



CERTIFICATION



Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 1401-02

**Venturi Vacuum Technology (V2T) Roof
Vent**

V2T IP, LLC

Product:

**Venturi Vacuum Technology
(V2T) Roof Vent**

Issue Date:

August 13, 2018

Revision Date:

November 3, 2020

Subject to Renewal:

July 1, 2021



COMPANY
INFORMATION:

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DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION

SECTION: 07 05 00 - Membrane Roofing

SECTION: 07 07 00 - Roof Accessories

1 PRODUCT EVALUATED¹

- 1.1 Venturi Vacuum Technology (V2T) Roof Vent

2 APPLICABLE CODES AND STANDARDS^{2,3}

2.1 Codes

- 2.1.1 *IBC—12, 15, 18: International Building Code®*
- 2.1.2 *FBC—17, 20: Florida Building Code (FL 27944)*

2.2 Standards and Referenced Documents

- 2.2.1 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*
- 2.2.2 *UL 1897: Uplift Tests for Roof Covering Systems*

3 PERFORMANCE EVALUATION

- 3.1 This TER examines the ability of the V2T roof vent to resist wind uplift forces for the following conditions:
 - 3.1.1 Performance of V2T roof vents used with modified bitumen and single-ply roof membranes installed on low-slope roofs.
- 3.2 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

¹ Building codes require data from valid research reports be obtained from *approved sources*. Agencies who are accredited through ISO/IEC 17065 have met the code requirements for approval by the *building official*. DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131.

Through ANAB accreditation and the IAF MLA, DrJ certification can be used to obtain product approval in any *jurisdiction* or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – “certified once, accepted everywhere.”

Building official approval of a licensed *registered design professional* (RDP) is performed by verifying the RDP and/or their business entity complies with all professional engineering laws of the relevant *jurisdiction*. Therefore, the work of licensed RDPs is accepted by *building officials*, except when plan (i.e., peer) review finds an error with respect to a specific section of the code. Where this TER is not approved, the *building official* responds in writing stating the reasons for disapproval.

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, visit drjcertification.org or call us at 608-310-6748.

² Unless otherwise noted, all references in this TER are from the 2018 version of the codes and the standards referenced therein (e.g., *ASCE 7, NDS, ASTM*). This material, design, or method of construction also complies with the 2000-2015 versions of the referenced codes and the standards referenced therein.

³ All terms defined in the applicable building codes are italicized.

- 3.3 Any engineering evaluation conducted for this TER was performed on the dates provided in this TER and within DrJ's professional scope of work.

4 PRODUCT DESCRIPTION AND MATERIALS

- 4.1 The product evaluated in this TER is shown in Figure 1.

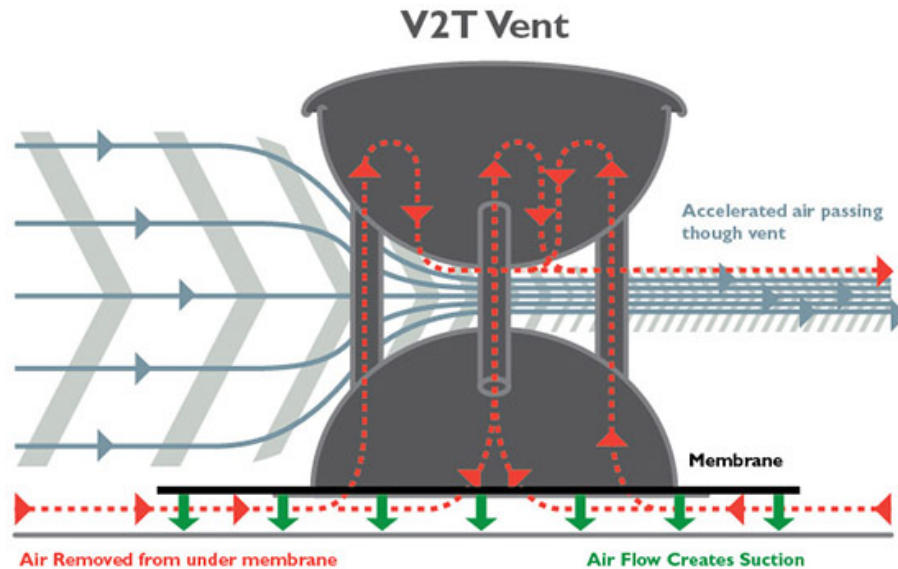


FIGURE 1. SCHEMATIC OF V2T VENT OPERATION

4.2 V2T Vent System Description

- 4.2.1 The V2T vent is a roof anchoring system for modified bitumen and single-ply roof membranes.
- 4.2.2 The V2T vent is a patented technology under U.S. Patent Nos. 7,001,266 and 7,607,974.
- 4.2.3 The V2T vent draws air from under the roof membrane to create a negative pressure (suction) that prevents the membrane from lifting off the roof deck.
- 4.2.4 The V2T vent uses the Bernoulli Principle and the Venturi effect, as shown in Figure 1, to create the negative pressure beneath the roof membrane.
- 4.2.4.1 The Bernoulli Principle states that an increase in the speed of a fluid (air) causes a decrease in the fluid pressure.
- 4.2.4.2 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.
- 4.2.5 The V2T vent consists of two hollow, hemispherical domes separated by a gap (Figure 2).
- 4.2.6 As the wind blows through the narrow gap, it accelerates which lowers the pressure and creates suction.
- 4.2.7 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.
- 4.2.8 Distribution strips are placed on the roof deck under the roofing membrane to allow air flow to the V2T vents. The strips connect the vents to the perimeter and corners of the roof to insure air under the membrane can be removed (Figure 2).
- 4.2.9 The V2T vents are placed over the intersection of distribution pathways at openings cut in the membrane (Figure 2).
- 4.2.10 The lower hemisphere of the V2T vent has a flange for attaching the roof membrane to the vent (see Figure 2).

- 4.2.11 The V2T vents are located according to a layout plan provided for each project. To achieve the highest level of efficiency, the V2T vents should be positioned a sufficient distance from parapet walls to insure that they receive air flow at the full wind speed (Figure 2).



Distribution Strips Connect the Roof Perimeter to the V2T Vents



Roof Membrane is Placed Over the Distribution Strips



An Opening is Cut in the Roof Membrane for the V2T Vent



Skirt on the V2T Vent is Adhered Using Double-Sided Butyl Tape to the Roofing Membrane



Position of V2T Vents are Staggered to Accommodate Variations in Wind Speed on a Completed Roof Application

FIGURE 2. PHOTOS OF V2T ROOF VENT SYSTEM



4.3 Materials

4.3.1 V2T Vents:

- 4.3.1.1 The V2T vents are manufactured from UV-resistant PVC.

4.3.2 Distribution Strips:

- 4.3.2.1 The distribution strip is a 10"-wide plastic wire mat that allows unrestricted air flow under the membrane.

4.3.3 Roofing Membrane:

- 4.3.3.1 The V2T vents are used with V2T Technologies, LLC Approved Membranes.
- 4.3.3.2 Other modified bitumen roofing, thermoset single-ply roof membrane, or thermoplastic single-ply roof membrane products can be used, if they meet the material standards and installation requirements of *IBC* Section 1507.11, 1507.12, or 1507.13, respectively.

4.3.4 Termination Bar:

- 4.3.4.1 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 1504.5.

5 APPLICATIONS

5.1 General

- 5.1.1 The V2T vent system is used as a hold-down device to resist wind uplift forces on single-ply and modified bitumen membrane systems, and has been tested in accordance with *UL 1897* per *IBC* Section 1504.3.1.
- 5.1.2 The V2T roof vent system is used as an alternative attachment method to a mechanically attached or fully adhered roof membrane.
- 5.1.3 The V2T roof vent system can also be used for recovering existing roof or as a re-roofing application in accordance with Section 5.2.
- 5.1.4 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.
- 5.1.5 **Design** Table 1 Table 1 lists the allowable uplift resistance for the V2T vent system.
 - 5.1.5.1 The uplift resistance provided by the fasteners in the termination bar (see Figure 4) around the roof perimeter and at penetrations can be added to the uplift resistance of the V2T vents given in Table 1.
 - 5.1.5.2 The total allowable uplift resistance provided by the V2T vents and the mechanical fasteners shall be greater than the design wind pressures calculated in accordance with Section 5.1.7.
 - 5.1.5.3 The factor of safety for the V2T vent system shall be calculated as the total nominal uplift resistance provided by the V2T vents and the mechanical fasteners in pounds divided by the total wind uplift force in pounds.
 - 5.1.5.3.1 The nominal (ultimate) uplift resistance for the V2T vents in pounds is determined by multiplying the nominal uplift resistance of the V2T vents in Table 1 by the total area of the roof.
 - 5.1.5.3.2 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's literature.
 - 5.1.5.3.3 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 5.1.7 multiplied by the area of the field, perimeter, and corners of the roof, respectively.

TABLE 1. NOMINAL UPLIFT RESISTANCE FOR THE V2T VENT^{1,2,3}

Model Number	Nominal Wind Uplift Resistance (psf)
V2T Vent	195
SI: 1 psf = 0.0479 kN/m ² 1. Testing to determine the nominal uplift resistance for the V2T vent was conducted by UL in accordance with <i>UL 1897: Uplift Tests for Roof Covering Systems</i> . 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 5.1.5.1.	

5.1.6 The layout of the V2T vents must meet the following minimum requirements.

- 5.1.6.1 The first row of V2T vents around the perimeter of the roof shall be staggered. The V2T vents that are the farthest from the parapet wall in this row shall be located, at a minimum, in accordance with Table 2 (see Figure 3).
- 5.1.6.2 The distance from the parapet wall to the V2T vents closest to the parapet wall in the first row shall be located, at a minimum, in accordance with Table 2 multiplied by a factor of 0.7.
- 5.1.6.2.1 The purpose of this spacing requirement is to insure that the V2T vents operate as efficiently as possible for varying wind speed conditions.
- 5.1.6.2.2 Computational Fluid Dynamics (CFD) modeling was used to determine the distances given in Table 2.
- 5.1.6.2.3 Interpolation of the distances in Table 2, based on sound engineering principles for specific roof configurations, is permitted.

TABLE 2. MINIMUM REQUIRED DISTANCE FROM THE PARAPET WALL TO THE V2T VENT FOR RISK CATEGORY III-IV (FT)

Roof Area (ft ²)	Building Height (ft)	Parapet Height (in)	Ultimate Wind Speed for Risk Category III-IV (mph)					
			110	120	130	140	150	160
25,000	12	0	20	21	22	23	24	24
		6	21	22	23	24	26	26
		12	23	25	26	27	28	28
		24	25	27	28	29	30	30
		36	28	29	30	31	32	32
	24	0	23	23	24	25	26	27
		6	24	24	25	26	27	28
		12	25	26	28	29	30	31
		24	27	28	30	31	32	33
		36	29	30	32	33	34	36
	36	0	26	27	28	30	31	32
		6	27	28	29	32	33	33
		12	30	31	32	34	35	36
		24	33	34	35	36	38	40
		36	35	36	37	38	40	43
	48	0	28	29	30	31	32	33
		6	29	30	31	32	33	34
		12	31	33	34	34	35	35
		24	33	35	37	38	38	39
		36	35	36	39	40	41	42
	60	0	30	31	32	33	34	35
		6	31	32	34	35	36	37
		12	34	35	37	39	39	40
		24	37	38	39	41	42	43



Roof Area (ft ²)	Building Height (ft)	Parapet Height (in)	Ultimate Wind Speed for Risk Category III-IV (mph)					
			110	120	130	140	150	160
		36	39	40	42	42	44	45
50,000	12	0	20	21	22	23	24	24
		6	21	23	23	24	25	25
		12	23	25	26	27	28	29
		24	25	27	28	29	30	31
		36	28	29	30	31	32	32
	24	0	26	28	29	31	32	33
		6	27	29	30	32	34	35
		12	29	33	34	37	38	39
		24	34	36	37	39	40	41
		36	37	38	39	41	42	43
100,000	24	0	24	25	26	27	28	29
		6	25	26	27	28	29	30
		12	27	28	29	30	31	32
		24	29	30	31	32	32	33
		36	31	33	34	34	34	35
150,000	24	0	28	28	29	30	30	31
		6	29	29	30	31	31	32
		12	31	31	32	33	33	34
		24	32	32	33	34	35	35
		36	33	33	34	35	36	37

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

1. Ultimate wind speeds are based on ASCE 7-10 and ASCE 7-16. Ultimate wind speeds, V_{ult} , can be converted to nominal wind speeds, V_{asd} , using the equation, $V_{asd} = V_{ult} \sqrt{0.6}$.
2. Linear interpolation is permitted.
3. For roof areas less than what is shown in the table, use of the next highest value in the table is permitted (e.g., for a 20,000 ft² roof, use 25,000 ft²).

- 5.1.6.3 The maximum spacing between the V2T vents along the perimeter of the roof is 50' o.c.
- 5.1.6.4 If the roof spans 200' or more between parapet walls in both directions, a second row of V2T vents around the perimeter of the roof must be provided.
 - 5.1.6.4.1 The second row of V2T vents shall be placed a minimum of 100' from the parapet wall.
 - 5.1.6.4.2 The maximum spacing between the V2T vents in the second row is 125' o.c.
- 5.1.6.5 The dimensions of the roof shall be sufficient to allow a minimum of two (2) V2T vents to be placed along each side.
- 5.1.6.6 If the roof is separated by interior parapets, each portion of the roof shall be designed as a separate roof.
- 5.1.7 Wind load pressures on the roof membrane that are to be resisted by the V2T vent system shall be determined in accordance with ASCE 7 per IBC Section 1504.3 and Section 1609.5.
 - 5.1.7.1 The roof membrane shall be designed to resist the design wind load pressures for components and cladding in accordance with ASCE 7 Chapter 30.
 - 5.1.7.2 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.
 - 5.1.7.2.1 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.
 - 5.1.7.3 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.



- 5.1.7.3.1 For roofs designed in accordance with the recommendations of *FM LPDS 1-28*, the wind pressures shall be based on a maximum 10 ft² effective wind area, regardless of the actual effective area of the roof membrane.

- 5.1.8 See Appendix A for a design example with the wind pressure and factor of safety calculations, along with a roof layout for the V2T vents.

5.2 Roof Re-covering

- 5.2.1 The V2T roof vent system may be installed without first removing the existing layers of roof coverings in accordance with Exception 1 of *IBC* Section 1511.3.1.1.⁴
 - 5.2.1.1 The V2T vents 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.
 - 5.2.1.2 The presence of water in the existing roof covering has no detrimental effect on the V2T system because there are no adhesives or metal fasteners that could deteriorate or corrode due to the moisture.
 - 5.2.1.3 The V2T roof vent system draws moisture out of the roof assembly, causing the roof assembly to dry out over time and protecting the existing sheathing from deterioration.
 - 5.2.1.4 Since mechanical fasteners are not used by the V2T 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.
- 5.2.2 The V2T roof vent system may be used to re-cover an existing roof without first removing the existing layers of roof coverings, if the following conditions are met.
 - 5.2.2.1 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 1511.2.⁵
 - 5.2.2.2 The existing roof deck and structural components shall also be capable of supporting the additional loads due to the construction activities.
 - 5.2.2.3 Where the existing roof deck or roof covering is water soaked, the existing membranes shall be perforated to allow moisture passage to the V2T vents.
 - 5.2.2.4 If the existing roof deck or roof covering is water soaked, it should be verified that the substrate is not damaged and is still able to serve its intended purpose. Any damaged roofing areas and/or structural members shall be replaced.
 - 5.2.2.5 The existing roof covering shall not be wood shake, slate, clay, cement, or asbestos-cement tile.

⁴ 2012 *IBC* Section 1510.3

⁵ 2012 *IBC* Section 1510.2



6 INSTALLATION

- 6.1 Installation shall comply with the manufacturer's installation instructions and this TER. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.
- 6.2 A copy of the manufacturer's published installation instructions shall be available at all times on the jobsite during installation.
- 6.3 All contractors using the V2T vent system must be certified by V2T IP, LLC to insure proper installation.
- 6.4 Installation of the roofing membrane shall be in accordance with the roofing membrane manufacturer's specifications and the approved Construction Documents.
- 6.5 The roof shall have flashing installed in accordance with *IBC* Section 1503.2 and the flashing manufacturer's installation instructions.
- 6.6 *Installation Procedure*
 - 6.6.1 Depending on the roof application, the roof surface may need to be sealed to insure that air infiltration is minimized in all areas of the roof.
 - 6.6.1.1 All equipment, curb and parapet wall penetrations in the roofing deck structure need to be sealed for optimal performance of the V2T vent system.
 - 6.6.1.2 Openings in the deck shall be sealed with peel and stick modified bitumen material, caulk tape, or spray foam.
 - 6.6.1.3 For metal decking, the use of a pre-molded foam insert to seal around the perimeter and interior openings is recommended.
 - 6.6.2 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.
 - 6.6.3 Distribution strips shall be installed over the roof deck or insulation board to create a pathway for air flow 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 engineered drawings provided for the project.
 - 6.6.3.1 Around the roof perimeter, three (3) distribution strips shall connect each V2T vent to the parapet wall: one (1) distribution strip shall run perpendicular to the parapet wall to the V2T vent, and the other two (2) distribution strips shall run diagonally from the V2T vent to the point on the parapet wall midway between the V2T vents.
 - 6.6.3.2 See Figure 3 for an example of the distribution strip layout for the perimeter V2T vents.

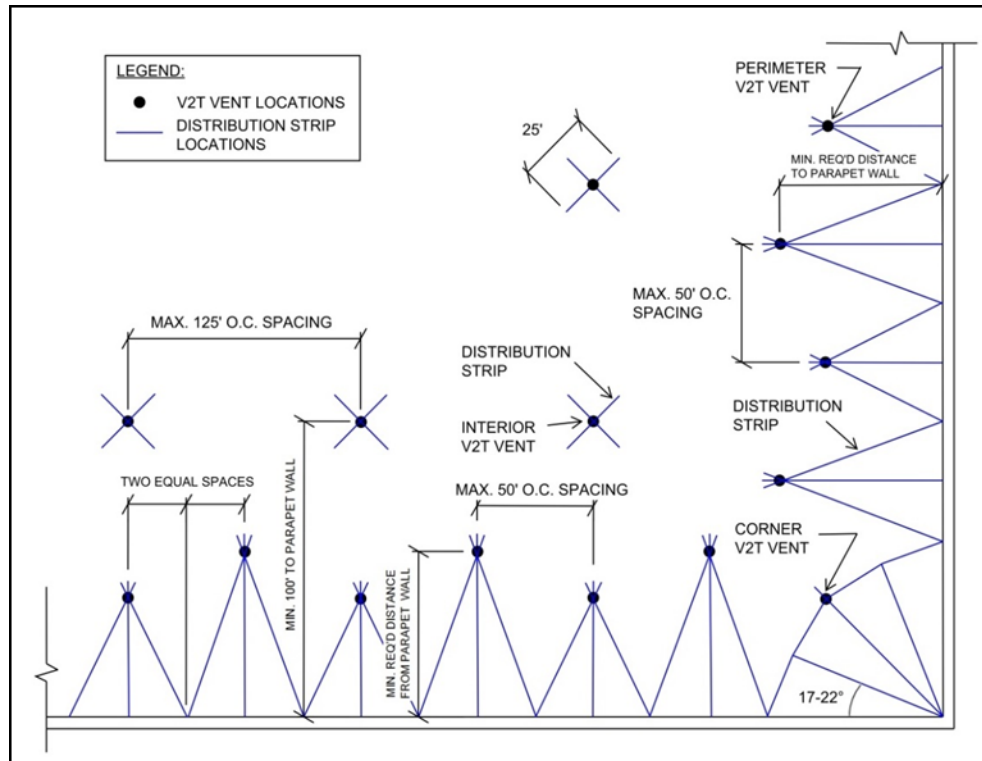
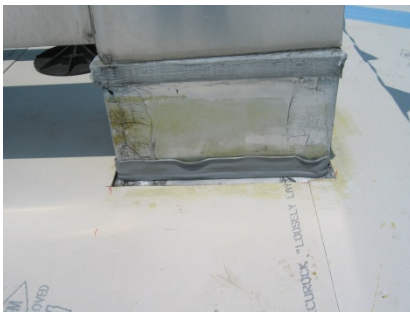


FIGURE 3. DISTRIBUTION STRIP LAYOUT FOR V2T VENTS

- 6.6.3.3 At re-entrant roof corners, three (3) distribution strips shall radiate from the corner.
 - 6.6.3.3.1 The center strip shall be at an angle of 45° to each of the parapet walls and connect directly to the V2T vent. The remaining two (2) distribution strips shall radiate from the corner at an angle of 17°-22° to the parapet wall.
 - 6.6.3.3.2 Two (2) additional strips running perpendicular to the center strip shall connect the V2T vent to the strips radiating from the corner.
- 6.6.3.4 At interior vent locations, two (2) 25'-long distribution strips shall be laid out in an "X" pattern with the V2T vent at the center, as shown in Figure 3.
- 6.6.3.5 The distribution strips shall be routed around any openings/obstructions in its path.
- 6.6.4 All intersections of the distribution strips where the V2T vents 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.
- 6.6.5 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.
- 6.6.6 An 11"-diameter opening is cut in the membrane at the locations identified by the markers, and the objects used as markers are removed.
- 6.6.7 The V2T vents are located over the intersection of distribution pathways at the openings cut in the membrane. A skirt on the V2T vent is welded to the roofing membrane.
- 6.6.8 *Edge Detail Applications*
 - 6.6.8.1 Install caulk tape along the perimeter edge over a cleaned and primed surface to insure adhesion.
 - 6.6.8.2 Once the primer or adhesive is dry, roll the tape out along the edge and extend over the wood nailer.
 - 6.6.8.3 After the membrane is in place, the release paper is removed, and the membrane is extended over the edge and secured to the caulk tape.

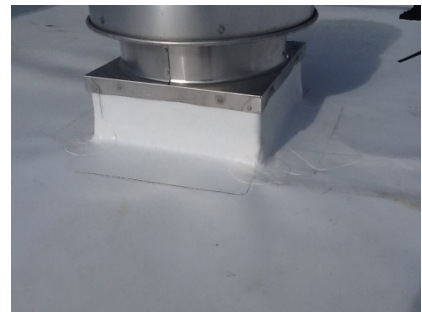
- 6.6.8.4 A termination bar is then installed to the outside edge and fastened through caulk tape to provide an air-tight seal.
- 6.6.8.5 The termination bar is secured at 6" o.c. to form a compression-fit air seal.
- 6.6.8.6 Once the termination bar is secured, membrane flashing, coated metal, or standard metal edging can be applied and completed with a welded edge or stripped in with cover tape.
- 6.6.9 ***Curb Detail Applications***
 - 6.6.9.1 The curb must be cleaned and primed, if necessary, to improve adhesion.
 - 6.6.9.2 Apply caulk tape to the base of each curb, making sure to have a continuous application completely around the curb.
 - 6.6.9.3 Extend the membrane 2" above the termination point to allow for pull through.
 - 6.6.9.4 At the corner where the membrane is split, weld the cover membrane at the corner to assure a complete seal around the base of the curb.
 - 6.6.9.5 The termination bar is fastened 6" o.c. to the base of the curb through the membrane and the caulk tape, assuring an airtight seal at the base of the curb (Figure 4).
 - 6.6.9.5.1 Note that the channel termination bar is to be used with the channel edges oriented toward the curb.
 - 6.6.9.6 Flash the curb in accordance with standard roofing procedures (see Section 6.6).



Caulk Tape Applied to Base of Curb



Fasten Termination Bar 6" o.c.



Flashing Applied to Curb

FIGURE 4. PHOTOS OF CURB DETAIL APPLICATION

- 6.6.10 ***Wall Flashings***
 - 6.6.10.1 The bases of the walls shall be cleaned and primed, to improve adhesion of the caulk tape.
 - 6.6.10.2 Caulk tape shall be applied along the base with 1.5" to 2" on the vertical surface of the wall.
 - 6.6.10.3 The membrane shall be rolled out with the membrane extending 2" above the point of termination.
 - 6.6.10.4 The membrane shall be secured at the base of the wall with a channel termination bar, making sure the channel legs are oriented toward the wall.
 - 6.6.10.5 The termination bar shall be secured every 6" to assure a good air seal along the wall.
 - 6.6.10.6 The wall shall be flashed in accordance with standard roofing procedures to complete the installation (see Section 6.6).

7 TEST AND ENGINEERING SUBSTANTIATING DATA

- 7.1 Full-scale building testing at the Institute for Business and Home Safety (IBHS) Research Center, 2012.
- 7.2 Uplift resistance testing conducted by UL, based on *UL 1897*, 2009.
- 7.3 Full-scale wind tunnel testing at NASA's Langley Research Center, 2004.
- 7.4 Wind tunnel testing at Virginia Tech, 2003.



- 7.5 Some information contained herein is the result of testing and/or data analysis by other sources which conform to *IBC* Section 1703 and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.
- 7.6 Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *IBC*, *IRC*, *NDS*®, and *SDPWS*). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8 FINDINGS:

- 8.1 Data and engineering analysis review has found that the V2T vent, as described in this TER, conforms to the requirements of the code references listed in Section 2.
- 8.2 *IBC* Section 104.11 (*IRC* Section R104.11 and *IFC* Section 104.9 are similar) states:
- 104.11 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 has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code...Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.
- 8.3 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this TER, they are listed here.
- 8.3.1 No known variations

9 CONDITIONS OF USE

- 9.1 Where required by the *building official*, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of *permit* application.
- 9.2 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.3 Design loads shall be determined in accordance with the building code adopted by the *jurisdiction* in which the project is to be constructed and/or by the Building Designer (e.g., *owner* or *registered design professional*).
- 9.4 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.5 This product is manufactured under a third-party quality control program in accordance with *IBC* Section 104.4 and 110.4 and *IRC* Section R104.4 and R109.2.
- 9.6 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the *owner* or the owner's authorized agent. Therefore, the TER shall be reviewed for code compliance by the *building official* for acceptance.
- 9.7 The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the *building official's* inspection, and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.



10 IDENTIFICATION

- 10.1 V2T vents described in this TER are identified by a label with the UL mark and the word “CLASSIFIED”; the manufacturer’s name, V2T IP, LLC; and the product name, V2T Rigid Pressure Equalizing Vent.
- 10.2 Additional technical information can be found at v2troofsystem.com.

11 REVIEW SCHEDULE

- 11.1 This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjcertification.org.
- 11.2 For information on the current status of this TER, contact DrJ Certification.



APPENDIX A

Example Design Calculations and Layout

Wind Pressure Calculations:

Simplified Design Roof Pressure Calculator Based on ASCE 7 **FOR BUILDINGS LESS THAN 60 FT HIGH**

Project: Example

The purpose of this calculator is to provide "basic" design pressures in accordance with ASCE simplified guidelines.

Red numbers may be changed. Black numbers are constants and can not be changed. Blue numbers are the final numbers.

$$qz = 0.00256(kz)(kzt)(kd)(V)^2(I)$$

qz=	0.00256	ASCE Constant Value
kz=	0.83	Mean roof height and exposure. Use number from Table 1 below.
kzt=	1	Topographic factor. A 1 should always be used, unless abrupt elevation change, such as a hill or escarpment.
kd=	1	Do not change unless directed to do so.
	120	Obtain velocity from wind map. If the zone "divides" the area, use the higher velocity or use a more detailed wind map.
v ² =	14400	Total Wind Velocity ²
I=	1	ASCE 7 will allow an importance factor of 0.87, 1.0 or 1.15. (see importance factors for more information)
qh=	30.60	This is the pressure at roof height. This is not the final number.
Field gcp=	-1	FIELD = -1.0
Perimeter gcp=	-1.8	PERIMETER = -1.8
Corner gcp=	-2.8	CORNERS = -2.8
gcpi=	0.55	partially enclosed building = 0.55 (in most instances use 0.55), open building = 0.00, enclosed building = 0.18
Design Pressure	-47.43	Field Of Roof
Design Pressure	-71.90	Perimeter Of Roof
Design Pressure	-102.50	Corners Of Roof
SAFETY FACTOR	2	Enter Safety Factor if desired (FM Global uses a safety factor of 2)
	94.85	Field Design Pressure with desired safety factor

For buildings GREATER than 60 FT HIGH

[**CLICK HERE**](#)**TABLE 1**

Mean Roof Height	Exposure Category		
	B	C	D
In ft	kz=	kz=	kz=
0-15	0.70	0.85	1.03
20	0.70	0.90	1.08
25	0.70	0.94	1.12
30	0.70	0.98	1.16
40	0.76	1.04	1.22
50	0.81	1.09	1.27
60	0.85	1.13	1.31
70	0.89	1.17	1.34
80	0.93	1.21	1.38
90	0.96	1.24	1.40
100	0.99	1.26	1.43
120	1.04	1.31	1.48
140	1.09	1.36	1.52
160	1.13	1.39	1.55
180	1.17	1.43	1.58
200	1.20	1.46	1.61
250	1.28	1.53	1.68
300	1.35	1.59	1.73
350	1.41	1.64	1.78
400	1.47	1.69	1.82
450	1.52	1.73	1.86

Definition of exposures:

Exposure B

Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Use of this exposure category shall be limited to those areas for which terrain representative of exposure B prevails in the upwind direction for a distance of at least 1,500 feet (460 m) or 10 times the height of the building or structure, whichever is greater.

Exposure C

Open Terrain with scattered obstructions having heights generally less than 30 feet (9.1 m). This category includes flat open country and grasslands.

Exposure D

Flat, unobstructed areas exposed to wind flowing over water for a distance of at least 1 mile (1.61 km). This exposure shall apply only to those building and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 1,500 feet (460 m) or 10 times the height of the building or structure, whichever is greater.

This calculator is for simplified, basic calculations only.

For more accurate calculations, please contact an engineer or architect.



Factor of Safety Calculations:

CALCULATION FOR UPLIFT

Project Title **Example**

DATA REQUIRED- Input Values in Yellow

UPLIFT RESULT FROM ASCE-7 CALCULATIONS

FIELD UPLIFT	47.43
PERIMETER UPLIFT	71.9
CORNER UPLIFT	102.5

PERIMETER UPLIFT WIDTH	8
CORNER SQUARE FOOTAGE	64

Calculation from drawing

TOTAL SQUARE FEET OF ROOF	14333
NUMBER OF CORNERS	20
LINEAL FEET OF PERIMETER	1392
NUMBER OF CURBS	19
AVERAGE LINEAL FEET PER CURB	15
PULL-OUT VALUE OF FASTENERS	800

UPLIFT RESISTENCE OF V2T VENT	195
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Perimeter Half Sheets(if required)	0
Pullout Values for half sheet attachment	689
Pullout Resistance Calculation	0

TOTAL CORNER SQUARE FOOTAGE	1280
TOTAL PRIMETER SQUARE FOOTAGE	11136

Corner Uplift Calculation = (number of corners x corner square footage) x Corner Uplift

131200

Perimeter Uplift Calculations = ((Lineal feet of perimeter* Perimeter uplift width)- Corner square footage))*Perimeter uplift

708646

Field Uplift Calculation = (Total Square feet of roof - Total perimeter square feet) x Field Uplift

151634

TOTAL UPLIFT FORCE(lbf)

991480

Resistance Calculations

Vent Resistance = Total Square Feet x 195 lbs

2794935

Fastener Resistance = (Perimeter lineal feet +(Number of curbs * Average Lineal Feet per curb)) * (Pullout *2)

2683200

Perimeter Half Sheet = (# of perimeter half sheet * perimeter length) * 2 * Pullout values

0

TOTAL UPLIFT RESISTANCE(lbf)

5478135

SAFETY FACTOR CALCULATION = TOTAL UPLIFT RESISTANCE/TOTAL UPLIFT FORCE

SAFETY FACTOR

5.53



Roof Layout for V2T Vents:

