



Product Evaluation Report

Date: October 13, 2015

PTC Report No.: 2397

Report Revision No.: 0

PTC Project No.: 415-0316

Product Mfg.: Solatube International, Inc.
2210 Oak Ridge Way
Vista, CA 92081

Product Name: Solatube M74 DS Curb Mount TDD with Amplifier - Dual Glazed
Solatube M74 DS Curb Mount TDD with Amplifier - Single Glazed

Product Category: Sky Lights

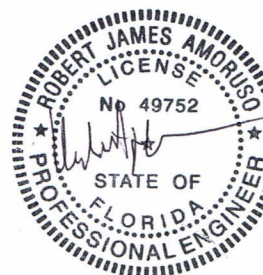
Product Sub-Category: Skylight

Compliance Method: Product Approval Rule 61G20-3.005 (1)(d) – Product Evaluation Report by a Licensed Professional Engineer

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CERTIFICATE OF INDEPENDENCE

PTC Product Design Group, LLC and Robert J. Amoruso, P.E. do not have, nor will acquire, any financial interest in the company manufacturing or distributing product(s) covered by this Product Evaluation Report. PTC Product Design Group, LLC and Robert J. Amoruso, P.E. do not have, nor will acquire any financial interest in any other entity involved in the approval process or testing of the product(s) covered by this Product Evaluation Report.



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Evaluated by:
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Project Scope

Evaluate Solatube M74 DS Curb Mount TDD with Amplifier - Dual Glazed for conformance to the 5th Edition (2014) Florida Building Code – Building and Residential Volumes including the High Velocity Hurricane Zone (HVHZ) and Solatube M74 DS Curb Mount TDD with Amplifier - Single Glazed Tubular Daylight Devices for conformance to the 5th Edition (2014) Florida Building Code – Building and Residential Volumes including the High Velocity Hurricane Zone (HVHZ).

The engineering analysis (Reference 3.a) determines the anchorage of the product to the supporting substrate and the product evaluation report (this document) summarizes 5th Edition (2014) FBC compliance verification and appropriate Limitations and Conditions of Use.

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 makes reference 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.

Applications/Installations outside the Limitations and Conditions of Use of this Product's Approval

Rule 61G20-3.005(1)(e) states “Rational engineering analysis cannot be used in lieu of a standard test required by the Code for approval of products within the scope of the standard, except that project specific approval by the local authorities having jurisdiction in accordance with alternate methods and materials authorized in the Code.”

Any modification to this product as evaluated in this report and approved by the Florida Building Commission is outside the scope of this evaluation and will be the responsibility of others. As allowed in Rule 61G20-3.005(1)(e), a project specific approval by the local authorities having jurisdiction may be used given an appropriate rational analysis is conducted and deemed acceptable to the local authorities having jurisdiction.

Quality Assurance

This product is manufactured under a quality assurance program audited by an approved Certification and Quality Assurance Entity **Keystone Certifications Inc. (KCI)** as required in Rule 61G20-3.005(3). See FBC Organization No. CER1523 and QUA1824 for approval under Rule 61G20-3.

Code Conformance – Air, Water and Structural Performance, Impact & Cyclic Loading

Reference 2.a conducted testing to the following standard(s). See Reference 3.b for Code Conformance Evaluation to the 5th Edition (2014) FBC for these testing standards as applicable.

1. AAMA/WDMA/CSA 101/I.S.2/A440-11, North American Fenestration Standard/Specification for windows, doors, and skylights.
2. ASTM E1886-13, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
3. ASTM E1996-12, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.
4. ASTM E283-04, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
5. ASTM E330-02, Standard Test Method for Structural Performance of Exterior windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E547-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
7. TAS201-94, Impact Test Procedures.
8. TAS202-94, Criteria for Testing Impact & Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure.
9. TAS203-94, Criteria for Testing Products Subjected to Cyclic Wind Pressure Loading.

LIGHT AMPLIFIER OPTION VS. OPEN CEILING LIGHT DIFFUSER MODEL TESTED

The Light Amplifier Option shown on M74 DS-O-DP-FC-A-L2-REG and M74 DS-O-DPP-FC-A-L2-REG replaces the Light Diffuser Option of the Open Ceiling model shown on M74 DS-O-DP-FC-B-L2-REG and M74 DS-O-DPP-FC-B-L2-REG.

1. There are no changes to those components making up the roof-top portion of the TDD that comprise the structural, air infiltration and water penetration components that include:
 - a. Roof Top portion: Dome, Clamps, Curb Cap, Foam Insulation etc.
 - b. Extension Tube
2. Remove Light Diffuser Components:
 - a. Light Diffuser, Seal, & Retaining Belt Assembly

3. Add Light Amplifier Components:

- a. Amplifier (Conical Tube Section)
- b. Enlarged Light Diffuser, Enlarged Seal, & Enlarged Retaining Belt Assembly
 - i. These new components use material common to the 1st Phase
 - ii. The only changes are in the new conical shaped tube section and increased diffuser assembly size.

Because the overall structural components of the TDD as well as the components affecting air infiltration and water penetration remain identical, and because installation requirements have not changed, exiting testing in Reference 2 remains applicable to these models/series.

DESIGN PRESSURE LIMITATIONS

- From Reference 2.a.iv and 2.a.v (air, water and structural) and 2.a.i (impact/cyclic) testing of Solatube M74 DS Curb Mount Open Ceiling TDD - Single and Dual Glazed:
 - Uniform Load Structural Test Pressures where +160/-160 psf.
 - Water Test Pressure of +12.11 psf.
 - Cyclic Wind Loading Pressure of +/-80 psf.
- From Reference 2.a.ii (air, water and structural and impact/cyclic) testing of - Solatube M74 DS Curb Mount Open Ceiling TDD – Single and Dual Glazed to HVHZ requirements:
 - Uniform Load Structural Test Pressures where +160/-160 psf.
 - Water Test Pressure of +12 psf.
 - Cyclic Wind Loading Pressure of +/-80 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 +80/-80 psf.
 - A factor of $1/0.15 = 6.67$ applied to the Water Test Pressure arrive at Design Pressure of +80 psf.
- Overall Design Pressure is +/-80 psf.

Code Conformance – Plastics

The 5th Edition (2014) Florida Building Code, Sections 2606.4 & 2614.2 define requirements for Approved Plastics. Note that Sections 2614.2 dictate HVHZ requirements.

The table below summarizes BOM components and requisite test report/evaluation report/NOA references demonstrating compliance. The tables on the following pages summarize plastics testing results for applicable components. See Reference 3.b for Code Conformance Evaluation to the 5th Edition (2014) FBC for the testing standards mentioned below. BOM Item No. in parenthesis ().

BILL OF MATERIALS					Plastics Test Report No. (* ASTM E84 or D2843 required for Smoke Density, not both)					DWG NO. APPLICABLE, YES/NO	
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.	MATERIAL	ASTM G155/D638	ASTM D635	ASTM D1929	ASTM E84*	ASTM D2843*	SOLA0011	SOLA0012
1	508005	OUTER DOME M74 DS	1	Bayer Material Science / Makrolon SL	NOA 12-0605.05	ICC-ES ESR-2728 and NOA 12-0605.05	ICC-ES ESR-2728 and NOA 12-0605.05	NA	ICC-ES ESR-2728 and NOA 12-0605.05	YES	YES
2	510510	INNER THERMAL DISC M74 DS	1	Eastman / Spectar	NA	ICC-ES ESR-1407	ICC-ES ESR-1407	NA	ICC-ES ESR-1407	YES	NO
				Plaskolite / Vivak	NA	QAI Laboratories No. TJ1009-3	QAI Laboratories No. RJ2298F-1	NA	QAI Laboratories No. TJ1009-2		
14	500375	INSULATION SECTION, RIGID	4	R-Max / TSX-8500	NA	NA	NA	ICC-ES ESR-1864	NA	YES	YES
				DOW / Thermax Sheathing	NA	NA	NA	ICC-ES ESR-1659	NA	YES	YES
26	420986	DIFFUSER M74 DS AMP. PRISMATIC PANEL	1	Plaskolite / Optix	NA	ICC-ES RE-2590	ICC-ES RE-2590	NA	ICC-ES RE-2590	YES	YES

(1) OUTER DOME M74 DS – Bayer Material Science / Makrolon SL

Attribute	Report Reference	ASTM	Result	Acceptance Criteria	Code Section
Outdoor Exposure	NOA 12-0605.05	ASTM G155 and D638	1%	+/- 10% difference in tensile strength	2614.2
Rate of Burning	ICC-ES ESR-2728 and NOA 12-0605.05	ASTM D635	CC1	CC1 or CC2	2606.4, 2614.2
Self-Ignition Temperature		ASTM D1929	Met per ICC-ES ESR-2728 and 1022°F (NOA)	≥ 650°F	
Smoke Density		ASTM D2843	Met per ICC-ES ESR-2728 and 57.7 % (NOA)	≤ 75	

Conclusion: ACCEPTABLE

ICC-ES ESR-2728 confirms acceptance to the IBC, Section 2606.4 which requires the same Acceptance Criteria as the 5th Edition (2014) FBC, Sections 2606.4 and 2614.2.

NOA 12-0605.05 confirms testing meets 2010 Florida Building Code – See Reference 3.b for Equivalency Evaluation.

(2) INNER THERMAL DISC 640DS - Eastman / Spectar

Attribute	Report Reference	ASTM (per 2006 ICC)	Result	Acceptance Criteria	Code Section
Rate of Burning	ICC-ES ESR-1407	ASTM D635-03	CC1	CC1 or CC2	2606.4, 2614.2
Self-Ignition Temperature	ICC-ES ESR-1407	ASTM D1929-96(2001)e1	Met per ICC-ES ESR-1407	≥ 650°F	
Smoke Density	ICC-ES ESR-1407	ASTM D2843-99(2004)	Met per ICC-ES ESR-1407	≤ 75	

Conclusion: ACCEPTABLE

ICC-ES ESR-1407 confirms acceptance to the IBC, Section 2606.4 which requires the same Acceptance Criteria as the 5th Edition (2014) FBC, Sections 2606.4 and 2614.2.

(2) INNER THERMAL DISC 640DS - Plaskolite / Vivak

Attribute	Report Reference	ASTM	Result	Acceptance Criteria	Code Section
Rate of Burning	QAI Laboratories No. TJ1009-3	ASTM D635-06	CC1	CC1 or CC2	2606.4, 2614.2
Self-Ignition Temperature	QAI Laboratories No. RJ2298F-1	ASTM D1929-12	880°F	≥ 650°F	
Smoke Density	QAI Laboratories No. TJ1009-2	ASTM D2843-10	68%	≤ 75	

Conclusion: ACCEPTABLE

(14) INSULATION SECTION, RIGID - R-Max / TSX-8500					
Attribute	Report Reference	ASTM (per 2006 ICC)	Result	Acceptance Criteria	Code Section
Smoke Developed Index	ICC-ES ESR-1864	ASTM E84-04	<450	≤ 450	2603
Flame Spread Index			<25	≤ 75	
Conclusion: ACCEPTABLE					
ICC-ES ESR-1864 confirms acceptance to the IBC, Section 2603.3 which requires the same Acceptance Criteria as the 5th Edition (2014) FBC Section 2603.3.					

(14) INSULATION SECTION, RIGID - DOW / Thermax Sheathing					
Attribute	Report Reference	ASTM (per 2006 ICC)	Result	Acceptance Criteria	Code Section
Smoke Developed Index	ICC-ES ESR-1659	ASTM E84-04	<450	≤ 450	2603
Flame Spread Index			<25	≤ 75	
Conclusion: ACCEPTABLE					
ICC-ES ESR-1659 confirms acceptance to the IBC, Section 2603.3 which requires the same Acceptance Criteria as the 5th Edition (2014) FBC Section 2603.3.					

(26) DIFFUSER M74 DS PRISMATIC PANEL - Plaskolite / Optix					
Attribute	Report Reference	ASTM (per 2006 ICC)	Result	Acceptance Criteria	Code Section
Rate of Burning	ICC-ES ESR-2590	ASTM D635-03	CC2	CC1 or CC2	2606.4, 2614.2
Self-Ignition Temperature	ICC-ES ESR-2590	ASTM D1929-96(2001)e1	Met per ICC-ES ESR-2590	≥ 650°F	
Smoke Density	ICC-ES ESR-2590	ASTM D2843-99(2004)	Met per ICC-ES ESR-2590	≤ 75	
Conclusion: ACCEPTABLE					
ICC-ES ESR-2591 confirms acceptance to the IBC, Section 2606.4 which requires the same Acceptance Criteria as the 5th Edition (2014) FBC Sections 2606.4 and 2614.2.					

Performance and Testing Standards

Reference 2.a conducted air, water and structural testing including impact and cyclic loading to the following standard(s). See Reference 3.b for Code Conformance Evaluation to the 5th Edition (2014) FBC for these testing standards as applicable.

1. AAMA/WDMA/CSA 101/I.S.2/A440-11, North American Fenestration Standard/Specification for windows, doors, and skylights.
2. ASTM E1886-13, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
3. ASTM E1996-12, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.
4. ASTM E283-04, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
5. ASTM E330-02, Standard Test Method for Structural Performance of Exterior windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E547-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
7. TAS201-94, Impact Test Procedures.
8. TAS202-94, Criteria for Testing Impact & Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure.
9. TAS203-94, Criteria for Testing Products Subjected to Cyclic Wind Pressure Loading.

Reference 2.b.i conducted plastic testing to the following standard(s). See Reference 3.b for Code Conformance Evaluation to the 5th Edition (2014) FBC for these testing standards as applicable.

1. ASTM D638-03, Standard Test Method for Tensile Properties of Plastics
2. ASTM D638-06, Standard Test Method for Tensile Properties of Plastics
3. ASTM D1929-96 (2001)e1, Standard Test Method for Determining Ignition Temperature of Plastics.
4. ASTM D1929-12, Standard Test Method for Determining Ignition Temperature of Plastics.
5. ASTM D2843-99(2004), Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
6. ASTM D2843-10, Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
7. ASTM E84-04, Standard Test Method for Surface Burning Characteristics of Building Materials

Reference 2.b.ii conducted plastics testing to the following standard(s) in which NOA No. NOA 12-0605.05 confirms that plastic testing meets the 5th Edition (2014) FBC/FRC.

1. ASTM D638, Standard Test Method for Tensile Properties of Plastics
2. ASTM D1929, Standard Test Method for Determining Ignition Temperature of Plastics.
3. ASTM D2843, Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

References and Supporting Documents

1) Drawings

- a. Applicable to this product Approval Document
 - i. M74 DS-O-DPP-FC-A-L2-REG, signed and sealed by Robert J. Amoruso, P.E. on 10/13/15, *Solatube M74 DS Curb Mount TDD with Amplifier - Dual Glazed.*
 - ii. M74 DS-O-DP-FC-A-L2-REG, signed and sealed by Robert J. Amoruso, P.E. on 10/13/15, *Solatube M74 DS Curb Mount TDD with Amplifier - Single Glazed.*
- b. Product Approval under Product Approval Report Number 2396
 - i. M74 DS-O-DPP-FC-B-L2-REG, signed and sealed by Robert J. Amoruso, P.E. on 10/13/15, *Solatube M74 DS Curb Mount Open Ceiling TDD - Dual Glazed.*
 - ii. M74 DS-O-DP-FC-B-L2-REG, signed and sealed by Robert J. Amoruso, P.E. on 10/13/15, *Solatube M74 DS Curb Mount Open Ceiling TDD - Single Glazed.*

2) Testing

- a. Performance Testing
 - i. Architectural Testing Inc. (Fresno, CA) **Test Report No. 08050.01-301-44** Dated 7/14/2014
 1. Solatube M74-DS Open Ceiling Tubular Daylight Device
 2. ASTM E1886-13 and ASTM E1996-12
 3. Series/Model M74 DS-O-DP-FC-B-L2 (Single Dome)
 4. Series/Model M74 DS-O-DDP-FC-B-L2 (Dual Dome)
 5. Wind Zone 4, Missile Level D
 6. DP = 80 psf
 - ii. Architectural Testing Inc. (Fresno, CA) **Test Report No. D8050.02-301-44** Dated 7/14/2014
 1. Solatube Open Ceiling Tubular Daylighting Device M74 DS
 2. Series/Model M74 DS-O-DP-FC-B-L2 (Single Dome)
 3. Series/Model M74 DS-O-DDP-FC-B-L2 (Dual Dome)
 4. TAS-201, TAS-202, and TAS 203 (Signed and Sealed by Tyler Westerling, P.E.)
 5. Large Missile Impact
 6. DP = 80 psf
 - iii. Architectural Testing Inc. (Fresno, CA) **Test Report No. D8050.03-301-44** Dated 7/14/2014
 1. Solatube M74-DS Open Ceiling Tubular Daylight Device
 2. Occupational Safety and Health Administration/ U.S. Department of Labor Regulations Standards - 29 CFR 1926 Subpart M (Fall Protection), 1926.501(b)(4)(i); 1926.501(i)(2); 1926.S01(b)(4)(ii)

- iv. Architectural Testing Inc.(Fresno, CA) **Test Report No. 08051.01-301-44** Dated 7/14/2014,
 - 1. Solatube Open Ceiling Tubular Daylighting Device M74 OS
 - 2. AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS
 - 3. Series/Model M74 DS-O-DP-FC-B-L2 (Single Dome)
 - 4. Series/Model M74 DS-O-DDP-FC-B-L2 (Dual Dome)
 - 5. DP = 80 psf
- v. Architectural Testing Inc. (Fresno, CA) **Test Report No. D8051.02-301-44** Dated 7/14/2014
 - 1. Solatube M74 DS Single Glazed and Dual Glazed - Tubular Daylighting Device - Open Ceiling testing
 - 2. ICC-ES AC-16 (Part A3.1, A3.2, A3.3, A4.3 & Part 84.1), ASTM E 283-04, ASTM E 330-02 and ASTM E 547-00
 - 3. Series/Model M74 DS-O-DP-FC-B-L2 (Single Dome)
 - 4. Series/Model M74 DS-O-DDP-FC-B-L2 (Dual Dome)
 - 5. DP = 80 psf

b. Plastics Testing

- i. International Code Council Evaluation Services – Evaluation Reports
 - 1. ICC-ES ESR-1407
 - 2. ICC-ES ESR-1864
 - 3. ICC-ES ESR-1659
 - 4. ICC-ES ESR-2590
 - 5. ICC-ES ESR-2728
- ii. Miami-Dade Product Control Notice of Acceptance (NOA) No.
 - 1. NOA 12-0605.05

3) Reports

- a. PTC Report No. 2236, Rev. 0, *Solatube M74 DS Curb Mount Open Ceiling TDD - Anchorage Engineering*, Dated 6/26/13, signed and sealed by Robert J. Amoruso, P.E.
- b. PTC Report No. 2397-EER, Rev. 0, *Solatube M74 DS Curb Mount Open Ceiling TDD with Amplifier – Equivalency Evaluation to the 5th Edition (2014) FBC*, Dated 10/13/15, signed and sealed by Robert J. Amoruso, P.E.

4) 5th Edition (2014) Florida Building Code & 5th Edition (2014) Florida Residential Code

- a. Testing and Labeling Requirements
 - i. Section 1626 – Impact Tests (HVHZ – WBDR)
 - ii. Section 1626.2 – Large Missile Impact Tests
 - iii. Section 1710.6 – Skylights and Sloped Glazing
 - iv. Section 2405 – Sloped Glazing and Skylights
 - v. Section 2410.4 – Product Approval Required
 - vi. Section 2610 – Light-Transmitting Plastic Skylight Glazing
 - vii. Section 2610.2 – Light-Transmitting Plastic Skylight Glazing, Mounting
 - viii. Section R308.6 – Skylights and Sloped Glazing

- b. Glazing Requirements
 - i. Section 2405.1 – Sloped Glazing and Skylights - Scope
 - ii. Section 2405.2 – Allowable Glazing Materials and Limitations
 - iii. Section R308.6 – Skylights and Sloped Glazing
- c. Plastics Requirements
 - i. Section 2603.3 – Foam Plastic Insulation
 - ii. Section 2606.4 – Specifications, Light-transmitting plastics
 - iii. Section 2614.2 – Definitions, Approved Plastics