

Product Evaluation Report

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Manufacturer
Solatube International, Inc
2210 Oak Ridge Way
Vista, CA 92081

Product Series, Model and/or Description
Solatube Brighten Up® Series Model 160 DS TDD
Solatube Brighten Up® Series Model 290 DS TDD

Code: 8th Edition (2023) Florida Building Code including the 8th Edition Florida Building Code

Compliance Methods:

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

Product Description: Products covered by this evaluation include the following.

- Solatube Brighten Up® Series Model 160 DS (10-inch Tube Dia.) TDD
- Solatube Brighten Up® Series Model 290 DS (14-inch Tube Dia.) TDD

Product Testing Results: testing by Architectural Testing, Inc. (Fresno, CA) – Testing shown below includes other Solatube Models not included in this evaluation (specifically the 330 DS and 750 DS)

- 97759.01-30-44-R2
 - 330 DS-O & C, 750 DS-O & C and 290 DS
 - AAMA/WDMA/CSA 101/I.S.2/A440-08
 - DP = +/-70 psf, SF = 3 for negative and 2 for positive test pressures
 - Water penetration tested; WTP = 12.11 psf (equates to + 80 psf DP)
 - Air Infiltration tested; 1.57 psf
- 97744.01-301-26-R0
 - 160 DS
 - ASTM 283-04
 - 290 DS
 - ASTM E 283-04
 - ASTM E 331-00
 - ASTM E 547-00
 - Water penetration tested; WTP = 12 psf (equates to + 80 psf DP)
 - Air Infiltration tested; 1.57 psf
- 81605 01-301-26-R1
 - 160 DS (Cyro)
 - ASTM E 283-04
 - 290 DS (Cyro)
 - ASTM E 283-04
 - ASTM E 547-00
 - ASTM E 331-00
 - ASTM E 330-02
 - 330DS-O (Arkema)
 - ASTM E 283-04
 - ASTM E 547-00
 - ASTM E 331-00
 - ASTM E 330-02
 - 330DS-O (Cyro)
 - ASTM E 330-02
 - 330DS-C (Cyro and Arkema)
 - ASTM E 283-04
 - ASTM E 547-00



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- ASTM E 331-00
 - 750DS-O (Arkema)
 - ASTM E 283-04
 - ASTM E 547-00
 - ASTM E 331-00
 - ASTM E 330-02
 - 750DS-O (Cryo)
 - ASTM E 330-02
 - 750DS-C (Arkema)
 - ASTM E 283-04
 - ASTM E 547-00
 - ASTM E 331-00
 - DP = +/-70 psf, SF = 3 for negative and 2 for positive test pressures
 - Water penetration tested; WTP = 12 psf (equates to + 80 psf DP)
 - Air Infiltration tested; 1.57 psf
- 81604.01-301-26-R2
 - 160 DS
 - ASTM E283-04
 - 290 DS
 - ASTM E 283-04
 - ASTM E 547-00
 - ASTM E 331-00
 - ASTM E 330-02
 - 330 DS-O
 - ASTM E 283-04
 - ASTM E 547-00
 - ASTM E 331-00
 - ASTM E 330-02
 - 330 DS-C
 - ASTM E 283-04
 - ASTM E 547-00
 - ASTM E 331-00
 - DP = +70/-70 psf, SF = 3 for negative and 2 for positive test pressures
 - Water penetration tested; WTP = 10.7 psf (equates to + 70 psf DP)
 - Air Infiltration tested; 1.57 psf

Product Installation Instructions: See the following manufacturer's product drawings included with this product approval document.

- Model 160 DS TDD - Product Drawing Package
 - 160-PF-HC-STD, Product Drawing
 - 160-290-ESR, Product Details
 - 160 DS Alternate Round to Square Assembly
- Model 290 DS TDD - Product Drawing Package
 - 290-PF-HC-STD, Product Drawing
 - 160-290-ESR, Product Details
 - 290-6F-BDECK, Commercial Roof Assembly Detail
 - 290-6F-TYPE II_III, TYPE II & III Roof Assembly Detail
 - 290-CURB-BDECK, Commercial Roof Assembly Detail
 - 290-CURB-TYPE II-III, TYPE II & III Roof Assembly Detail



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- 290-PF-TYPE IV, Type IV (T & G) Roof Assembly Detail
- 290 DS Alternate Round to Square Assembly

Performance Testing:

- AAMA/WDMA/CSA 101/I.S.2/A440-08, North American Fenestration Standard/Specification for windows, doors, and skylights.
- ASTM E283-04 & 99, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- ASTM E330-02, Standard Test Method for Structural Performance of Exterior windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- ASTM E331-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- ASTM E547-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference

Plastics Testing:

The 8th Edition (2023) Florida Building Code, Chapter 26 defines 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.

| OUTER DOME, DOME RING, TOP TUBE CLIP AND INNER DOME 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 | ≥ 650°F | |
| Smoke Density | 2.b.iv | ASTM E84-06 | 400 | ≤ 450 | |
| Conclusion: ACCEPTABLE | | | | | |

| OUTER DOME, DOME RING, TOP TUBE CLIP AND INNER DOME 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 | ≥ 650°F | |
| Smoke Density | 2.c.iv | ASTM D2843-99 | 5.8 | ≤ 75 | |
| Conclusion: ACCEPTABLE | | | | | |



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| EFFECT LENS 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 AND DRESS RING 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 AND DRESS RING 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 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 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 | |



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Conclusion: ACCEPTABLE

ACRYLIC LENS AND TRIM RING 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 | | | | | |

References:

- Product Installation Instructions. See the following manufacturer's product drawings included with this product approval document.
 - Model 160 DS TDD - Product Drawing Package
 - 160-PF-HC-STD, Product Drawing
 - 160-290-ESR, Product Details
 - Model 290 DS TDD - Product Drawing Package
 - 290-PF-HC-STD, Product Drawing
 - 160-290-ESR, Product Details
 - 290-6F-BDECK, Commercial Roof Assembly Detail
 - 290-6F-TYPE II_III, TYPE II & III Roof Assembly Detail
 - 290-CURB-BDECK, Commercial Roof Assembly Detail
 - 290-CURB-TYPE II-III, TYPE II & III Roof Assembly Detail
 - 290-PF-TYPE IV, Type IV (T & G) Roof Assembly Detail
- Testing
 - Performance Testing, Architectural Testing, Inc. (Fresno, CA)
 - 97759.01-30-44-R2 for 330 DS-O & C, 750 DS-O & C and 290 DS
 - 97744.01-301-26-R0 for 160 DS and 290 DS
 - 81605 01-301-26-R1 for 160 DS, 290 DS, 330DS-O, 330DS-C, 750DS-O and 750DS-C
 - 81604.01-301-26-R2 for 160 DS, 290 DS, 330DS-O and 330DS-C
 - OUTER DOME, DOME RING, TOP TUBE CLIP AND INNER DOME testing for High Impact Acrylic PMMA (Poly(methyl methacrylate))
 - Intertek Test Report No. 3143957-004, dated 9/24/08, testing to ASTM G155-05a and D638-08 in accordance with ASTM D2565-99.
 - SGS Test Report No. 177:013002-01-R1, dated 6/10/08, testing to ASTM D635-06.
 - SGS Test Report No. 177:013002-02-R1, dated 6/10/08, testing to ASTM D1929-96.
 - SWRI Test Report No. 01.12693.01.139, dated 4/5/07, testing to ASTM E84-06.
 - OUTER DOME, DOME RING, TOP TUBE CLIP AND INNER DOME testing for High Impact Acrylic PMMA (Poly(methyl methacrylate))
 - Architectural Testing Inc. Test Report No. 58735.01-106-18, dated 1/4/07, testing to ASTM G155-00ae1 and D638-03.
 - SGS Test Report No. 177:002666-03, dated 1/2/07, testing to ASTM D635-06.
 - SGS Test Report No. 177:002666-01, dated 1/13/07, testing to ASTM D1929-96(2001)e1.
 - SGS Test Report No. 177:002666-02, dated 1/2/07, testing to ASTM D2843-99.
 - EFFECT LENS, PET-GAG (PET – Polyethylene Terephthalate, High Frequency Welding Grade - GAG) testing
 - SGS Test Report No. 2138368-1, dated 8/27/10, testing to ASTM D635-06.



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- 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 AND DRESS RING 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 AND DRESS RING testing for Medium Impact Acrylic PMMA (Poly(methyl methacrylate))
 - i. 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 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 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).
 - i. 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, testing to ASTM D635-14, ASTM D1929-16 and ASTM D2843-16
- 3. Reports:
 - a. Engineering Analysis: Anchorage and product verification has been substantiated by calculation prepared, signed and sealed by Robert J. Amoruso, P.E. in accordance with the 8th Edition (2023) Florida Building Code.
 - b. PTC Report No. 2399-EER, Rev. 4, *Solatube Brighten Up® Series Model 160 DS and Model 290 DS Tubular Daylight Device – Referenced Testing Standards Evaluation Report*, signed and sealed by Robert J. Amoruso, P.E.

Limitations & Conditions of Use:

- This product has not been evaluated for use inside the HVHZ (High Velocity Hurricane Zone)
- This product is not Impact Resistance.
- Refer to Table 1 below for Maximum Design Pressures
- Refer to Table 2 below for installation Anchorage Schedule
- Site wind pressures shall be determined by a licensed professional engineer in accordance with the 8th Edition (2023) Florida Building Code (and/or ASCE 7 as referenced in the 8th Edition (2023) Florida Building Code) for components and cladding based on allowable stress design.
- Site conditions not covered in this product evaluation document are subject to additional engineering analysis by a licensed professional engineer or registered architect as required by the authority having jurisdiction.
- Adequacy of the existing structural substrates as a main wind force resisting system capable of withstanding and transferring applied product loads to the foundation is the responsibility of the licensed professional engineer or registered architect acting as the design professional of record for the project of installation.



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Table 1 – Maximum Allowable Design Pressures²

| Model Series | Model No | Dia. (inch) | Dome Thickness (inch) | Wind Loads ³ (psf) |
|------------------------------|----------|-------------|-----------------------|-------------------------------|
| Solatube Brighten-Up® Series | 160 DS | 10 | 0.125 | +70 -70 |
| | 290 DS | 14 | 0.125 | |

1. Positive (+) loads are directed inward; negative (-) are directed outward.
2. All positive design pressures were tested to a safety factor of 2. All negative design pressures were tested to a safety factor of 3.
3. Allowable design loads for consideration of water penetration are limited to those values indicated above.

Table 2 - Anchorage Schedule

| Model #s | Anchorage | Substrate | Anchor Description and Quantity |
|------------------|----------------------------|-----------------------------------|---------------------------------|
| 160 DS 290 DS | Metal Flange to wood curb | SPF (S.G. ≥ .42) wood curb | Qty 8 #10 x 2" Screw |
| | Metal Flange to wood deck | 5/8" Type 2 Plywood | Qty 8 #10 x 2" Screw |
| | Metal Flange to Metal Deck | 22-gauge steel 33ksi Min Yield | Qty 8 #10 TEKS |
| | Metal Flange to wood curb | SPF (S.G. ≥ .42) wood curb | Qty 8 #10 x 2" Screw |

Certificate of Independence per Product Approval Rule 61G20-3.009

PTC Product Design Group, LLC and Robert J. Amoruso, P.E. does 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.

Evaluated by:
Robert J. Amoruso, P.E.
FL PE License No. 49752



PTC Product Design Group, LLC | PO Box 520775 | Longwood, FL 32752-0775
321-690-1788 | FBPE Certification of Authorization No. 25935