Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

Report No: 1906-01

Issue Date: April 3, 2020

Revision Date: August 1, 2025

Subject to Renewal: July 1, 2026

Quadravent® as a Component of Wind Ballasted Securement Systems for Single-Ply Membrane Roofs

Trade Secret Report Holder:

Qorbo Enterprises, LLC

Phone: 833-276-7263 Website: www.qorboenterprises.com Email: info@qorboenterprises.com

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 Quadravent

2 Product Description and Materials

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

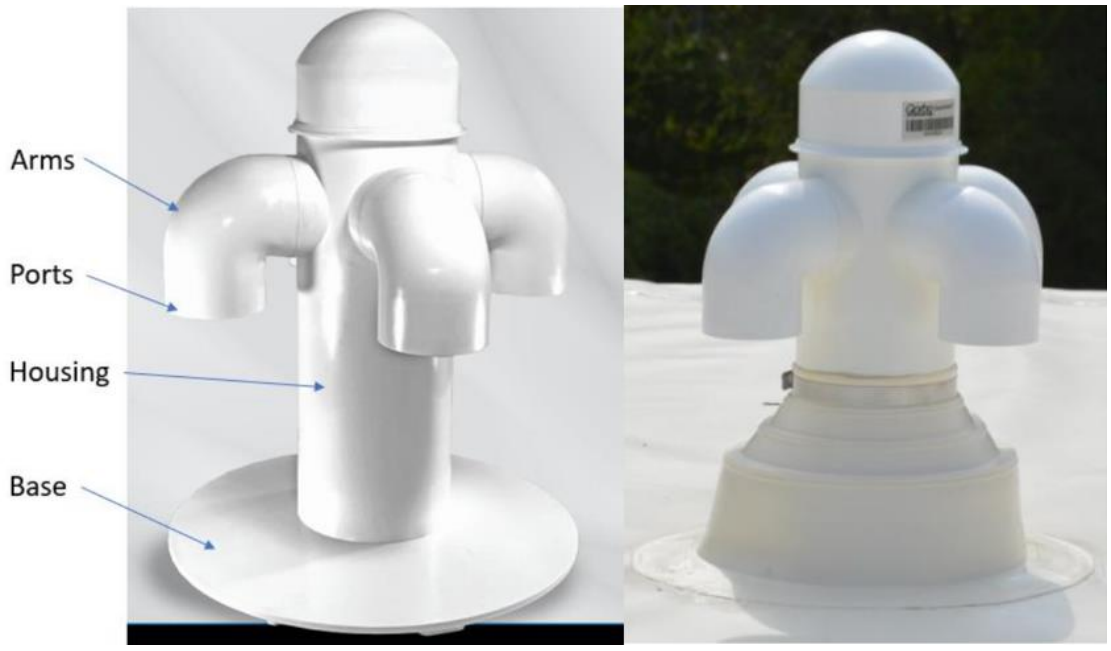

Figure 1. Quadravent Before Installation (Left) and After Installation (Right)

2.2 *Quadravent Roof Vent System Description*

2.2.1 Dimensions of the Quadravent are shown in **Figure 2**.

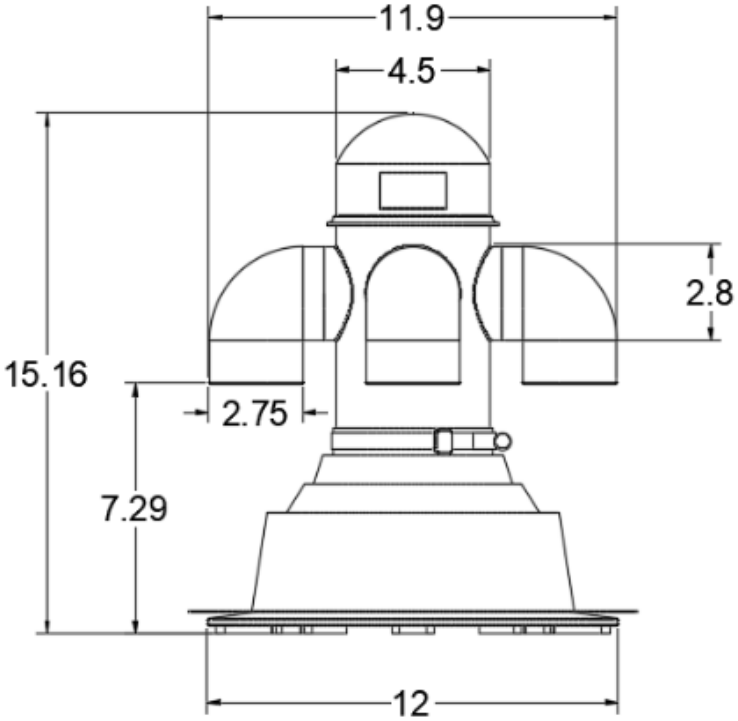

Figure 2. Dimensions of Quadravent Post-Installation

2.2.2 Quadravent is a bi-modal roof vent for use on loose-laid, single-ply roof membrane systems on low slope (*"flat"*) roofs to keep the roof membrane in place during low-pressure weather events. The term bimodal means the Quadravent can be placed in both a low wind velocity, low air pressure zone, as well as a high wind velocity, low air pressure zone.

2.2.3 When turbulent wind passes the Quadravent, a low air pressure zone is created at its ports. This low air pressure zone creates a vacuum effect and is communicated from the ports through the housing to the base of the Quadravent, which is welded, and as a result, air-sealed to the membrane. The stronger the wind, the lower the air pressure created. See **Figure 3** for an illustration.

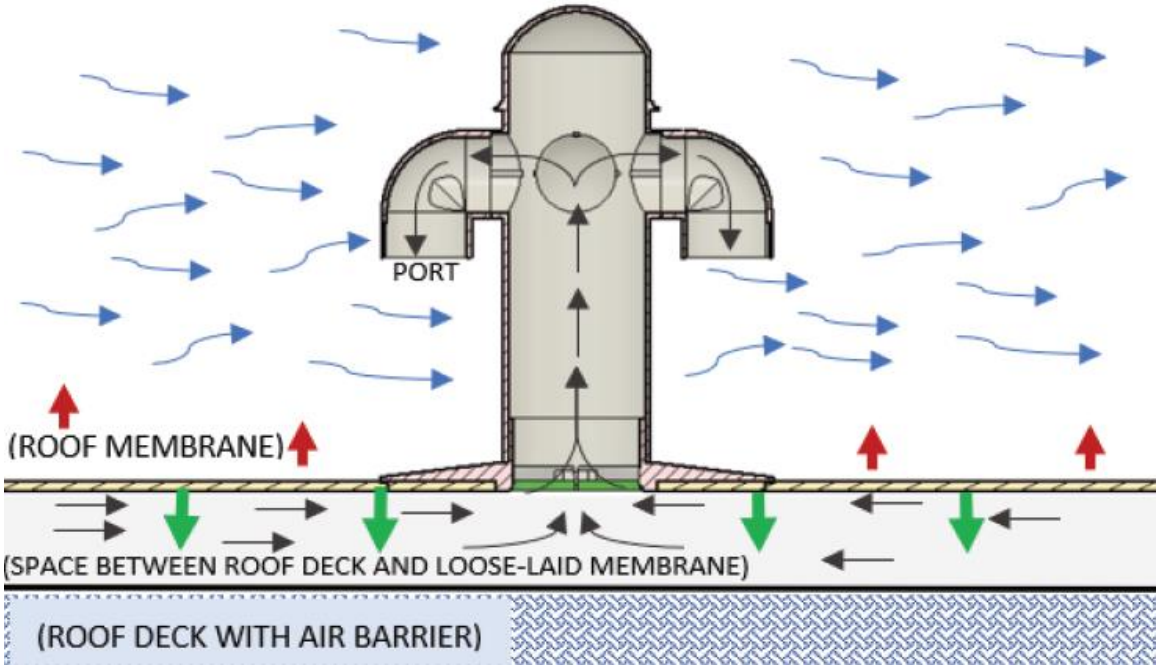

Figure 3. Quadravent - Air Flow Diagram

2.2.4 Air distribution strips, called *"scrim"*, are placed on the roof layer just beneath the roof membrane to allow airflow under the membrane and between each Quadravent. See **Section 9** for installation details.

2.2.5 The underlying substrate layer and the roof membrane layer are air-sealed to each other to create an air-sealed space between the underlying substrate and the membrane. The low air pressure created by each Quadravent will evacuate air from between the membrane and the underlying substrate, which lowers the pressure under the membrane across the roof and pulls the membrane down against the layers below it, thereby protecting the roof against wind.

2.2.6 The Quadravent roof system replaces ballasted, adhered, or mechanically attached methods of securing the roof membrane to the roof deck.

2.3 *Materials*

2.3.1 *Quadravent: Made from UV-Stable PVC:*

2.3.1.1 *Air Distribution Strips (Scrim):*

2.3.1.1.1 Air permeable filter fabric (loose laid) approved by Qorbo Enterprises, LLC.

2.3.1.1.2 Scrim is a thin polyethylene mesh material that has thin strands of plastic laid out in a grid with widthwise strands on top and lengthwise strands on bottom.

2.3.1.2 *Roof Membrane:*

2.3.1.2.1 Ketone Ethylene Ester (KEE) based sheet-roofing membrane meeting ASTM D6754 or equivalent approved by Qorbo Enterprises, LLC.

2.3.1.2.2 Other modified bitumen roofing or single-ply roof membrane products can be used if they meet the material standards and installation requirements of IBC Section 1507.11 or IBC Section 1507.12,[2] respectively.

2.3.1.3 *Air Sealing:*

2.3.1.3.1 Bitumen, modified bitumen, built up roof, commercial air and vapor barriers, vapor barrier adhesive sheets or other materials approved by Qorbo Enterprises, LLC.

2.3.1.3.2 All termination points of both the underlying substrate layer and the membrane layer must be air sealed at the membrane layer and at the underlying substrate layer. See **Section 9** for further details.

2.3.1.4 *Edge Securement:*

2.3.1.4.1 Edge metal meeting the requirements of ES 1, as required by the authority having jurisdiction or equivalent.

2.3.1.4.2 Roof edge must be air sealed using techniques shown in the manufacturer installation instructions or shop drawings accepted by Qorbo Enterprises, LLC.

2.3.1.4.3 The edge securement method used for securing the edges of the roof membrane shall meet the requirements of IBC Section 1504.6.[3]

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

3 Definitions[4]

3.1 New Materials[5] 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.[6] The design strength and permissible stresses shall be established by tests[7] and/or engineering analysis.[8]

3.2 Duly authenticated reports[9] and research reports[10] are test reports and related engineering evaluations that are written by an approved agency[11] and/or an approved source.[12]

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).[13]

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.[14]

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[15] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[16] 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[17] 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.[18]

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.[19] Thus, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent,[20] 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.[21]

4 Applicable Local, State, and Federal Approvals; Standards; Regulations[22]

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.[23]

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.[24]

4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[25] and Part 3280[26] 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 *ASCI/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*

4.2.2 *FM 4474: American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures*

4.2.3 *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 *FBC-B—20, 23: Florida Building Code – Building[27] (FL 41888)*

4.3.4 *FBC-R—20, 23: Florida Building Code – Residential[27] (FL 41888)*

5 Listed[28]

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 Quadravent is used as a hold-down device to resist wind uplift forces on single-ply and modified bitumen membrane systems in accordance with IBC Section 1504.4.1.[29]

6.2 *Design*

6.2.1 The Quadravent roof system shall be designed on a per roof basis in accordance with ASCE 7 to meet the wind pressure requirements and/or designed by the building designer (i.e., owner or registered design professional).

6.2.2 The ultimate uplift resistance for the Quadravent is given in **Table 1**.

Table 1. Uplift Resistance for the Quadravent [3,4]

Product	Ultimate Wind Uplift Resistance[1,2] (psf)
Quadravent	345

SI: 1 psf = 0.0479 kN/m2

1. Tested in accordance with UL 1897
2. Building designer shall apply appropriate factors of safety.
3. Design wind loads shall be in accordance with ASCE 7. ***Note:*** the basic wind speeds (V) used in ASCE 7 are ultimate design wind speeds (V_{ult}). If required, conversion to nominal design wind speed (V_{asd}) is specified in IBC Section 1609.3.1.
4. Perimeter enhancements are additive to the ultimate wind uplift resistance in accordance with **Section 6.2.3**.

6.2.3 The uplift resistance provided by the fastening method in the edge securement around the roof perimeter and at penetrations can be added to the uplift resistance of the Quadravent system given in **Table 1**.

6.2.4 Wind load pressures on the roof membrane that are to be resisted by the Quadravent system shall be determined in accordance with ASCE 7 per IBC Section 1504.4[30] and IBC Section 1609.6.[31]

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

6.2.4.2 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.

6.2.4.2.1 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.

6.2.4.3 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.

6.2.4.3.1 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.

6.2.5 Quadravent vents are positioned according to a layout plan provided for each project.

6.2.5.1 The Vent Edge Distance (VED), or the distance between the vents closest to the roof edge and the outer edge of the roof, shall be no less than 5 ft. and no more than 20 ft.

6.2.5.2 For roofs with surface area greater than 500 ft^2, the number of vents per roof shall be greater than or equal to two.

6.2.5.3 The maximum grid spacing between the vents is 50 ft.

6.2.5.4 Quadravents that service corner zones shall be oriented with the arm facing the apex of the corner as detailed in **Section 9**. Exceptions are allowed for special circumstances per specific designs.

6.2.5.5 Quadravents that do not service corner zones shall be oriented with arm facing the closest roof edge as detailed in **Section 9**. Exceptions are allowed for special circumstances per specific designs.

6.2.5.6 The design wind pressure of each roof zone as defined in ASCE 7 shall each be less than the nominal wind uplift resistance of the Quadravent.

6.2.5.7 See **Appendix A** for a calculation example for a roof height ≤ 60 ft.

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[32]

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.[33]

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.[34]

8 Regulatory Evaluation and Accepted Engineering Practice

8.1 Quadravent complies with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 Quadravent was evaluated for use with modified bitumen and single-ply roof membranes installed on low slope roofs to resist wind uplift forces:

8.1.1.1 Wind load resistance for roof coverings in accordance with IBC Section 1504.1.

8.1.1.2 Resistance to wind loads on non-ballasted roofs in accordance with IBC Section 1504.4[35] and IBC Section 1504.4.1.[36]

8.1.2 The roof assembly design, materials, and components, other than the Quadravent, are outside the scope of this report.

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[37] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[38] 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 manufacturer published installation instructions shall be available at all times on the jobsite during installation.

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

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

9.6 The roof covering used in the roof assembly shall meet the requirements of IBC Section 1507.

9.7 *Installation Procedure*

9.7.1 *Documentation Review:*

9.7.1.1 Review the design documents for the specific roof.

9.7.1.2 Confirm the existing underlying substrate can support the loads from the roof system including the weight of all Quadravent vents and roof system materials during and after the construction process and the wind load requirements for the roof as determined by ASCE 7 per **Section 6.2.4**.

9.7.2 *Air Seal the Underlying Substrate:*

9.7.2.1 Assure the underlying substrate is adequately air-sealed prior to installing the new roof system. This includes the entire field and all termination points of the underlying substrate including roof edges, walls, penetrations, curbs, drains, scuppers, expansion joints, visible dividers, and any unique termination points.

9.7.2.2 A floating membrane from an existing roof cannot be the primary air-seal for the underlying substrate.

9.7.3 *Roof Recovering:*

9.7.3.1 Quadravent single-ply membrane roof system can be installed over an existing roof, which serves as the underlying substrate, when the existing roof meets the following requirements:

9.7.3.1.1 The existing roof has an existing air barrier that provides an adequate air-seal across the entire roof and at every termination point, or can be made to have an adequate air-seal across the entire roof and at every termination point. Termination points include roof edges, walls, penetrations, curbs, drains, scuppers, expansion joints, visible dividers, and any unique termination points not mentioned above.

9.7.3.1.2 The primary air-seal of the existing roof is not from a loose-laid membrane.

9.7.3.2 If the existing roof has a floating membrane and an air-sealed layer below the floating membrane, and the design calls for leaving the membrane in place, a hole at every Quadravent location equal to the diameter of the Quadravent base flange shall be cut to allow air under the existing membrane to escape.

9.7.4 *Insulate:*

9.7.4.1 If required, install the insulation and cover board layers. Place these layers on top of the air-sealed underlying substrate. These can be loose-laid or, if required, adhered to the underlying substrate.

9.7.4.2 Mechanical fasteners cannot be used to install insulation on top of the air-sealed underlying substrate.

9.7.5 *Install Air Distribution Strips (Scrim):*

9.7.5.1 Scrim is laid out on the roof layer just below the membrane, allowing air to travel along and across the scrim area while the membrane is resting on top of it.

9.7.5.2 Lay out the scrim to create the air distribution system per the design documentation. For each Quadravent location, there is a star scrim pattern; for each roof edge there is edge scrim. **Figure 4** shows a typical star scrim pattern. **Figure 5** shows a typical 200' x 400' rooftop including both star scrim patterns and edge scrim.

9.7.5.3 For each Quadravent location, lay out a pattern of scrim as shown on the design documentation. The scrim is laid out and oriented so that the widthwise strands are on top and the lengthwise strands are on the bottom as shown in Section A-A of **Figure 4**.

9.7.5.4 There is one scrim pattern per Quadravent. There are four scrim segments per pattern. Each segment is laid so that it intersects the other three segments at the Quadravent location. The length of each segment of the pattern is cut per the design documentation.

9.7.5.5 Tack scrim to the roofing surface over which it is being laid using 2" square tabs of Qorbo Butyl Tape. The roofing surface must be clear of debris and be a suitable surface as specified in the design documentation.

9.7.5.6 Lay out the roof edge scrim (see **Figure 5**). Roof edge scrim is in addition to scrim patterns at each vent location. A length of scrim is placed parallel to and within 5' of each roof edge so that it intersects with one or more of the lengths of scrim from the scrim patterns of the line of Quadravent closest to the edge. The roof edge scrim is tacked per **Section 9.7.5.5**.

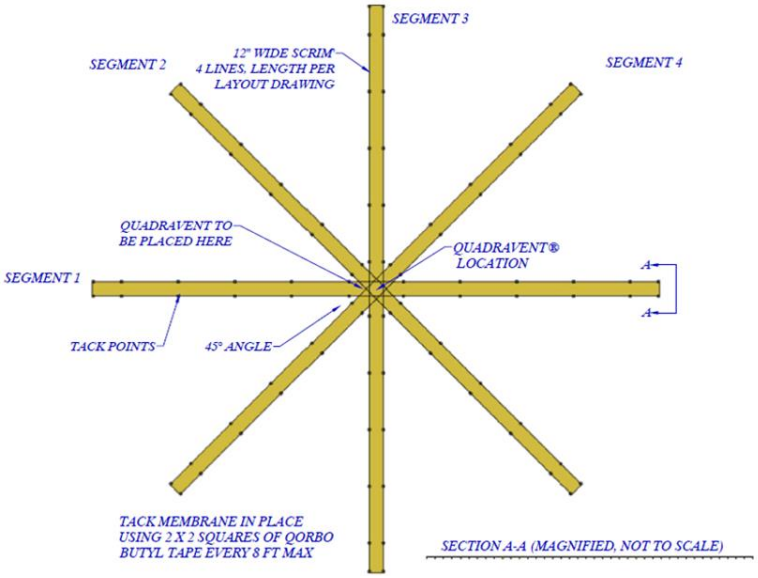

Figure 4. Scrim Layout and Cross Section Showing Proper Orientation of Scrim

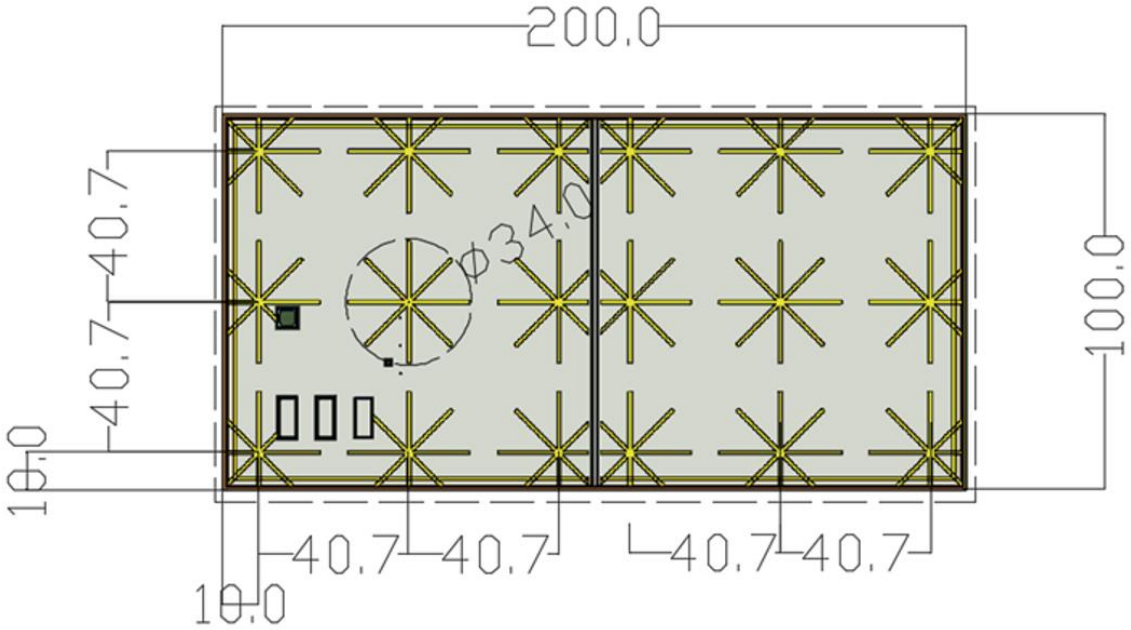

Figure 5. Detail of Star Scrim Patterns and Edge Scrim Layout

9.7.5.7 Scrim may be moved or trimmed as required to avoid large obstructions not shown in the design documentation. In addition, it is acceptable to cut holes in scrim to go around small penetrations.

9.7.5.8 In the field of the roof, a scrim segment can be moved ±3 ft from the specified layout in order to avoid obstructions that are not shown on the design documentation. In cases where many scrim segments need to be moved, contact Qorbo Enterprises, LLC.

9.7.6 *Install and Air Seal the Membrane:*

9.7.6.1 Sheets of membrane are welded together per manufacturer specifications to create a single, airtight sheet that fits over the air distribution layer. The membrane is loose laid and to be attached or adhered and air-sealed to the building structure at all membrane termination points.

9.7.6.2 Air sealing the membrane beyond weather sealing is required. The membrane must be air sealed at all terminations, including roof edges, walls, penetrations, curbs, drains, scuppers, expansion joints, visible dividers, and any unique termination points. The air seals must meet the guidelines in the manufacturer installation manual and/or in the membrane manufacturer installation guide, whichever is the more stringent.

9.7.7 *Install the Quadravent with Preinstalled Boot:*

9.7.7.1 Carefully cut the pattern shown in **Figure 6** into the membrane at the Quadravent locations specified by the layout document. Do not cut the 12.0" cuts beyond the edge of the Quadravent flange (which is 12.0" in diameter).

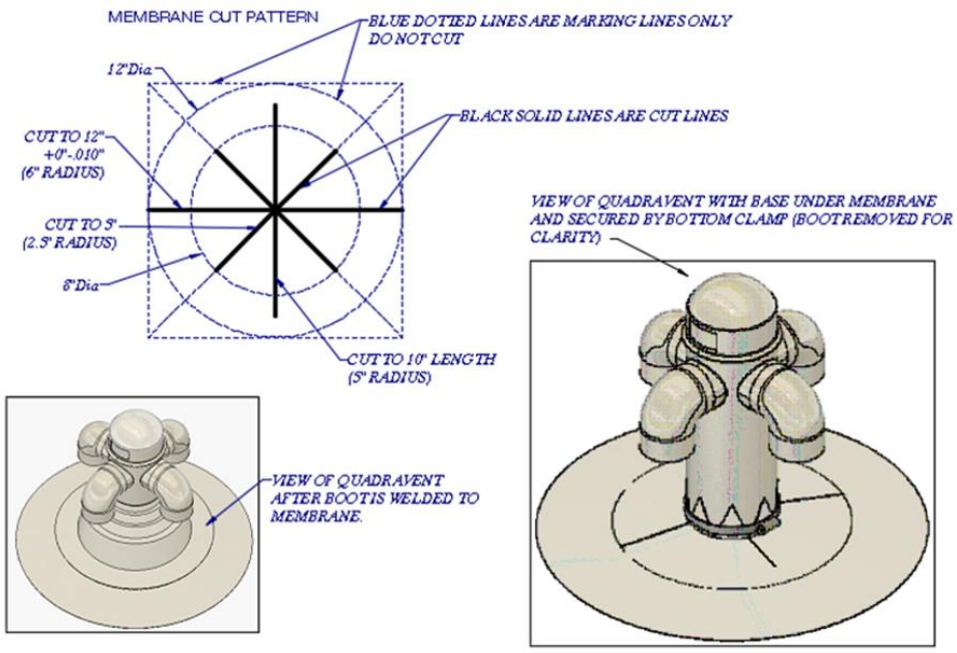

Figure 6. Detailed Drawing of Membrane Cut Pattern

9.7.7.2 The location of each Quadravent cut pattern should coincide with the center of the scrim star pattern below the membrane.

9.7.7.3 Place a Quadravent at each cut pattern with the flange positioned under the membrane through the large slits and aligned per the design specifications.

9.7.7.4 Orient the Quadravent per the layout design, which is typically determined by the location of the Quadravent as shown in **Figure 7**.

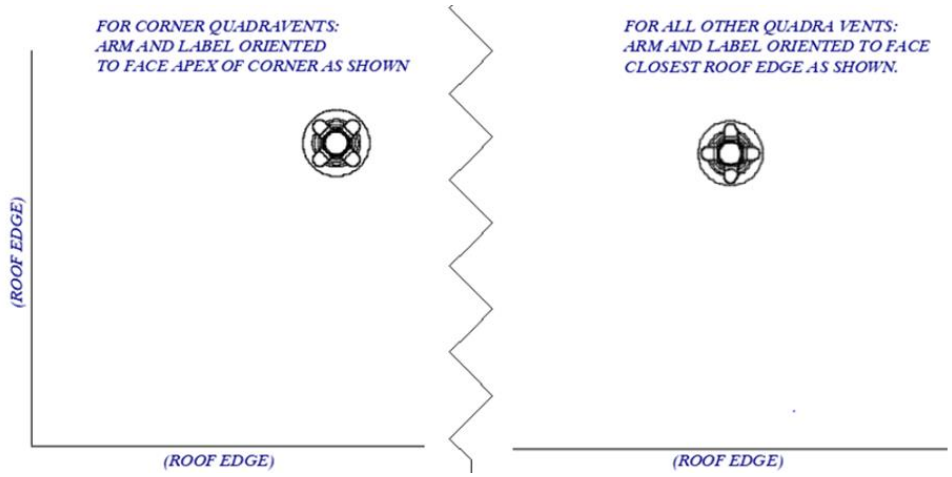

Figure 7. Detailed Drawing of Quadravent Orientation

9.7.7.5 Lift the boot to expose the clamp and position the clamp at the top of the cut triangles of the membrane (**Figure 6**) and torque down.

9.7.7.6 Lower the boot so that the boot flange makes contact with the membrane. Weld the boot flange to the membrane per the membrane manufacturer specification. The finished product should look similar to the right picture in **Figure 1**. The resultant roof assembly cross section at the Quadravent is shown in **Figure 8**.

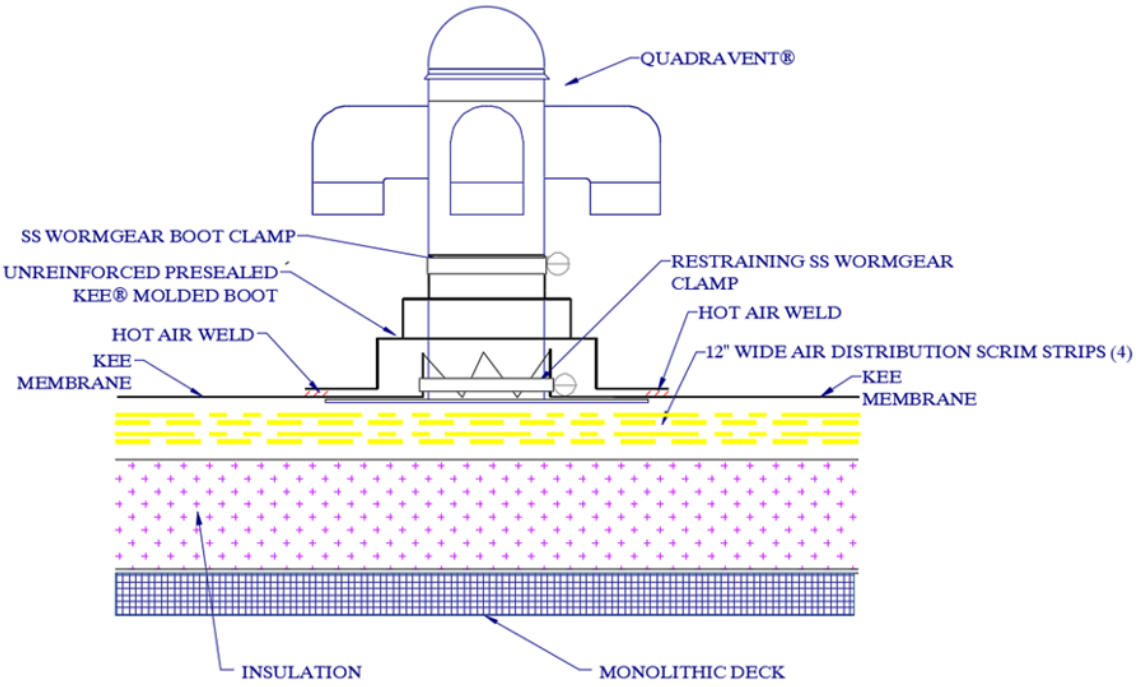

Figure 8. Detailed Drawing of Resulting Typical Roof Assembly at the Quadravent

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 Uplift resistance in accordance with FM 4474 and UL 1897

10.1.2 Wind tunnel testing

10.1.3 Computational Fluid Dynamics (CFD) Study

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.[39]

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

11 Findings

11.1 As outlined in **Section 6**, Quadravent 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, Quadravent shall be approved for the following applications:

11.2.1 Use to resist wind loads on low-slope roofs with loose-laid membranes.

11.3 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from Qorbo Enterprises, LLC.

11.4 IBC Section 104.2.3 (IRC Section R104.2.2 and IFC Section 104.2.3[40] 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:**[41] Building regulations require that the building official shall accept duly authenticated reports.[42]

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.[43]

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 Roof assembly materials must meet the requirements listed in **Section 2.3**.

12.4 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:

12.4.1 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.

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

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

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

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

12.4.6 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.

12.4.7 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.

12.5 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.

12.6 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).

12.7 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.qorboenterprises.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

Design Example using Allowable Stress Design and ASCE 7-10 Table 30.4-1 Steps to Determine C&C Wind Loads Enclosed and Partially Enclosed Low-rise Buildings

Step 1: Determine risk category, see Table 1.5-1

Risk Category = III

Step 2: Determine the basic wind speed, V, for applicable risk category, see Fig. 26.5-1A, B or C

$V_{ult} := 120$

$V := V_{ult}$ V = V_ult in ASCE 7-10

Step 3: Determine wind load parameters:

$K_d := 0.85$ Wind directionality factor, see Section 26.6 and Table 26.6-1

Exposure Category = C Exposure category B, C or D , see Section 26.7

$K_{zt} := 1$ Topographic factor, see Section 26.8 and Fig. 26.8-1

Enclosure Classification = Partially Enclosed Enclosure classification, see Section 26.10

$GC_{pi} := 0.55$ Internal pressure coefficient, see Section 26.11 and Table 26.11-1

Step 4: Determine velocity pressure exposure coefficient, see Table 30.3-1

$h := 50$ Height of flat roof

$z := h$ Height above ground level

$K_h := 1.09$ Velocity pressure exposure coefficient evaluated at height z = h

Step 5: Determine velocity pressure, Eq. 30.3-1

$q_h := 0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot V^2 = 34.15$

Step 6: Determine external pressure coefficient, Fig. 30.4-2A for flat roofs

$GC_{p\_zone1} := -1.0$ Negative external pressure coefficient for Zone 1, rounded up to h=10 ft

$GC_{p\_zone2} := -1.8$ Negative external pressure coefficient for Zone 2, rounded up to h=10 ft

$GC_{p\_zone3} := -2.8$ Negative external pressure coefficient for Zone 3, rounded up to h=10 ft

Step 7: Calculate wind pressure, Eq. 30.4-1

$p_{zone1} := q_h \cdot \left(GC_{p\_zone1} - GC_{pi}\right) = -52.9$

$p_{zone2} := q_h \cdot \left(GC_{p\_zone2} - GC_{pi}\right) = -80.3$

$p_{zone3} := q_h \cdot \left(GC_{p\_zone3} - GC_{pi}\right) = -114.4$

CHECK: All wind pressures are less than the nominal wind uplift resistance.

Roof Dimensions:

$l := 100$ Length of roof

$w := 100$ Width of roof

$A := l \cdot w = 10000$ Area of roof

$a := 0.1 \cdot l = 10$

$A_{zone3} := 4 \cdot a \cdot a = 400$

$A_{zone2} := \left(2 \cdot a \cdot \left(l - \left(2 \cdot a\right)\right)\right) + \left(2 \cdot a \cdot \left(w - \left(2 \cdot a\right)\right)\right) = 3200$ Area of Zone 1

$A_{zone1} := \left(l - \left(2 \cdot a\right)\right) \cdot \left(w - \left(2 \cdot a\right)\right) = 6400$ Area of Zone 2

$A_{total} := A_{zone1} + A_{zone2} + A_{zone3} = 10000$ Area of Zone 3

Minimum Number of Quadravents Calculation: Using the uplift resistance of the Quadravent provided in the TER, calculate the required number of vents for the roof area.

$R_{ASD} := 0.6$ — ASD reduction factor to account for V_ult wind loads

$P_{ult} := 345$ — Ultimate wind uplift resistance of the Quadravent, psf

$DSF := 2$ — Design safety factor used per *FM 4474* for example only. Other design safety factors may be used where applicable.

$P_N := \frac{P_{ult}}{DSF} = 172.5$ — Nominal wind uplift resistance of the Quadravent, psf

$A_T := 12 \cdot 24 = 288$ — Surface area of test, ft^2

$F_N := P_N \cdot A_T = 49680$ — Nominal force resistance per Quadravent, lb

$L_{W\_zone1} := A_{zone1} \cdot p_{zone1} = -338813$ — Wind load on Zone 1

$L_{W\_zone2} := A_{zone2} \cdot p_{zone2} = -256842$ — Wind load on Zone 2

$L_{W\_zone3} := A_{zone3} \cdot p_{zone3} = -45767$ — Wind load on Zone 3

$L_W := -\left(L_{W\_zone1} + L_{W\_zone2} + L_{W\_zone3}\right) \cdot R_{ASD} = 384853$ — Total wind load on the roof, lb

$N_{vents} := \frac{L_W}{F_N} = 8$ — Minimum number of vents required

NOTE: Vents are spaced according to the requirements set forth in the TER and the Quadravent roof system design provided by Qorbo Enterprises LLC.

Issue Date: January 23, 2023
Subject to Renewal: July 1, 2026

FBC Supplement to Report Number 1906-01

REPORT HOLDER: Qorbo Enterprises, LLC

1 Evaluation Subject

1.1 Quadravent

2 Purpose and Scope

2.1 Purpose

2.1.1 The purpose of this Report Supplement is to show Quadravent, recognized in Report Number 1906-01, 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 41888)*

2.2.2 *FBC-R—20, 23: Florida Building Code – Residential (FL 41888)*

3 Conclusions

3.1 Quadravent, described in Report Number 1906-01, 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 is reserved.

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

3.2.3 FBC-B Section 110.4 is reserved and replaces IBC Section 110.4.

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

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

3.2.6 FBC-B Section 105.3 replaces IBC Section 105.3.

3.2.7 FBC-B Section 105.3.1 replaces IBC Section 105.3.1.

3.2.8 FBC-B Section 110.3 replaces IBC Section 110.3.

3.2.9 FBC-B Section 1503.2 replaces IBC Section 1503.2.

3.2.10 FBC-B Section 1504.1 replaces IBC Section 1504.1.

3.2.11 FBC-B Section 1504.3 replaces IBC Section 1504.4.

3.2.12 FBC-B Section 1504.3.1 replaces IBC Section 1504.4.1.

3.2.13 FBC-B Section 1504.5 replaces IBC Section 1504.6.

3.2.14 FBC-B Section 1609.3.1 replaces IBC Section 1609.3.1.

3.2.15 FBC-B Section 1707.1 replaces IBC Section 1707.1.

3.2.16 FBC-B Section 2306.1 replaces IBC Section 2306.1.

3.2.17 FBC-B Section 2306.3 replaces IBC Section 2306.3.

4 Conditions of Use

4.1 Quadravent, described in Report Number 1906-01, must comply with all of the following conditions:

4.1.1 All applicable sections in Report Number 1906-01.

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 1507.12 and 2018 IBC Section 1507.13

3 2018 IBC Section 1504.5

4 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.

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

6 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

7 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

8 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

9 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.

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

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

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

13 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.

14 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/

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

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

17 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

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

19 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

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

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

22 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.

23 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

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

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

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

27 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.

28 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

29 2018 IBC Section 1504.3.1

30 2018 IBC Section 1504.3

31 2021 IBC Section 1609.5

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

[33] 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

[34] 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

[35] 2018 IBC Section 1504.3

[36] 2018 IBC Section 1504.3.1

[37] 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.

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

[39] 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

[40] 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

[41] 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.

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

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