%20or%20cause%20to%20be%20made%2C%20the%20necessary%20tests%20and%20investigations%3B%20or%20the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies%20in%20respect%20to%20the%20quality%20and%20manner%20of%20use%20of%20new%20materials%20or%20assemblies%20as%20provided%20for%20in%20Section%20104.2.3.

9 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4.2

10 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_agency

11 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_source

12 https://www.law.cornell.edu/uscode/text/18/1832 (b) Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of $5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. To follow DTSA and comply state public records and trade secret legislation requires approval through ANAB ISO/IEC 17065 accredited certification bodies or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

13 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/

14 https://www.cbitest.com/accreditation/

15 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.1:~:text=directed%20to%20enforce%20the%20provisions%20of%20this%20code

16 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3 AND https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#105.3.1

17 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

18 https://iaf.nu/en/about-iaf-mla/#:~:text=Once%20an%20accreditation%20body%20is%20a%20signatory%20of%20the%20IAF%20MLA%2C%20it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope

19 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.

20 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

21 Unless otherwise noted, the links referenced herein use un-amended versions of the 2024 International Code Council (ICC) 2024 International Code Council (ICC) model codes as foundation references. Mississippi versions of the IBC 2024 and the IRC 2024 are un-amended. This material, product, design, service and/or method of construction also complies with the 2000-2012 versions of the referenced codes and the standards referenced therein. As pertinent to this technical and code compliance evaluation, CBI and/or DrJ staff have reviewed any state or local regulatory amendments to assure this report is in compliance.

22 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by the local jurisdiction. https://up.codes/codes/general

23 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by state. https://up.codes/codes/general

24 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14

25 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

26 All references to the FBC-B and FBC-R are the same as the 2024 IBC and 2024 IRC unless otherwise noted in the Florida Supplement at the end of this report.

27 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#p-3280.2(Listed%20or%20certified); https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#listed AND https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#labeled

28 2018 IBC Section 1504.3.1

29 2018 IBC Section 1504.3

30 2021 IBC Section 1609.5

31 2018 IBC Section 1511.3.1.1

32 2021 IBC Section 3301.2.1, 2018 IBC Section 1511.2

33 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4

[34] https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=All%20construction%20methods%20shall%20be%20in%20conformance%20with%20accepted%20engineering%20practices%20to%20insure%20durable%2C%20livable%2C%20and%20safe%20housing%20and%20shall%20demonstrate%20acceptable%20workmanship%20reflecting%20journeyman%20quality%20of%20work%20of%20the%20various%20trades

[35] https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=The%20strength%20and%20rigidity%20of%20the%20component%20parts%20and/or%20the%20integrated%20structure%20shall%20be%20determined%20by%20engineering%20analysis%20or%20by%20suitable%20load%20tests%20to%20simulate%20the%20actual%20loads%20and%20conditions%20of%20application%20that%20occur

[36] Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

[37] https://anabpd.ansi.org/Accreditation/product-certification/AllDirectoryDetails?prgID=1&orgID=2125&statusID=4#:~:text=Bill%20Payment%20Date-,Accredited%20Scopes,-13%20ENVIRONMENT.%20HEALTH

[38] See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition: https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

[39] 2018: https://up.codes/viewer/wyoming/ifc-2018/chapter/1/scope-and-administration#104.9 AND 2021: https://up.codes/viewer/wyoming/ibc-2021/chapter/1/scope-and-administration#104.11

[40] Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 (https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#201.4) where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

[41] https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

[42] Multilateral approval is true for all ANAB accredited product evaluation agencies and all International Trade Agreements.