TEST REPORT

Report No.: G4124.02-109-44

Rendered to:

VELUX America LLC
Greenwood, South Carolina

PRODUCT TYPE: Sun Tunnel Skylight
SERIES/MODEL: TCC 022

SPECIFICATION(S): Occupational Safety and Health Administration/U.S. Department of Labor Regulations (Standards- 29 CFR) - 1910.23(e) (8)

California Code of Regulations, Title 8, Section 3212

Test Date(s): 10/25/16
Report Date: 01/10/18
Test Record Retention End Date: 10/25/20

1.0 Report Issued To: VELUX America LLC
1418 Evans Pond Road
P.O. Box 5001
Greenwood, South Carolina 29648-5001

2.0 Test Laboratory: Architectural Testing, Inc., an Intertek company ("Intertek-ATI")
130 Derry Court
York, Pennsylvania 17406-8405
717-764-7700

3.0 Project Summary:

3.1 Product Type: Sun Tunnel Skylight

3.2 Series/Model: TCC 022

3.3 Compliance Statement: Results obtained are tested values and were secured by using the designated test method(s).

3.4 Test Date(s): 10/25/16

3.5 Test Record Retention End Date: All test records for this report will be retained until October 25, 2020.

3.6 Test Location: Intertek-ATI test facility in York, Pennsylvania.

3.7 Test Specimen Source: The test specimen(s) was provided by the client. Representative samples of the test specimen(s) will be retained by Intertek-ATI for a minimum of two years from the test completion date.

3.8 Drawing Reference: The test specimen drawings have been reviewed by Intertek-ATI and are representative of the test specimen(s) reported herein. Test specimen construction was verified by Intertek-ATI per the drawings located in Appendix B. Any deviations are documented herein or on the drawings.

3.9 List of Official Observers:

Name	Company
Tyler Holland	Intertek-ATI
Timothy J. McGill	Intertek-ATI
Kyle Ruth	Intertek-ATI

4.0 Test Specification(s):

Occupational Safety and Health Administration/U.S. Department of Labor Regulations (Standards- 29 CFR) - 1910.23(e) (8)

California Code of Regulations, Title 8, Section 3212

A 400 lb. weight, fabricated from a bag filled with lead shot, was placed on the center of the dome for a minimum of 60 seconds. The bag was removed and the test unit was inspected for any signs of damage or failure.

Additional Loading:

The specimen was loaded every 60 seconds in 100 lb. increments using sandbags placed on the center of the dome. The highest load achieved was recorded.

5.0 Test Specimen Description:

Intertek Building & Construction (B&C) was contracted by VELUX America LLC, 1418 Evans Pond Road on December 4, 2017 to evaluate the OSHA fall protection testing to the most recent referenced document. Occupational Safety and Health Administration (OSHA)/U.S. Department of Labor Regulations Standard 29 CFR §1910.29 – Fall protection systems and falling object protection-criteria and practices. Section 1910.29(e)(1) requires a cover to be capable of supporting without failure at least twice the maximum intended load that may be imposed on the cover at any one time.

Intertek Building & Construction (B&C) was contracted by VELUX America LLC, 1418 Evans Pond Road on December 4, 2017 to evaluate the Cal/OSHA fall protection testing to the most recent referenced document. California Code of Regulations, Title 8, Section 3212 §(b), which states, "covers shall be capable of safely supporting the greater of 400 lbs or twice the weight of the employees, equipment and materials that may be imposed on any one square foot area of the cover at any time."

6.0 Test Specimen Description:

6.1 Product Sizes:

Overall Area: 6.7 ft^2	**Width (inches)**	**Length (inches)**	**Height (inches)**
Curb mount flashing	31	31	3

Product	**Diameter (inches)**	**Height (inches)**
Dome	25-1/4	16-1/2

6.2 Unit Construction:

Unit Member	**Material**	**Description**
Flashing	Steel	22 gauge sheet metal that utilized a rigid plastic dome mounting ring
Top collar	Aluminum	0.022" thick, stamped sheet

	Joinery Type	**Detail**
Flashing	Overlapped	All sides of the flashing were bent at 90 degrees creating a 3" return. The corners were then overlapped and secured with two 5/16" rivets per corner located 1-1/2" from the end.

5.0 Test Specimen Description: (Continued)

6.3 Weatherstripping:

Description	Quantity	Location
5/16" wide by 1/8" high foam tape	1 row	Located on the bottom perimeter of the plastic dome mounting ring
2" wide by 1/4" high foam tape	1 row	Located on the underside, interior perimeter of the curb flashing
5/16" wide by 1/4" high foam	1 row	Located on the exterior perimeter of the top collar and secured with adhesive

6.4 Glazing: *No conclusions of any kind regarding the adequacy or inadequacy of the glazing can be made.*

Glazing	Glazing Method
5/32" smooth molded polycarbonate	The glazing was set from the exterior onto the dome mount. The glazing was secured to the exterior of the dome mount using six 1/2" diameter by 3/32" thick washers with rubber gaskets and #8 x 3/4" pan head screws spaced evenly around the exterior of the dome

Location	Quantity	Daylight Opening (diameter)
Dome	1	25-1/4"

6.5 Hardware:

Description	Quantity	Location
Daylight directing device	1	The acrylic device rested on the interior surface of the plastic dome mounting ring

7.0 Installation:

The specimen was installed onto a Spruce-Pine-Fir wood curb. The curb was sized to be tight-fitting to the frame, eliminating the need for shimming.

Location	Anchor Description	Anchor Location
Curb mount flashing	#8 x 1-1/2" self-tapping pan head screws	2-1/8" from each corner

8.0 Test Results: The results are tabulated as follows:

8.1 California (and OSHA) minimum loading:

Test Load	Load Location	Results	Deflection (in.)
400 lbf	Center of dome	Flashing began to bend; no damage to the dome	0.26

***Note**: The 400 lbf weight was applied perpendicular to the center of each dome. After 60 seconds of rest time, there was no visible damage to the exterior glazing.*

8.2 Additional loading (applied on the same unit in the listed order):

Test Load	Load Location	Results	Deflection
500 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.27
600 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.31
700 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.37
800 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.46
900 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.49
1000 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.54
1100 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.60
1200 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.62
1300 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.66
1400 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.73
1500 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.81
1600 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	0.96

7.0 Test Results: (Continued)

7.2 Additional loading (applied on the same unit in the listed order): (Continued)

Test Load	Load Location	Results	Deflection
1700 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.15
1800 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.24
1900 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.34
2000 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.43
2100 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.56
2200 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.61
2300 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.71
2400 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.77
2500 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.85
2600 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.94
2700 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	1.98
2800 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	2.01
2900 lbf at rest	Center of dome	Flashing continued to deflect; no damage to the dome	2.05
3000 lbf at rest	Center of dome	See note #1	2.10

***Note #1**: After the 3000 lbf load, testing was discontinued.*

***General Note:** All of the deflection readings were due to the bending of the flashing with no result of dome failure.*

9.0 Conclusion:

The specimen was evaluated in accordance with Occupational Safety and Health Administration (OSHA)/U.S. Department of Labor Regulations Standard 29 CFR §1910.29(e)(1) to be capable of supporting twice the maximum intended load, up to (200) ft-lb.

The specimen was evaluated in accordance with California Code of Regulations, Title 8, Section 3212 §(b) to be capable of safely supporting loads exceeding 400 ft-lb.

Intertek-ATI will service this report for the entire test record retention period. Test records such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained by Intertek-ATI for the entire test record retention period.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen(s) tested. This report may not be reproduced, except in full, without the written approval of Intertek-ATI.

For ARCHITECTURAL TESTING, Inc.

Digitally Signed by: Kyle Ruth

Kyle Ruth
Technician

Digitally Signed by: Timothy J. McGill

Timothy J. McGill
Manager – Product Testing

KR:asm/abo

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix-A: Photograph(s) (2)
Appendix-B: Drawing(s) (1)

Appendix A

Photograph(s)

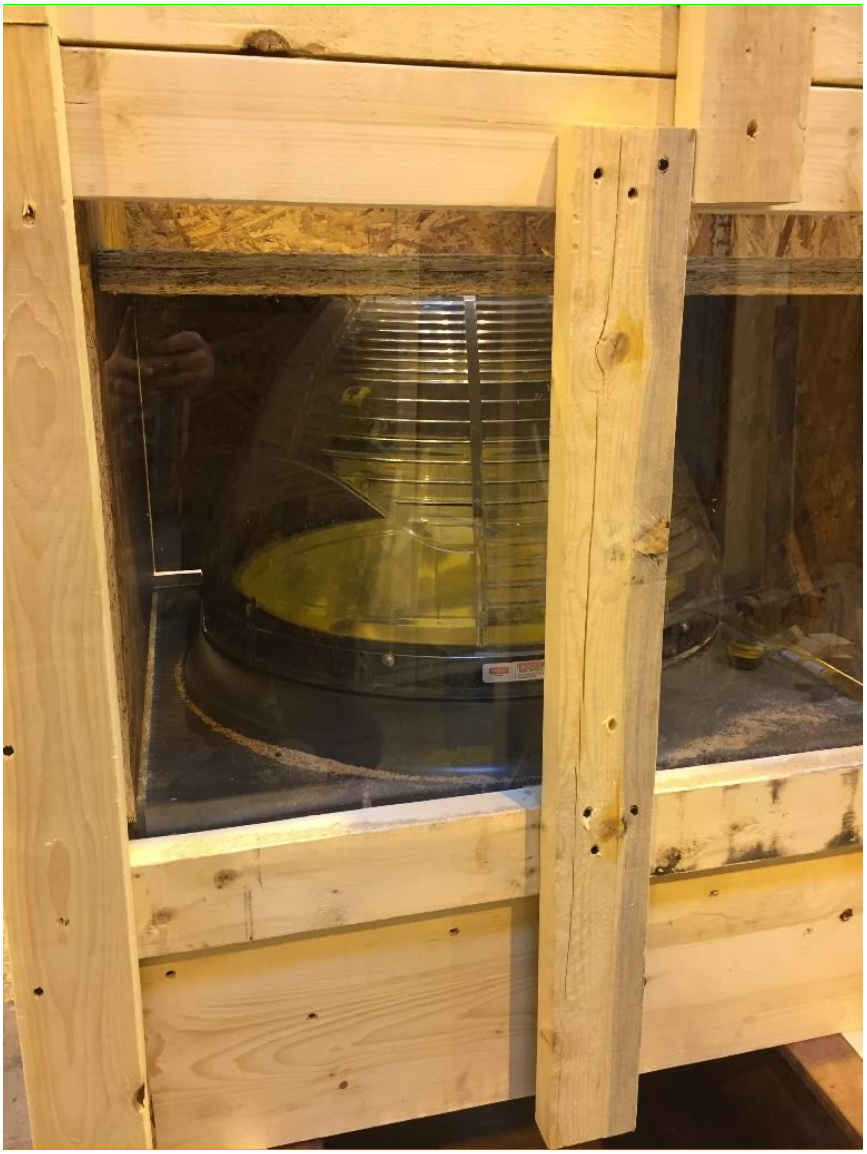


Photo No. 1
The Test Specimen

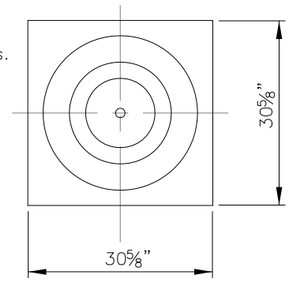
Photo No. 2
The Test Set-up

Appendix B

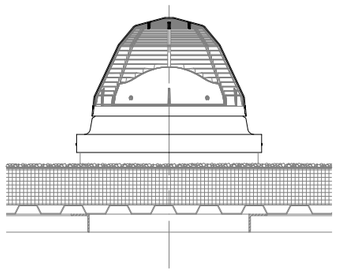
Drawing(s)

General Notes

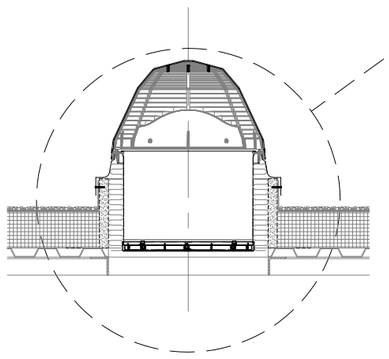
1. This drawing emphasizes the TCC curb flashed VELUX SUN TUNNEL Skylight. It illustrates a general arrangement layout (plus recommendations) for a VELUX TCC installation in a 0–60 degree roof pitch application utilizing an open ceiling installation.
2. The architectural/structural design and specifications for the inclusion of a tubular daylighting device, such as the VELUX TCC, in any roofing/ceiling application is determined and provided by others. The design criteria includes, but is not limited to design loads, structural configurations, structural framing member sizes and material, architectural finishes and integration with the roofing/ceiling systems of the building. VELUX assumes no responsibility or liability in the design, construction and performance of a building structure by others.
3. Secure eye screws/bolts to the roofing structure and attach suspension wire to connect to clips at end of tunnel section.
4. Secure suspension wires to the ceiling adaptor assembly & eyebolts.
5. Dimensions shown are nominal, unless indicated otherwise.
6. Product specific dimensions are referenced in the TCC Product Data Sheet documentation.
7. The minimum commercial roof opening for tunnel installation is is 22"x22" for straight tunnels. Some tunnel configurations may require a larger opening, not to exceed 26½"x26½".



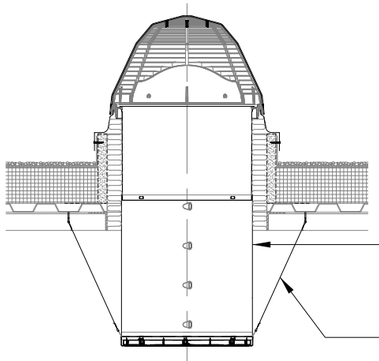
Plan



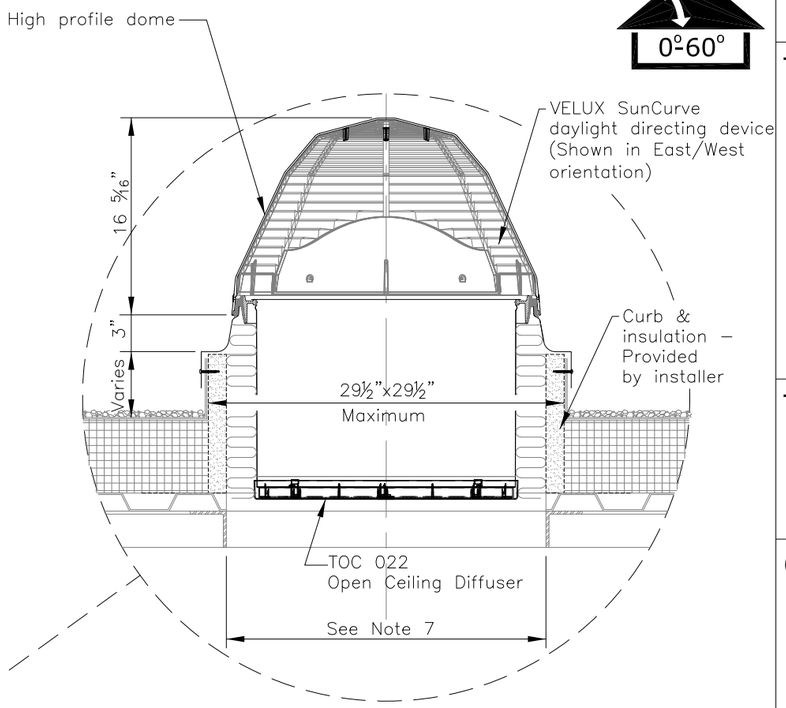
Elevation



Cross Section
TOC 022
Open Ceiling Diffuser

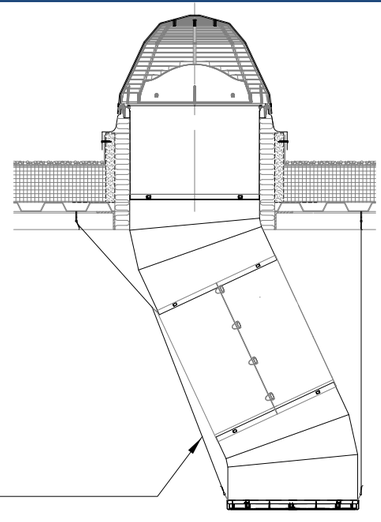


Option: ZTR 022



2:1

Intertek	Report #:	G4124.01-109-44
	Date:	11/2/2016
	Verified by:	

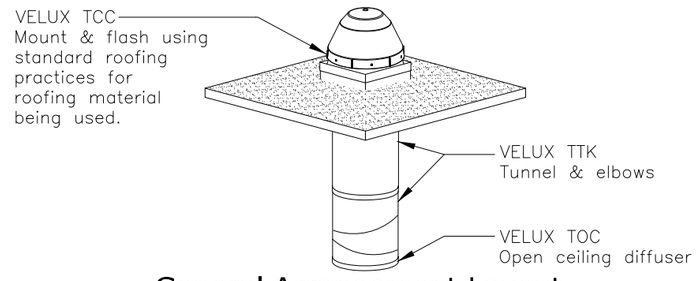


Option: TTK 022

TCC 022 Components	Quantity
TCC 022 3000 • Acrylic Dome • VELUX SunCurve daylight directing device • Counter flashing assembly • Top collar (16"/.41m) • Aluminum tape (length 16"/.41m) for top collar • Hardware bag • Option • TCC 022 5000 – Impact Polycarbonate dome	____

TOC 022 Open Ceiling Diffuser
• TOC 022 0002 – Prismatic Diffuser
• Options
  • TOC 022 0000 – Frosted diffuser
  • TOC 022 0003 – Fresnel diffuser
	____

Option: ZTR 022 • ZTR 022 0002 24"/.61m Rigid tunnel • ZTR 022 0004 48"/1.22m Rigid tunnel • ZTR 022 0006 72"/1.83m Rigid tunnel ZTR 022 0012 144"/3.66m Rigid tunnel ZTR 022 0024 288"/7.32m Rigid tunnel	____
Option: TTK 022 • 24"/.61m Rigid tunnel • (2) 16"/.41m Rigid elbows • Tape for tunnel joints • Suspension wire • Hardware bag	____



General Arrangement Layout

VELUX	VELUX 1418 Evans Pond Road Greenwood, SC 29649 1–800–88–VELUX www.VELUXUSA.com		Name	Date
Sky–Product Management		Drawn by	JDH	July 2015
		Checked by	JL,CJ	July 2015
		Drawing No.		
Commercial SUN TUNNEL Skylight TCC 022 w/ TOC 022 & optional ZTR 022, TTK 022			TCC 022–01–0715	