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


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.


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.


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.


O. ASTM D 2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.


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 percent for the Visible Light spectrum (400 nm to 700 nm) providing maximized visible light transmission and less than 25 percent 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. BRIGHTEN UP 160 DS (Suspended or Open Ceilings)
1. AAMA/WDMA/CSA 101/IS2/A440, Class CW-PG70 size tested 14 inch (350 mm), Type TDDCC.
a. **Air Infiltration Test:** 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 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 60 psf (2.87 kPa) in accordance with ICC AC-16 Section A, or Negative Load of 70 psf (3.35 kPa) if tested per ICC AC-16 Section B.

d. **Hurricane Resistance:**
   2) Meets ASTM E 1886 and ASTM E1996 for missile and cyclic pressure differential testing.

e. **Fire Testing:**
   1) When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the International Building Code.
   2) Self-Ignition Temperature - Greater than 650 degrees F per ASTM D-1929.
   3) Smoke Density: Rating no greater than 450 per ASTM E 84 in way intended for use. Classification C.
   4) Rate of Burn and/or Extent: Maximum Burning Rate: 2.5 inches/min (64 mm/min) Classification CC-2 per ASTM D 635.
   5) Rate of Burn and/or Extent: Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.

### 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. 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: Engaged in manufacture of tubular daylighting devices for minimum 20 years.

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. 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.

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


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. Brighten Up Series: Solatube Model 160 DS, 10 Inch (250 mm) Daylighting System.
1. Model:
   a. Solatube Model 160 DS used for daylighting systems with suspended or hard ceilings. AAMA Type TDDCC.
2. Capture Zone:
   a. Domes:
      1) Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
         a) Outer Dome Glazing: Type DA, 0.125 inch (3 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.
            1) Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
         b) Acrylic Dome Plus Shock Inner Dome Glazing: Type DAI, Inner Dome is 0.115 inch (2.9 mm) minimum thickness classified as CC1 material. High impact injection molded acrylic required for high velocity wind zones.
         c) Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact acrylic; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
      2) Dome Seal: Polyethylene foam seal, black, 0.13 inch (3.3 mm) thick by 10.73 (272.5 mm) diameter, 2 PCF polyethylene foam.
      3) 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) Dome Edge Protection Band: Type PB, for fire rated Class A, B or C roof applications. Aluminized steel nominal thickness of 0.028 inches (0.7 mm).
   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 A792/A 792M, 0.028 inch (0.7 mm) plus or minus 0.06 inch (.015 mm) thick.
            1) Base Flat: Flat Type F4, no pitch 4 inches (102 mm) high.
            2) Base Flat: Flat Type F6, no pitch 6 inches (152 mm) high.
            3) Base Pitched: Pitched Type FP, 22.5 degrees slope from horizontal, 4 inches (102 mm) high.
4)  Tile Roof No Pitch: No Pitch Type FT, 4 inches (102 mm) high. Tile Roof Counter-Flash: corrugated aluminum 1100-0, 0.020 inch (.508 mm).

5)  Tile Roof Pitched: Pitched Type FPT, 22.5 degrees slope from horizontal, 4 inches (102 mm) high. Tile Roof Counter-Flash: corrugated aluminum 1100-0, 0.020 inch (.508 mm).

2)  Flashing Options:
   a)  Flashing Insulator: Type FI, thermal isolation material for use under flashing.
   b)  Metal Roof Flashing Kit: Type MR, includes Butyl tape, flashing screws, speed nuts, corner washers and polyurethane sealant.
   c)  Roof Flashing Turret Extensions: Provide manufacturer's standard extension tubes for applications requiring:
   1)  Type T2, Additional lengths of 2 inches (50 mm) extension.
   2)  Type T4, Additional lengths of 4 inches (102 mm) extension.
   3)  Type T12, Additional lengths of 12 inches (305 mm) extension.
   4)  Type T24, Additional lengths of 24 inches (610mm) extension.
   5)  Type T36, Additional lengths of 36 inches (914 mm) extension.
   6)  Type T48, Additional lengths of 48 inches (1219 mm) extension.

3.  Transfer Zone:
   a.  Extension Tubes: Aluminum sheet, thickness 0.015 inch (0.4 mm).
      1)  Reflective Tubes:
          a)  Reflective angle adapter tube (standard Top and Bottom Tubes), providing up to a 30-degree angle adjustment.
          b)  Reflective extension tube, Type EXX and Type EL with total length of run as indicated on the Drawings.
          c)  Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
      2)  Extension 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)  Severe Climate Glazing: Type SCG PET GAG plastic glazing to minimize potential for condensation and heat loss. Nominal thickness 0.039 inches (0.99 mm).
          c)  Wire Suspension Kit: Type E, Use the wire suspension kit when additional bracing to the structure is required.
          d)  Thermal Insulation Panel: Type TIP, high-performance dual-glazed, tube insulation system.
4. **Delivery Zone:**
   a. **Ceiling Ring:** Injection molded impact resistant acrylic. Nominal thickness is 0.110 inches (2.8 mm).
   b. **Ceiling Ring Seal:** Polyethylene foam seal, white, 0.25 inch (6.4 mm) wide by 0.19 inch (4.8 mm) high, 2 PCF polyethylene foam with low-tack pressure sensitive adhesive.
   c. **Upper glazing:** PET GAG plastic with EPDM low density sponge seal to minimize condensation and bug, dirt, and air infiltration per ASTM E283. The nominal thickness is 0.039 inches (0.99 mm).
      1) **Natural Effect Lens:** Type LN.
      2) **Softening Effect Lens:** Type LS.
      3) **Warm Effect Lens:** Type LW.
      4) **Warm Softening Effect Lens:** Type LWS.
   d. **Round Diffusers/Decorative Fixtures:** Dual Glazed Diffuser Assembly.
      1) Lower glazing with integral injection molded acrylic Dress Ring classified as CC2 material. Nominal thickness is 0.110 inches (2.8 mm)
         a) **Classic Vusion Diffuser:** Type L4, molded acrylic plastic classified as CC2 material (nominal thickness 0.090 inches (2.29 mm) with injection molded acrylic Diffuser Trim Ring.
         b) **Classic OptiView (Fresnel Lens) Diffuser:** Type L1, molded polycarbonate plastic classified as CC1 material, nominal thickness 0.022 inches (0.5 mm) with injection molded acrylic Diffuser Trim Ring.
         c) **JustFrost Decorative Fixture:** Type L9, frosted acrylic plastic lens classified as CC2 material (nominal thickness is 0.16 inches (4 mm)), and decorative metal fasteners.
         d) **TierDrop Decorative Fixture:** Type L10, three layers of frosted acrylic plastic lens classified as CC2 material (nominal thickness is 0.16 inches (4 mm)). Bottom layer is continuous with two stepped full-tempered glass rings on top and decorative metal fasteners.
         e) **OptiView Decorative Fixture:** Type L11, molded polycarbonate plastic Fresnel Lens classified as CC1 material (nominal thickness is 0.022 inches (0.5 mm)) with full-tempered frosted glass bezel (nominal thickness is 0.16 inches (4 mm)), and decorative metal fasteners.
   e. **Square 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 10 inches by 10 inches (254 mm by 254 mm) square diffuser opening.
      1) **Square JustFrost Decorative Fixture:** Type L9, frosted acrylic plastic lens classified as CC2 material (nominal thickness is 0.16 inches (4 mm)), and decorative metal fasteners.
      2) **Square OptiView Decorative Fixture:** Type L11, molded polycarbonate plastic Fresnel Lens classified as CC1 material (nominal thickness is 0.022 inches (0.5 mm)) with white metal bezel (nominal thickness is 0.16 inches (4 mm)), and decorative metal fasteners.

5. **Delivery Zone Options**
Local Dimmer Control utilizing a butterfly baffle design of Spectralight Infinity reflective material to minimize shadowing when in use:
Provided with dimmer switch and cable.

1) Daylight Dimmer – 0 to 10 V Dimmer Control: Provide an electrical actuator 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 Electromechanically actuated daylight valve; 0-10 V Control, Class-2, UL Listed. Low voltage Daylight Dimmer electrical actuator provides for programmable (0 to 10 VDC) scene-based dimming control for daylight output between 2 and 100 percent, auxiliary 12 VDC dimming control for daylight output between 2 and 100 percent, or auxiliary ON/OFF control. Input voltage: 24 VAC at 50 or 60 Hz.

1) Programmable (0 to 10 VDC) Control: requires an electrical actuator controller or building automation controller capable of producing a signal between 0 and +10 VDC (Min 50 mA) 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 12 VDC Dimming Control: requires 12VDC Dimming Switch (Current Sourcing; 12 VDC power supply not required).

a) Requires CL-2 (Min), 18 AWG, 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.

a) 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.

2) Power can be transformed from line voltage through use of a UL Listed Class-2, 24VAC Transformer.

b. Lighting Fixture: Bracket mounted inside system just above diffuser; UL and CSA Listed.

1) Universal: Type INC, for one 23 W maximum LED, Compact Fluorescent (CFL), or Incandescent total length 4-3/4 inch, ceramic screw-in lamp holder, medium base, two lamps.

2) Electrical Requirements: 110 V, 15 amp GFCI circuit for damp and wet conditions.

c. Exhaust Fan: Type VEN, permanently lubricated in-line fan motor, 110 cfm (52 L/s) capacity.

1) Exhaust Duct: Flexible, Class 1, in accordance with UL 181. Provide as specified in Section 15810.
2) Air Intake trim: Injection molded impact resistance acrylic with trim to fit installation conditions.
3) Exhaust Vent Cap: Type RV, low-profile roof cap.
4) Electrical Requirements: 115 V; install fan on same switch as internal light fixture.
5) Electrical Requirements: 115 V; wall switch.
6. Accessories
   a. Optional Low-voltage Transformer: Solatube Remote Transformer, Type TR20, is a 20 VA, 24 VAC, 50/60 HZ, 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: 120 VAC, 208 VAC, 240 VAC, and 277 VAC. For use with Daylight Dimmer Type D1 only.
   b. Optional Low-voltage Transformer: Solatube Remote Transformer, Type TR96, is a 96 VA, 24 VAC, 50/60 HZ, 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: 120 VAC, 240 VAC, 277 VAC and 480 VAC. For use with Daylight Dimmer Type D1 only.
   c. Optional Switch: Type S1, is a Low-voltage 0-10 V Class 2 control switch (white) required to operate 0-10 V Daylight Dimmer. Note: only one switch is required per set of up to 50 synchronously controlled dimmers. For use with 0-10 V 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