Product Evaluation Report

Date:	August 2, 2023
PTC Report No.:	1971-PER
Report Revision No.:	7
PTC Project No.:	422-0615
Product Mfg.:	Solatube International, Inc. 2210 Oak Ridge Way Vista, CA 92081
Product Name:	Impact 160 DS (10”), 290 DS (14”) & 300 DS (14”) Tubular Daylight Device - HVHZ
Product Category:	Sky Lights
Product Sub-Category:	Skylight
Compliance Method:	Product Approval Rule 61G20-3.005(1)(d) – Product Evaluation Report by a Licensed Professional Engineer
Prepared By:	Robert J. Amoruso, P.E. Florida P.E. License Number 49752 PTC Product Design Group, LLC FBPE Certification of Authorization No. 25935

CERTIFICATE OF INDEPENDENCE

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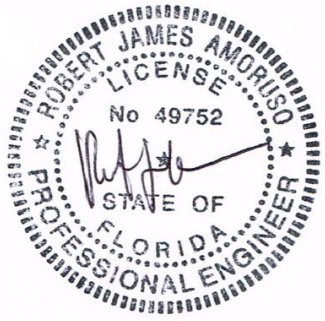

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Evaluated by:
Robert J. Amoruso, P.E.
Florida P.E. License Number 49752

Project Scope

Evaluate Solatube Impact 160 DS (10”), 290 DS (14”) & 300 DS (14”) Tubular Daylight Device for conformance to the 8th Edition (2023) Florida Building Code – Building and Residential Volumes including the High Velocity Hurricane Zone (HVHZ). Prepare the following:

- Product Installation Details/Drawings (Reference 1)
- Installation Anchorage Evaluation (Reference 3)
- Product Evaluation Report (this report)

Description of Product – Installation Requirements

See Reference 1 for a description of the product, its installation and other pertinent data related to its approved use.

Limitations and Conditions of Use

This product evaluation report contains or refers to specifications, technical details and installation details and/or methods that pertain to the proper use and/or installation of the product specified herein. Specific limitations and conditions of its use including but not limited to the following are contained in Reference 1 and are the subject of Product Approval in accordance with the State of Florida Product Approval Rule 61G20-3.

- Design Pressure Rating (psf)
- Installation substrate requirements.
- Installation anchor requirements.
- Installation restrictions.
- Product description.
- Product components.

Code Conformance – Performance Testing

Reference 2.a conducted testing to the following standard(s). See Reference 3.b for Code Conformance Evaluation to the 8th Edition (2023) FBC for these testing standards.

1) TAS 201-94 - *Impact Test Procedures*
2) TAS 202-94 - *Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure*
3) TAS 203-94 - *Criteria for Testing Products Subject to Cyclic Wind Pressure Loading*

DESIGN PRESSURE LIMITATIONS

- From Reference 2.a
  - Uniform Load Structural Test Pressures where +210/-140 psf.
  - Water Test Pressure of +10.5 psf.
  - Cyclic Wind Loading Pressure of +/-70 psf.
- Apply the following factors to arrive at Design Pressure.
  - A Safety Factor of 2 applied to the Uniform Load Structural Test Pressures to arrive at Design Pressures of +105/-70 psf.
  - A factor of 1/0.15 = 6.67 applied to the Water Test Pressure arrive at Design Pressures of +70 psf.
- Overall Design Pressure is +/-70 psf.

Code Conformance – Plastics

The 8th Edition (2023) Florida Building Code, Chapter 26 define requirements for Approved Plastics. The following table summarizes plastics testing for applicable components. See Reference 3.b for Code Conformance Evaluation to the 8th Edition (2023) FBC for the testing standards mentioned below. BOM Item No. in parenthesis refer to drawing number SOLA0004 and SOLA0013 unless otherwise indicated.

OUTER DOME (1), DOME RING (3), TOP TUBE CLIP (7) AND INNER DOME (26 on SOLA0004 and 27 on SOLA0013) testing for High Impact Acrylic PMMA (Poly(methyl methacrylate))					
Attribute	**Report Reference**	**ASTM**	**Result**	**Acceptance Criteria**	
Outdoor Exposure	2.b.i	ASTM G155-05a and D638-03	9.25%	+/- 10% difference in tensile strength	
Rate of Burning	2.b.ii	ASTM D635-06	CC2	CC1 or CC2	
Self-Ignition Temperature	2.b.iii	ASTM D1929-96	982°F	$\geq$ 650°F	
Smoke Density	2.b.iv	ASTM E84-06	400	$\leq$ 450	
Conclusion: ACCEPTABLE					

OUTER DOME (1), DOME RING (3), TOP TUBE CLIP (7) AND INNER DOME (26 on SOLA0004 and 27 on SOLA0013) testing for High Impact Acrylic PMMA (Poly(methyl methacrylate))					
Attribute	**Report Reference**	**ASTM**	**Result**	**Acceptance Criteria**	
Outdoor Exposure	2.c.i	ASTM G155-00ae1 and D638-03	3.3%	+/- 10% difference in tensile strength	
Rate of Burning	2.c.ii	ASTM D635-06	CC1	CC1 or CC2	
Self-Ignition Temperature	2.c.iii	ASTM D1929-96(2001)e1	930°F	$\geq$ 650°F	
Smoke Density	2.c.iv	ASTM D2843-99	5.8	$\leq$ 75	
Conclusion: ACCEPTABLE					

EFFECT LENS (17) testing for PET-GAG (PET-Polyethylene Terephthalate, High Frequency Welding Grade-GAG)					
Attribute	**Report Reference**	**ASTM**	**Result**	**Acceptance Criteria**	
Rate of Burning	2.d.ii	ASTM D635-06	CC1	CC1 or CC2	
Self-Ignition Temperature	2.d.iii	ASTM D1929-96(2001)e1	765°F	≥ 650°F	
Smoke Density	2.d.iv	ASTM E84-09a	95	≤ 450	
Conclusion: ACCEPTABLE					

CEILING RING (16) AND DRESS RING (19) testing for Medium Impact Acrylic PMMA (Poly(methyl methacrylate))					
Attribute	**Report Reference**	**ASTM**	**Result**	**Acceptance Criteria**	
Outdoor Exposure	2.e.iv	ASTM G155-05a and D638-03	9.25%	+/- 10% difference in tensile strength	
Rate of Burning	2.e.i	ASTM D635-06	CC2	CC1 or CC2	
Self-Ignition Temperature	2.e.ii	ASTM D1929-96	982°F	≥ 650°F	
Smoke Density	2.e.iii	ASTM E84-06	400	≤ 450	
Conclusion: ACCEPTABLE					

CEILING RING (16) AND DRESS RING (19) testing for Medium Impact Acrylic PMMA (Poly(methyl methacrylate))					
Attribute	**Report Reference**	**ICC-ES Report**	**Result**	**Acceptance Criteria**	**Comment**
Rate of Burning	2.f.i & 2.f.ii	ICC-ES ESR-1653	CC2	CC1 or CC2	IBC - 2606 has same requirements as 8th Edition (2023) FBC , Chapter 26
Self-Ignition Temperature	2.f.i & 2.f.ii		Conformance per ICC-ES ESR-1653	≥ 650°F	
Smoke Density	2.f.i & 2.f.ii			≤ 450	
Conclusion: ACCEPTABLE					

DIFFUSER PANEL (18) testing for Medium Impact Acrylic PMMA (Poly(methyl methacrylate))					
Attribute	**Report Reference**	**ASTM**	**Result**	**Acceptance Criteria**	
Rate of Burning	2.g.i	ASTM D635-06	CC2	CC1 or CC2	
Self-Ignition Temperature	2.g.ii	ASTM D1929-96	992°F	≥ 650°F	
Smoke Density	2.g.iii	ASTM E84-06	350	≤ 450	
Conclusion: ACCEPTABLE					

DIFFUSER PANEL (18) testing for Polycarbonate Sheet					
Attribute	**Report Reference**	**ASTM**	**Result**	**Acceptance Criteria**	
Rate of Burning	2.h.i	ASTM D635-74	CC2	CC1 or CC2	
Self-Ignition Temperature	2.h.ii	ASTM D1929-68(1975)	896°F	≥ 650°F	
Smoke Density	2.h.iii	ASTM D2843-93	38	≤ 75	
Conclusion: ACCEPTABLE					

ACRYLIC LENS AND TRIM RING (Various – BOM – Optional Diffusers on SOLA0004) testing for Acrylic					
Attribute	**Report Reference**	**ASTM**	**Result**	**Acceptance Criteria**	
Rate of Burning	2.i.i	ASTM D635-14	CC2	CC1 or CC2	
Self-Ignition Temperature	2.i.i	ASTM D1929-16	878°F	≥ 650°F	
Smoke Density	2.i.i	ASTM D2843-16	13.4	≤ 75	
Conclusion: ACCEPTABLE					

Performance and Testing Standards

Reference 2.a conducted air, water and structural testing including impact and cyclic loading to the following standard(s).

1) TAS 201-94 - *Impact Test Procedures*
2) TAS 202-94 - *Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure*
3) TAS 203-94 - *Criteria for Testing Products Subject to Cyclic Wind Pressure Loading*

Reference 2.b, 2.c, 2.d, 2.e, 2.g, 2.h and 2.i conducted plastics testing to the following standard(s).

1) ASTM G155-05a, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
2) ASTM G155-00ae1, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
3) ASTM D638-03, Standard Test Method for Tensile Properties of Plastics
4) ASTM D635-06, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
5) ASTM D635-74, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
6) ASTM D1929-96 (2001)e1, Standard Test Method for Determining Ignition Temperature of Plastics.
7) ASTM D1929-96, Standard Test Method for Determining Ignition Temperature of Plastics.
8) ASTM D1929-68(1975), Standard Test Method for Determining Ignition Temperature of Plastics.

9) ASTM E84-06, Standard Test Method for Surface Burning Characteristics of Building Materials
10) ASTM E84-09a, Standard Test Method for Surface Burning Characteristics of Building Materials
11) ASTM D 2843-99, Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
12) ASTM D 2843-93, Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
13) ASTM D635-14, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
14) ASTM D1929-16, Standard Test Method for Determining Ignition Temperature of Plastics
15) ASTM D2843-16, Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics

Reference 2.f recorded ICC/FBC conforming plastics testing in the following evaluation reports.

1) ICC-ES Report No. ESR-1653

References and Supporting Documents

1) Drawings

    a. SOLA0004, Rev. F, dated 9/19/23, signed and sealed by Robert J. Amoruso, PE, *Solatube Impact 160 DS (10") and 290 DS (14") Tubular Daylight Device – Installation Anchorage Details.*
    b. SOLA0013, Original Issue, dated 10/17/17, signed and sealed by Robert J. Amoruso, PE, *Solatube Impact 300 DS (14") Tubular Daylight Device – Installation Anchorage Details.*

2) Testing (note that References 2.b thru 2.h have the BOM Item description and (Item No.) shown.

    a. Architectural Testing Inc. Test Report No. 85320.01-301-18, dated 9/08/08, *Solatube Impact 160 DS (10") and 290 DS (14") Tubular Daylight Device testing to TAS 201, TAS 202 and TAS 203*, signed and sealed by Joshua M. Royce, P.E.
        i. 300 DS (14") Tubular Daylight Device same as 290 DS for exterior skylight components. Therefore, Test Report No. 85320.01-301-18 applicable.

    b. OUTER DOME (1), DOME RING (3), TOP TUBE CLIP (7) AND INNER DOME (26) testing for High Impact Acrylic PMMA (Poly(methyl methacrylate))
        i. Intertek Test Report No. 3143957-004, dated 9/24/08, testing to ASTM G155-05a and D638-08 in accordance with ASTM D2565-99.
        ii. SGS Test Report No. 177:013002-01-R1, dated 6/10/08, testing to ASTM D635-06.
        iii. SGS Test Report No. 177:013002-02-R1, dated 6/10/08, testing to ASTM D1929-96.
        iv. SWRI Test Report No. 01.12693.01.139, dated 4/5/07, testing to ASTM E84-06.

    c. OUTER DOME (1), DOME RING (3), TOP TUBE CLIP (7) AND INNER DOME (26) testing for High Impact Acrylic PMMA (Poly(methyl methacrylate))

i. Architectural Testing Inc. Test Report No. 58735.01-106-18, dated 1/4/07, testing to ASTM G155-00ae1 and D638-03.
ii. SGS Test Report No. 177:002666-03, dated 1/2/07, testing to ASTM D635-06.
iii. SGS Test Report No. 177:002666-01, dated 1/13/07, testing to ASTM D1929-96(2001)e1.
iv. SGS Test Report No. 177:002666-02, dated 1/2/07, testing to ASTM D2843-99.

d. EFFECT LENS (17), PET-GAG (PET – Polyethylene Terephthalate, High Frequency Welding Grade - GAG) testing
i. SGS Test Report No. 2138368-1, dated 8/27/10, testing to ASTM D635-06.
ii. SGS Test Report No. 2138368-3, dated 2/2/10, testing to ASTM D1929-96(2001)e1.
iii. SGS Test Report No. 2138368-2, dated 8/31/10, testing to ASTM E84-09a.

e. CEILING RING (16) AND DRESS RING (19) testing for Medium Impact Acrylic PMMA (Poly(methyl methacrylate))
i. SGS Test Report No. 177:013002-01-R1, dated 6/10/08, testing to ASTM D635-06.
ii. SGS Test Report No. 177:013002-02-R1, dated 6/10/08, testing to ASTM D1929-96.
iii. SWRI Test Report No. 01.12693.01.139, dated 4/5/07, testing to ASTM E84-06.
iv. Intertek Test Report No. 3143957-004, dated 9/24/08, testing to ASTM G155-05a and D638-08 in accordance with ASTM D2565-99.

f. CEILING RING (16) AND DRESS RING (19) testing for Medium Impact Acrylic PMMA (Poly(methyl methacrylate))
i. ICC-ES Report No. ER-1084 demonstrates compliance to I-Codes for use in skylight applications. Report No. 8th Edition (2023) FBC requirements same based on review of documented results.
ii. ICC-ES Report No. ESR-1653 demonstrates compliance to I-Codes for use in skylight applications. Report No. ESR-1653 and 8th Edition (2023) FBC requirements same based on review of documented results.

g. DIFFUSER PANEL (18) testing for Medium Impact Acrylic PMMA (Poly(methyl methacrylate))
i. SGS Test Report No. 177:013002-03-R1, dated 6/10/08, testing to ASTM D635-06.
ii. SGS Test Report No. 177:013002-04-R1, dated 6/10/08, testing to ASTM D1929-96.
iii. SWRI Test Report No. 01.13536.01.060, dated 1/30/08, testing to ASTM E84-06.

h. DIFFUSER PANEL (18) testing for Polycarbonate
i. SGS Test Report No. 153367-2, dated 4/2/01, testing to ASTM D635-74.
ii. SGS Test Report No. 153367-1, dated 4/2/01, testing to ASTM D1929-68(1975).
iii. SGS Test Report No. 153367-3, dated 4/2/01, testing to ASTM D2843-93.

i. Acrylic Lens and Trim Ring (Various in BOM of Optional Diffusers) testing for Acrylic Material
i. Intertek/ATI Test Report No. G3786.01-106-24, dated 4/28/17 for Huashuaite Clear Acrylic Sheet Material

3) Reports
    a. Engineering Analysis: Anchorage and product verification has been substantiated by calculations prepared, signed, and sealed by Robert J. Amoruso, P.E. in accordance with the 8th Edition (2023) Florida Building Code.
    b. PTC Report No. 1971-EER, Rev. 7, *Solatube Impact 160 DS (10"), 290 DS (14") and 300 DS (14") Tubular Daylight Device – Referenced Testing Standards Equivalency Evaluation,* signed and sealed by Robert J. Amoruso, P.E.