



## SECTION 08625 [08 62 23]

### TUBULAR DAYLIGHTING DEVICES

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#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Tubular daylighting devices and accessories.

##### 1.2 RELATED SECTIONS

- A. Section 06100 [06 10 00] - Wood Framing; Site built wood curbs and nailers.
- B. Section 07310 [07 31 00] - Roof Shingles and Shakes: Flashing of skylight base.
- C. Section 07320 [07 32 00] - Roof Tiles: Flashing of skylight base.
- D. Section 07510 [07 51 00] - Built-Up Bituminous Roofing: Flashing of skylight base.
- E. Section 07520 [07 52 00] - Modified Bituminous Membrane Roofing: Flashing of skylight base.
- F. Section 07530 [07 53 00] - Electrometric Membrane Roofing: Flashing of skylight base.
- G. Section 07540 [07 54 00] - Thermoplastic Membrane Roofing: Flashing of skylight base.
- H. Section 07600 [07 60 00] – Flashing and Sheet Metal: Metal curb flashings.
- I. Section 08620 [08 60 00] - Unit Skylights: Skylights without reflective tube.
- J. Section 08630 [08 63 00] - Metal Framed Skylights.
- K. Section 15810 [23 30 00] – HVAC Air Distribution: Fan vent duct and connections.
- L. Section 16570 [25 50 00] – Integrated Automation Facility Controls: Lighting controllers.
- M. Section 16150 [26 05 00] – Common Work Results Electrical: Power cable, power supply and electrical connections.

- N. Section 16500 [26 50 00] – Lighting Equipment and Controls: Control cable, dimming controls, light bulbs and lamps.

### 1.3 REFERENCES

- A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM A 463/A 463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process.
- D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process.
- E. ASTM A 792/A 792M – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- F. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.
- G. ASTM E 283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- H. ASTM E 308 - Standard Practice for Computing the Colors of Objects by Using the CIE System.
- I. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors.
- J. ASTM E 547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference.
- K. ASTM E 1886 - 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.
- L. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane.
- M. ASTM D 635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position.
- N. ASTM D 1929 - Test Method for Ignition Properties of Plastics.
- O. ASTM D 2843 – Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
- P. ASTM F 1642 – Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.

- Q. ASTM F 2912 – Standard Specification for Glazing and Glazing Systems Subject to Airblast Loading.
- R. AAMA/WDMA/CSA 101/I.S.2/A440 - Standard/Specification for Windows, Doors, and Unit Skylights; 2011.
- S. FM Standard 4431 - The Approval Standard for Skylights.
- T. FEMA P-361 – Safe Rooms for Tornadoes and Hurricanes.
- U. ICC 500 – Standard for the Design and Construction of Storm Shelters.
- V. UL 2108 - Low Voltage Lighting Systems.
- W. UL 8750 – Light Emitting Diode (LED) Equipment for Use in Lighting Products
- X. CFR 47 - Code of Federal Regulations (CFR) Rules & Regulations for FCC, FCC Part 15 - Radio Frequency Devices, Subpart B - Unintentional Radiators, Section 15.107 - Conducted Limits, and 15.109 - Radiated Emission Limits
- Y. ANSI C63.4-2014 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
- Z. GSA-TS01-2003: Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
- AA. Unified Facilities Criteria (UFC) 4-010-01, Change October 2013, DoD Minimum Antiterrorism Standards for Buildings,
- BB. CSA C22.2 No. 250.0 – Luminaires.
- CC. ICC-ES AC-16 - Acceptance Criteria for Plastic Skylights; 2008.
- DD. Florida Building Code TAS 201 – Impact Test Procedures.
- EE. Florida Building Code TAS 202 – Criteria for Testing Impact and Non Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading.
- FF. Florida Building Code TAS 203 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.
- GG. IBC Section 1710 - Load Test Procedure for Wind Load Testing on Rooftop Daylight Collecting System - Structural Performance Testing - Devised by ATI PE); 2012.
- HH. IBC Section 2606.7.2 – Installation – Diffuser Fall Out Test (Devised by PE); 2012.
- II. OSHA 29 CFR - 1910.23 (e)(8) (Guarding Requirements for Skylights); 1926 Subpart M (Fall Protection); 1926.501(b)(4)(i); 1926.501(i)(2); 1926.501(b)(4)(ii).
- JJ. California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1).

- KK. European Parliament Directive - Restriction of Hazardous Substances (RoHS) - Directive 2011/65/EU Annex II including amendment (EU) 2015/863 (RoHS 3)
- LL. EN 60598-1:2015+A1:2018 - Luminaires. General requirements and tests
- MM. EN 60598-2-2:2012 - Luminaires -- Part 2-2: Particular requirements - Recessed luminaires
- NN. EN 55015:2013+A1:2015 - Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
- OO. EN 61000-3-2:2014 - Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)
- PP. EN 61000-3-3:2013 - Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current  $\leq 16$  A per phase and not subject to conditional connection
- QQ. EN 61547:2009 - Equipment for general lighting purposes. EMC immunity requirements

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Daylight Reflective Tubes: Spectralight Infinity with INFRAREDuction Technology combines ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance. Patented spectrally-selective optical surface yields an average total- and specular-reflectance greater than 99.5% percent for the Visible Light spectrum (400 nm to 700 nm) providing maximized visible light transmission and less than 25% reflectance for Infrared (IR) heat wavelengths (750 nm to 2500 nm) for minimized heat transmission, resulting in a spectrally-selective Total Solar Spectrum (250 nm to 2500 nm) reflectance less than 37 percent, as measured using a Perkin Elmer Lambda 1050 spectrophotometer with a Universal Reflectance Accessory. Color:  $a^*$  and  $b^*$  (defined by CIE  $L^*a^*b^*$  color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
- B. SOLAMASTER 330 DS-O / 330 DS-C (OPEN/CLOSED CEILING)
  - 1. AAMA/WDMA/CSA 101/IS2/A440, Class CW-PG80, size tested 21 inch (530 mm) diameter, Type TDDOC and Type TDDCC.
    - a. Air Infiltration Test:
      - 1) Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.
    - b. Water Resistance Test:
      - 1) Passes water resistance; no uncontrolled water leakage with a pressure differential of 10.7 psf (512 Pa) or 15 percent of the design load (whichever is greater) and a water spray rate of 5 gallons/hour/sf for 24 minutes when tested in accordance with ICC-ES AC-16, ASTM E 547 and ASTM E 331.
    - c. Uniform Load Test: All units tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.
      - 1) No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause

excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 70 psf (3.35 kPa).

2. Hurricane Resistance:
  - a. Meets Florida Building Code TAS, 201, TAS, 202 and TAS 203 for Impact and non-impact components or HVHZ and non-HVHZ applications.
  - b. Meets ASTM E 1886 and ASTM E1996 for missile and cyclic pressure differential testing for TDI Windstorm zones.
3. Fire Testing:
  - a. Fire Rated Roof Assemblies:
    - 1) When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the International Building Code for Class A, B, and C roof assemblies.
  - b. Self-Ignition Temperature - Greater than 650 degrees F per ASTM D-1929.
  - c. Smoke Density: Rating no greater than 450 per ASTM E 84 in way intended for use. Classification C.
  - d. Rate of Burn and/or Extent: Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635.
  - e. Rate of Burn and/or Extent: Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.
4. FM Certification:
  - a. Spread of Flame: Passes: Class A at 5 in12. No flame spread when tested in accordance with FM modified version of ASTM E108 Fire Test of Roof Coverings.
  - b. Simulated Hail Resistance (Pre UV Exposure): Passes: No cracking or breaks when tested with nominal 2.0 in. (51 mm) diameter ice ball having a kinetic energy of 26.8 ft-lbs (36.4J)
  - c. Simulated Hail Resistance (Post UV Exposure): Passes: No cracking or breaks when tested with nominal 2.0 in. (51 mm) diameter ice ball having a kinetic energy of 26.8 ft-lbs (36.4J) after no less than 1000 hours of ultraviolet (UV) light exposure.
  - d. Simulated Impact: Passes: No breakage or through openings when a 100 lb (45.5 kg) weight dropped from 4 ft (1.2 m) above highest point of test sample.
  - e. Simulated Wind Uplift: Passes: 195 psf Wind Rating. No separation, breaking or cracking occurred when tested in accordance with FM 4431.
5. Fall Protection Performance:
  - a. Passes fall protection test: No penetration of dome or curb cap when subject to 400 lb (160 Kg)/42 inch (1066 mm) impact drop test when tested in accordance with OSHA 29 CFR 1926.506(c) Safety Net Systems.
  - b. Passes fall protection test: California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1) Skylight Screens.
6. Blast Resistance: ASTM F1642, ASTM F2912, GSA-TS01-2003, and UFC 4-010-01:
  - a. Airblast Loading ASTM Hazard Rating: Passes: No Hazard Rating
  - b. Airblast Loading UFC Level of Protection: Passes Medium Level of Protection
  - c. Dynamic Overpressure Loading ASTM Hazard Rating: Passes: No Hazard Rating

- d. Dynamic Overpressure Loading UFC Level of Protection: Passes Medium Level of Protection
- 7. LED Light Kit:
  - a. TUVus Marking and Certification for North American Market
  - b. FCC: This device complies with part 15 of the FCC Rules
  - c. CE Marking and Certification for European Market
  - d. California Prop 65: Tested for presence of:
    - 1) Lead  $\leq 30$ ppm in any component per CPSC-CH-E-1003-09, CPSC-CH-E-1001-08.3, & CPSC-CH-E-1002-08.3 Analysis: AAS/ICP-OES
    - 2) DEHP  $\leq 30$ ppm, DBP  $\leq 30$ ppm, BBP  $\leq 30$ ppm, DINP  $\leq 50$ , DIDP  $\leq 50$ ppm, DnHP  $\leq 30$ ppm in any component per: CPSC-CH-E-1003-09.4, GC/MS
  - e. RoHS: Complies with EU RoHS Directive 2011/65EU Annex II and amendment (EU) 2015/863

## 1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Data sheets showing roof dome assembly, flashing base, reflective tubes, diffuser assembly, and accessories.
  - 4. Installation requirements.
- C. Shop Drawings. Submit shop drawings showing layout, profiles and product components, including rough opening and framing dimensions, anchorage, roof flashings and accessories.
- D. Electrical wiring diagrams and recommendations for power and control wiring.
- E. Verification Samples: As requested by Architect.
- F. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.
- G. Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features:
  - 1. LED Luminaires: Include estimated useful life, calculated based on IES LM-80 test data.
  - 2. In order to meet LM-80 lifetime projections, LM-80 Max Drive Current must not be exceeded. Lumen maintenance and lifetime predictions are valid for drive current and case temperature conditions used for LM-80 testing as included in the applicable LM-80 test report for these products.
- H. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
  - 1. List of Daylight Credits available for the products specified.

2. Data on Energy Optimization Performance Credits for the products specified.
3. Data on Perimeter and Non-Perimeter Controllability of Systems for use of Daylight Dimmer option with the products specified.
4. Data on potential Innovation in Design Credits which may be available for the innovative use of the products specified.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of twenty years experience in the top lighting industry. Secondary products shall be acceptable to the primary manufacturer.
- B. Installer Qualifications: All products shall be installed by a single installer with a minimum of five years demonstrated experience, with adequate equipment, skilled workers, and practical experience to meet the project schedule.
- C. Skylights shall conform with authorities having jurisdiction and be designed to meet design criteria of the project location and the following:
  1. Skylights must be certified by NFRC.
  2. Skylights must be Tested and labeled in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
  3. Skylights must have Factory Mutual (FM) Approval Class Number 4431.
  4. On projects which fall under the jurisdiction of the Florida Building Code, Skylights are required to have a current Florida Building Code (FBC) Number to meet the High Velocity Hurricane Zone (HVHZ) requirements and are required for acceptance of Work specified in this section. Skylight must comply with the jurisdictional code body's submittal data and supporting drawings and documentation. Where the code body's acceptance criteria differs from these specifications regarding components and hardware, the code body's requirements shall govern.
  5. Meet or exceed OSHA 200 pound (90 kg) Drop Tests expressed in 29 CFR 1910.23(e)(8)
  6. Skylights shall provide minimum 69 psf (3.30 kPa) design load.
- D. LED Lighting and controls shall be designed to meet criteria of the project, and conform with authorities having jurisdiction, and the following:
  1. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
  2. Product Safety Marking, Certifying compliance with:
    - a. UL 1598 - Luminaires
    - b. UL 2108 - Low Voltage Lighting Systems.
    - c. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products
    - d. CSA C22.2 No. 250.0 - Luminaires
  3. FCC Rules Part 15
  4. California Prop 65:
  5. EU RoHS Directive 2011/65EU Annex II and amendment (EU) 2015/863
- E. Pre-Installation Meeting: Contractor shall convene a pre-installation meeting on the project site minimum one week before beginning work of this Section. The meeting shall include the Architect or Owner's Representative and representatives of all related trades to:
  1. Coordinate between the at least the following trades.

- a. Roofing to install the flashing, skylight, and LED Light Kit (when specified)
  - b. Electrical to wire components and program lighting controls.
2. Verify project requirements and site logistics.
3. Assess integrity of the roofing system and building structure.
4. Review manufacturer's installation instructions and warranty requirements.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.
- B. Store products in manufacturer's unopened packaging until ready for installation.

#### 1.8 PROJECT CONDITIONS

- A. Coordinate delivery schedule with the Contractor and project schedule to minimize on site storage.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- C. Store materials in a dry area, protected from freezing, staining, contamination or damage.

#### 1.9 WARRANTY

- A. Daylighting Device: Manufacturer's standard warranty for 10 years.
- B. Electrical Parts: Manufacturer's standard warranty for 5 years, unless otherwise indicated.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Solatube International, Inc.; 2210 Oak Ridge Way, Vista, CA 92081. Tel. Toll Free: 888-765-2882. Tel: (760) 477-1120. Fax: (760) 597-4488. Email: [commsales@solatube.com](mailto:commsales@solatube.com). Web: [www.solatube.com](http://www.solatube.com).
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

#### 2.2 TUBULAR DAYLIGHTING DEVICES

- A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.



- B. SolaMaster Series: Solatube Model 330 DS, 21 inch (530 mm) Daylighting System:
1. Model:
    - a. Solatube Model 330 DS-O Open Ceiling. AAMA Type TDDOC.
    - b. Solatube Model 330 DS-C Closed (Penetrating) Ceiling. AAMA Type TDDCC.
  2. Capture Zone:
    - a. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
      - 1) Dome Glazing: Type DA, 0.143 inch (3.7 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.
      - 2) Dome Glazing: Type DP, 0.115 inch (3 mm) minimum thickness polycarbonate classified as CC1 material.
      - 3) Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact PVC; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing. Attached to the base of the dome ring using butyl glazing rope 0.24 inch (6 mm) diameter; to minimize air infiltration.
      - 4) Dome Seal: Adhesive backed weatherstrip, 0.63 inch (16 mm) tall by 0.28 inch (7 mm) wide.
      - 5) LightTracker Reflector, made of aluminum sheet, thickness 0.015 inch (0.4 mm) with Spectralight Infinity. Positioned in the dome to capture low angle sunlight.
    - b. Dome Options:
      - 1) Security Bar: Type B Security Bar 0.375 inch (9.5 mm) stainless steel bar across flashing diameter opening.
      - 2) Security Kit: Type SK Dome Security Kit, rivets with nylon spacers to replace dome screws.
      - 3) Dome Edge Protection Band: Type PB, for fire rated Class A, B or C roof applications. Galvanized steel. Nominal thickness of 0.039 inch (1 mm). For use with all flashings types.
      - 4) Secondary Diffuser: Type SS, Acrylic plastic classified as CC2 material. Thickness shall not be less than 0.100 inches.
    - c. Flashings:
      - 1) Roof Flashing Base:
        - (a) One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M or ASTM A 792/A 792M, 0.028 inch (0.7 mm) plus or minus .006 inch (.015 mm) thick.
          - (1) Base Style: Type F4, Self Mounted, 4 inches (102 mm) high.
          - (2) Base Style: Type F8, Self Mounted, 8 inches (203 mm) high.
          - (3) Base Style: Type F11, Self Mounted, 11 inches (279 mm) high.
          - (4) Base Style: Type FC, Curb cap, with inside dimensions of 27 inches by 27 inches (685 mm by 685 mm) to cover curb as specified in Section 07600.

- d. Curbs: Metal Insulated Roof Curb: Corrosion resistant 18 Gauge hot-dipped galvanized steel conforming to ASTM A 653 G90 with continuous welded seams, integrated base plate for water tightness and extra strength, lined with 1-1/2 inch fiberglass fireproof sound attenuating thermal insulation, factory installed 2 by 2 treated wood nailer secured to top ledge of curb. Curb designed for single-ply roofing, lightweight fill or tapered insulation low slope roof types.
    - 1) C12 12 inch (305 mm) high Metal insulated curb
    - 2) C14 14 inch (356 mm) high Metal insulated curb
    - 3) C16 16 inch (406 mm) high Metal insulated curb
    - 4) C20 20 inch (508 mm) high Metal insulated curb
    - 5) CXX Metal insulated curb with a custom curb height as determined by the installer.
    - 6) Flashing Options:
      - (a) Flashing Insulator: Type FI, Thermal isolation material is for use under the following flashing types: Type F4, F8, or F11.
      - (b) Curb Insulator: Curb Insulator, Type CI, Thermal isolation material is for use under flashing Type FC.
      - (c) Curb Cap Insulation: Type CCI, Nominal 1 inch thick thermal insulation pad to reduce thermal conduction between curb-cap and tubing and thermal convection between room air and curb-cap. Rated R-6 ( $^{\circ}\text{F}\cdot\text{ft}^2\cdot\text{hr}/\text{Btu}$ ) Insulation is Polyisocyanurate foam utilizing CFC, HCFC, & HFC free blowing agent. Type-1 Class-1 per ASTM C 1289; Passes UL 1715 (15-minute thermal barrier per IBC 2603.4); Attic ventilation may be required per IBC 1203.2( $^{\circ}\text{F}\cdot\text{ft}^2\cdot\text{hr}/\text{Btu}$ ). For use with Curb Cap Flashing Type FC, only.
      - (d) Roof Flashing Turret Extensions: Provide manufacturer's standard extension tubes for applications as requiring:
        - (1) Type T12: Additional lengths of 12 inches (300 mm) extension.
        - (2) Type T24: Additional lengths of 24 inches (600 mm) extension.
        - (3) Type T36: Additional lengths of 36 inches (900 mm) extension.
        - (4) Type T48: Additional lengths of 48 inches (1200 mm) extension.
      - (e) Membrane Counter Flashing: Type MCF, one piece, seamless, spun Aluminum Alloy 1100, functioning as a counter flashing for use with F8 or F11 Flashings, only, when applied to membrane roofs. Corrosion resistant conforming to ASTM B 209, 0.059 inch (1.5 mm) thick.
3. Transfer Zone:
- a. Extension Tubes: Aluminum sheet, thickness 0.018 inch (0.5 mm).
    - 1) Reflective Tubes:
      - (a) Reflective extension tube, Type EXX and Type EL with total length of run as indicated on the Drawings.
      - (b) Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
    - 2) Tube Options

- (a) Extension Tube Angle Adapter: Provide manufacturer's standard adapters for applications requiring:
  - (1) Type A1 one 0 to 90 degree extension tube angle adapter.
  - (2) Type A2 two 0 to 90 degree extension tube angle adapters.
- (b) Top Tube Angle Adapter: Type TA, reflective 45 degree adjustable Top Tube Angle Adapter, 16 inches (406 mm) long.
- (c) Top Tube Angle Adapter and Bottom Tube Angle Adapter Kit: Type AK, reflective 45 degree adjustable top and bottom angle adapters (one each), 16 inches (406 mm) long
- (d) Bottom Tube Angle Adapter: Type BA, reflective 45 degree adjustable Bottom Tube Angle Adapter, 16 inches (406 mm) long.
- (e) Reflective Extension Tube: Type EL, 48 inches (1220 mm) long, replaces two normal 24-inch (610 mm) extension tubes when long tube runs are required.
- (f) Thermal Insulation Panel: Type TIP, high-performance dual-glazed, thermally-broken tube insulation system.
- (g) Open ceiling trim ring: Type R, ABS Plastic, White; nominal thickness of 0.04 inch (1 mm).
- (h) Wire Suspension Kit: Type E, Use the wire suspension kit when additional bracing to the structure is required.
- (i) Spectralight Infinity SoftLight Extension Tube: Type ES, 24 inch (610 mm) Super-reflective extension tube with structured surface providing precise light spread for enhanced visual comfort. Replaces one standard 24-inch (610 mm) extension tube in the tube assembly.

4. Delivery Zone:

- a. Diffuser Assemblies for Tubes Not Penetrating Ceilings (Open Ceiling): Solatube Model 330 DS-O. 21 inch (530 mm) diameter diffuser attached directly to bottom of tube.
  - 1) Lens: Type L1 OptiView Fresnel lens design to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.022 inch (0.6 mm) thick. Classified as CC2.
  - 2) Lens: Type L2, Prismatic lens designed to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.100 inch (2.5 mm) thick. Classified as CC2.
  - 3) Diffuser Seal: Open cell foam, acrylic adhesive backed, 0.75 inch (19 mm) wide by 0.125 inch (3.2 mm) thick to minimize condensation and bug, dirt and air infiltration per ASTM E 283.
  - 4) Diffuser Trim Ring: Injection molded acrylic. Nominal wall thickness 0.172 inches (4.4 mm).
- b. Diffuser Assemblies for Tubes Penetrating Ceilings: Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube 23.8 inches by 23.8 inches (605 mm by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.
  - 1) Polymeric Transition Box: Type TP, round-to-square transition box made of opaque polymeric material, classified as CC2, Class C, 0.110 inch (2.8 mm) thick.

- 2) Metal Transition Box: Type TM, Metal 2 Round to Square transition box comprised of Spectralight Infinity SoftLight material with structured finish on exposed reflective surface, .015in (0.4mm) thick. Color: a\* and b\* (defined by CIE L\*a\*b\* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
  - 3) Lens: Type L1 OptiView Fresnel lens design to maximize light output and diffusion with extruded aluminum frame and EPDM foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283. Visible Light Transmission shall be greater than 90 percent at 0.022 inch (0.6 mm) thick. Classified as CC2.
  - 4) Lens: Type L2 Prismatic lens design to maximize light output and diffusion with extruded aluminum frame and EPDM foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283. Visible Light Transmission shall be greater than 90 percent at 0.100 inches (2.5 mm) thick. Classified as CC2.
  - 5) Supplemental Natural Effect Lens: Type LN made of acrylic, classified as CC2, Class C, 0.060 inch (1.5 mm) thick, with open cell foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283.
- c. Delivery Zone Options
- 1) Local Dimmer Control utilizing a butterfly baffle design of Spectralight Infinity reflective material to minimize shadowing when in use:
  - 2) Daylight Dimmer – 0 to 10 V Dimmer Control: Provide an electrical actuator dimmer controller, auxiliary switch(s), and cable as specified in Section 25 50 00; Common Work Results Electrical Section 26 05 00; and Lighting Equipment and Controls Section 26 50 00.
    - (a) Low Voltage Daylight Dimmer: Type D1, is an Electro-mechanically actuated daylight valve; 0-10 V Control, Class-2, UL Listed. Low voltage Daylight Dimmer, an electrical actuator provides for programmable (0 to 10VDC) scene-based dimming control for daylight output between 2 and 100 percent, auxiliary 12VDC dimming control for daylight output between 2 and 100 percent, or auxiliary ON/OFF control. Input voltage: 24VAC at 50 or 60 Hz.
      - (1) Programmable (0 to 10VDC) Control: requires electrical actuator controller or building automation controller capable of producing a signal between 0 and +10 VDC (Min 50mA) to incrementally modulate up to 50 daisy chained Daylight Dimmers (Current Sinking) between fully closed at 0 to 1 volts to fully open at 9 to 10 volts.
      - (2) Auxiliary 12VDC Dimming Control: requires 12VDC Dimming Switch (Current Sourcing; 12VDC power supply not required).
        - (i) Requires CL-2 (Min), 18AWG, stranded copper, two conductor, twisted cable from lighting controller to first dimmer and interconnecting between subsequent dimmers.

- (3) Auxiliary ON/OFF Control: requires commercial or residential single pole electric light switch.
      - (i) 12VDC dimming control requires CL-2 (Min), 22 AWG, stranded, three conductor, twisted cable from switch to first dimmer and CL-2 (Min), 18 AWG, stranded copper, two conductor, twisted cable; interconnecting subsequent dimmers.
      - (b) Power can be transformed from line voltage through use of a UL Listed Class-2, 24VAC Transformer.
  - 3) LED Light Kit: Including driver and light engine two piece field assembly, bracket mounted inside system, cTUVus Listed.
    - (a) Type (LED); Long-lasting, high performance, non-replaceable light source, LED integrated in Light Engine.
    - (b) Electrical Input (AC~) 100-240V, 1.1A, 50/60Hz; 277V, 0.5A, 50/60Hz
    - (c) Light Engine: CCT 4,000 degrees K, CRI 80, at 1440 mA Nom Drive Current and Tc 25 degrees C: Typ Pulsed Flux 12,075 lm
    - (d) LED Output: 10,000 delivered lumens.
    - (e) Lumen Maintenance Rating (L70): ≥60,000 Hr/105 degrees C Case Temp: (87.66%) of Initial (lm), Per (TM-21)
- 5. Accessories
  - a. Optional Low-voltage Transformer: Solatube Remote Transformer, Type TR20, is a 20VA, 24VAC, 50/60HZ, UL Listed, UL Category XOKV7, CE Marked, Class-2 Transformer with cover plate mounting system configured for easy field assembly onto standard 4.06 inch by 4.06 inch (103 mm by 103 mm) square junction box: Inherently Limited, Primary: 120VAC, 208VAC, 240VAC, and 277VAC. For use with Daylight Dimmer Type D1 only.
  - b. Optional Low-voltage Transformer: Solatube Remote Transformer, Type TR96, is a 96VA, 24VAC, 50/60HZ, UL Listed, UL Category XOKV7, CE Marked, Class-2 Transformer with cover plate mounting system configured for easy field assembly onto standard 4.06-in x 4.06-in (103mm x 103mm) square junction box: Inherently Limited, Primary: 120VAC, 240VAC, 277VAC and 480VAC. For use with Daylight Dimmer Type D1 only.
  - c. Optional Switch: Type S1, is a Low-voltage 0-10V Class 2 control switch (white) required to operate 0-10V Daylight Dimmer. Note: only one switch is required per set of up to 50 synchronously controlled dimmers. For use with 0-10V Daylight Dimmer, Type D1, only.

## 2.3 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

- C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions.
- C. If substrate and rough opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Coordinate requirements for power supply, conduit and wiring.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. Coordinate installation with substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing to ensure that each element of the Work performs properly and that finished installation is weather tight.
  - 1. Install flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.
  - 2. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.
  - 3. Coordinate attachment and seal of perimeter air and vapor barrier material.
- C. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, provide permanent separation as recommended by manufacturer
- D. Align device free of warp or twist, maintain dimensional tolerances.
- E. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.
- F. Inspect installation to verify secure and proper mounting. Test each fixture to verify operation, control functions, and performance. Correct deficiencies.

### 3.4 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

### 3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION