Code Compliance Research Report
CCRR-0131

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DIVISION: 08 00 00 – OPENINGS
Section: 08 62 00 – Unit Skylights

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REPORT SUBJECT:
Solatube Tubular Daylighting Devices

1.0 SCOPE OF EVALUATION

1.1 This Research Report addresses compliance with the following Codes:

- 2015 *International Building Code®* (IBC)
- 2015 *International Residential Code®* (IRC)
- 2014 *Florida Building Code* (FBC), *Including High Velocity Hurricane Zones for 160 DS, 290 DS, Smart LED and 750 DS models*

1.2 Solatube Tubular Daylighting Devices have been evaluated for the following properties:

- Structural Performance
- Durability (UV, Weathering)
- Burning

1.3 Solatube Tubular Daylighting Devices recognized in this report are plastic glazed unit skylights complying with IBC Sections 2405 and 2610 and IRC Section R308.6.

2.0 STATEMENT OF COMPLIANCE

Solatube Tubular Daylighting Devices comply with the Codes listed in Section1.1, for the properties stated in Section 1.2 and uses stated in Section 1.3, when installed as described in this report, including the Conditions of Use stated in Section 6.0.

3.0 DESCRIPTION

3.1 *Solatube Tubular Daylighting Device* (TDD) Models recognized by this report are**:**

The *Solatube Brighten Up® Series* Models 160 DS (10 inch Tube Dia.), 290 DS (14 inch Tube Dia.) daylighting systems.

The *Solatube SolaMaster® Series* Models 300 DS-C in a 14 inch tube diameter, and 330 DS-O, 330 DS-C, 750 DS-O and 750 DS-C are daylighting systems available in a 21 inch tube diameter. The "O" and "C" designation refers to Open (O) and Closed (C) ceiling configurations.

The *Solatube Smart LED System* consists of a 10 inch roof dome assembly and 10 inch reflective tube assembly with a luminaire housing that transitions from a 10 inch to a 14 inch diameter at the ceiling. The *Smart LED System* monitors natural light and utilizes LEDs that come on when daylight is insufficient. See Section 6.2 and Figure 5.

These TDD models consist of three primary assemblies; the roof dome assembly, reflective tube assembly and diffuser assembly. These assemblies are detailed in Figures 1 through 5.

3.1.1 Roof Dome Assembly.

Primary components of the dome assembly are the dome, dome ring or tube ring and flashing.

3.1.1.1 A single dome manufactured from impact-resistant acrylic polymer is utilized on Models 160 DS, 290 DS, Smart LED, 300 DS, 330 DS and 750 DS.

3.1.1.2 Models 160 DS, 290 DS, Smart LED and 750 DS utilize an additional inner dome manufactured from impact resistant acrylic polymer or polycarbonate (750 DS) when installation is within the High Velocity Hurricane Zone as defined by the FBC.

3.1.1.3 A dome ring (160 DS, 290 DS, 300 DS & Smart LED) manufactured from impact resistant Acrylic polymer or tube ring (330 DS & 750 DS) manufactured from PVC, connects the inner reflective tube, inner reflector, inner dome and outer dome to the flashing.

3.1.1.4 A corrosion resistant steel dome edge protection band is utilized to protect the dome edge on installations on roof assemblies with fire classifications of A, B or C.

3.1.1.5 Corrosion resistant metal flashings are available in self-mounting, curb-mounting, steep, and low slope roof configurations. For models 160 DS, 290 DS, 300 DS and Smart LED, the low slope configuration is available in both 4 and 6 inch heights. For models 330 DS and 750 DS, low slope configurations in 4, 8 and 11 inch heights and metal roof flashing are also available. Also, a curb-cap flashing for site built curb mounting is available for the 290 DS, 300 DS, 330 DS and 750 DS models.

3.1.2 Reflective Tubes

Reflective tubes and angle adapters have a high reflectance interior tube finish and are manufactured from .015" thick aluminum for 160 DS, 290 DS, 300 DS and Smart LED, and .018" for 330 DS and 750 DS. Two inch wide polymer or aluminum foil tape is utilized at all joints between tube sections and at vertical seams of each tube.

3.1.3 Daylight Dimmer Assembly

A switch operated, electrically driven Daylight Dimmer Assembly is available for installation above the bottom tube on 160 DS, 290 DS, 300 DS, Smart LED and above the round-to-square for 330 DS / 750 DS. The Dimmer Assembly is used to restrict natural light from entering the room. See Section 6.3 and Figure 7.

3.1.4 Light Kit Assembly

Switch operated, electric light kits are available for installation into the bottom tube for the 160 DS and 290 DS models only. The kits contain either an incandescent or fluorescent light bulb. See Section 6.3 and Figure 6.

3.1.5 Metal Transition Assembly

Metal transitions are used to transition the reflective tube assembly to the square diffuser assemblies. The 300 DS, 330 DS and 750 DS models utilize the transition assembly, manufactured from 0.015 inch thick aluminum. Two inch wide aluminum foil tape is utilized at all joints. See Figure 8.

3.1.6 Thermal Insulation Panel

The thermal insulation panel assembly includes two thermal disks that are of 0.06" plastic sheets complying with IBC Section 803.1 and IBC Section 2606.4, and are available for installation within the reflective tube assembly. Thermal insulation panels are available for installation above the round-to-square or between the top tube and extension tube for 330 DS and 750 DS models to fit within the building insulation level. The thermal insulation panel is used to add insulation to the tube assembly for increased thermal performance.

3.1.7 Diffuser and Decorative Fixture Assembly.

The Diffuser and Decorative Fixture assemblies are either single or dual glazed with acrylic or polycarbonate plastic Diffusers classified as a CC2 plastic material. Diffusers have a flame spread index not exceeding 200 and a smoke development index not exceeding 450 when tested in accordance with ASTM E 84. The Aurora Glo lens is comprised of glass.

A dress (trim) ring is mounted over the assembly edge for aesthetic purposes.

For models 160 DS, 290 DS and Smart LED the standard diffuser and decorative fixtures (JustFrost, OptiView and Tier Drop) employ a ceiling ring that is manufactured from injection molded impact resistant acrylic and is used to connect the reflective tubing and diffusers or decorative fixtures to the interior room ceiling.

The Aurora Glo decorative fixtures employ a fixture mounting ring, in addition to the ceiling ring, that is manufactured from steel and is used to connect the decorative fixture to the interior room ceiling. The ceiling ring is also used to hold the reflective tubing in place.

4.0 PERFORMANCE CHARACTERISTICS

4.1 Models identified in this report have been tested for deflection and structural response under uniform loading in both the positive (inward) and negative (outward) directions in accordance with ICC-ES AC16. The maximum allowable positive and negative design loads for each model size combination, and associated anchoring, are indicated in Table 1.

4.2 Models identified in this report have met the air infiltration and water penetration acceptance criteria identified in ICC-ES AC16 when tested in accordance with Sections 5.3.2 and 5.3.3 of AAMA/WDMA/CSA 101/I.S.2/A440-11.

4.2.1 AAMA/WDMA/CSA101/I.S.2/A440-11 reviewed and deemed equivalent for compliance with IBC Section 2405.5.

4.2.2 Models 160 DS, 290 DS, and 300 DS have met the air leakage performance and water penetration resistance requirements of A440S1-09, the Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440.

5.0 INSTALLATION

Installation shall be in accordance with the manufacturer's installation instructions and this report. Where differences occur between this report and the manufacturer's installation instructions, this report shall govern.

5.1 The dome attachment for the 10" 160 DS, 14" 290 DS, 14" 300 DS, and Smart LED models is accomplished by attaching the dome ring to the flashing and top tube with four (4) #8x1" truss washer head screws and plastic spacers with a snap fit between the dome and dome ring. See Figures 1, 2 and 5.

5.2 Diffuser assemblies for the 10" 160 DS, 14" 290 DS and Smart LED models are comprised of an acrylic ceiling ring, an acrylic dress ring and dual glazed diffuser. The dress ring is snap fitted or twist secured onto the ceiling ring.

5.3 The Dome attachment for the 21" 330 DS and 750 DS models is accomplished with three (3) #8x1-5/8" washer head sheet metal screws passing through three (3) equally spaced plastic spacers, flashing and into the tube ring.

5.4 The Dome Assembly for the 21" 330 DS-O and 750 DS-O (Open Ceiling) models utilize a butyl putty seal (referred to as a glazing rope in installation instructions) between the flashing and tube ring. See Figure 2 and Figure 3.

5.5 For the 14" 300 DS-C, 21" 330 DS-C and 750 DS-C (Closed Ceiling) models, the tube ring should be sealed to the outer face of the top reflector tube with 2" wide polymer/foil tape.

5.6 Diffuser assembly for the 21" 330 DS-O and 750 DS-O (Open Ceiling) models is comprised of an acrylic dress ring and a single glazed diffuser. The assembly is snapped into the four (4) equally spaced slots provided in the end of the extension tube.

5.7 The 21" 330 DS-C and 750 DS-C (Closed Ceiling) models consist of a square diffuser assembly that connects to the round reflective tube through a square to round transition section.

5.8 Installation for compliance with the IBC and IRC shall be in accordance with IBC Section 2405 and 2610 and, IRC Section R308.6.

5.9 Installation for compliance with the FBC shall be in accordance with FBC Section 2405 and 2610.

5.10 The installation on roof assemblies with fire classifications A, B, or C, metal dome edge protective rings shall be installed on the 160 DS, 290 DS, 300 DS, Smart LED, 330 DS and 750 DS models utilizing the 4" flashings. Other flashings noted in Section 3.1.1.5 may be needed in order to maintain the required minimum 4" distance from roof deck to dome edge.

6.0 CONDITIONS OF USE

The *Solatube Tubular Daylighting Devices* identified in this report are deemed to comply with the referenced building codes subject to the following conditions:

6.1 Installation shall comply with the manufacturer's installation instructions, this report, IBC and FBC Sections 2405 and 2610 and IRC Section R308.6The wind uplift rating recognized in this report (See Table 2) is based on attachment to S-P-F wood curbing (Specific Gravity, G=0.42), 5/8" Group 2 Plywood and 22 gauge 33 ksi minimum yield steel deck. Installation on a wood substrate with a lesser specific gravity or lesser thickness may result in a lower wind uplift rating.

6.2 The Smart LED assembly, daylight dimmer, incandescent light and fluorescent light assemblies were only evaluated for effects on performance when TDDs were tested in accordance with ICC-ES AC16. Evaluation of these assemblies for compliance to electrical codes is not part of this report.

6.3 Where required by the building official, engineering calculations and details shall be provided. The calculations shall verify that the anchorage complies with the building code for the type of framing and condition of the supporting construction.

6.4 Model 330 DS shall not be installed in High Velocity Hurricane Zones as defined by the Florida Building Code.

6.5 Models 160 DS, 290 DS, 300 DS, Smart LED and 750 DS shall utilize the additional inner dome for use in High Velocity Hurricane Zones as defined by the Florida Building Code.

6.6 All products are manufactured in accordance with the manufacturer's approved quality control system with inspections by Keystone Certifications, Inc. (IAS AA-714).

7.0 SUPPORTING EVIDENCE

7.1 Manufacturer's drawings and installation instructions.

7.2 Reports of testing and engineering analysis in accordance with ICC-ES AC16, *Acceptance Criteria for Plastic Glazed Skylights*, revised August 2013.

7.3 Reports of testing to ASTM D 1929-12 *Test Method for determining Ignition Properties of Plastics*.

7.4 Reports of Testing to ASTM E84-2013A, *Test Method for Surface Burning Characteristics of Building Material* with equivalency to ASTM E84-09.

7.5 Reports of Testing to ASTM D635-10 *Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position* with equivalency to ASTM D635-03.

7.6 Reports of Testing to ASTM G 155 *Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials* and ASTM D638 *Test Method for Tensile Properties of Plastics*.

7.7 Documentation of an Intertek approved quality control system for the manufacturing of products recognized in this report.

7.8 Reports of engineering and installation analysis for alternate anchorage signed and sealed by a Professional Engineer registered in the State of Florida.

7.9 Testing for Florida Building Code was performed by a Miami-Dade County approved testing facility (Architectural Testing, Inc. - Fresno, CA) with reports signed and sealed by a Professional Engineer registered in the State of Florida. These reports are:

7.9.1 Reports of testing in accordance with AAMA/WDMA/CSA101/I.S.2/A440-11, "*Standard/Specification for Windows, Doors, and Unit Skylights", American Architectural Manufacturers Association, Window and Door Manufacturers Association, and Canadian Standards Association.*

7.9.2 Reports of testing to Testing Application Standard (TAS) 201-94 *"Impact Test Procedures"* as required by Section 1626 of the Florida Building Code.

7.9.3 Reports of testing to Testing Application Standard (TAS) 202-94 *"Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure"* as required by Section 1620 of the Florida Building Code.

7.9.4 Reports of testing to Testing Application Standard (TAS) 203-94 "*Criteria for Testing Products subject to Cyclic Wind Pressure Loading*" as required by Sections 1625, Table 1625.4 and Table 1626 of the Florida Building Code.

7.10 Reports of testing for 160 DS, 290 DS, and 300 DS models in accordance with A440S1-09, "*Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights.*"

7.11 Reports of testing in accordance with ASTM E1886-05, "*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".*

7.12 Reports of testing in accordance with ASTM E1996-2012a, "*Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"*.

7.13 ICC-ES Evaluation Report ESR-1407 for thermal insulation panel plastic sheet material compliance with IBC Section 803.1 and IBC Section 2606.4.

8.0 IDENTIFICATION

Solatube Tubular Daylighting devices produced in accordance with this report shall be identified with permanent labeling that includes the following information:

8.1 The manufacturers name and/or logo, address model number and allowable loads

8.2 The plastic dome glazing thickness and classification (CC2)

8.3 The Name or logo of the independent inspection agency, Keystone Certifications, Inc. (IAS AA-714)

8.4 The Intertek Code Compliance Research Report mark and report number (CCRR-0131) as follows:

CODE COMPLIANCE
Intertek
CCRR-0131

9.0 FLORIDA BUILDING CODE

9.1 Models 160 DS, 290 DS, 300 DS, Smart LED, 330 DS and 750 DS have been tested to show compliance with AAMA/WDMA/CSA 101/I.S.2/A440-11 *Standard Specification for Windows, Doors, and Unit Skylights*. Testing was performed by a Miami-Dade County approved testing facility and were signed and sealed by a Professional Engineer with current registration in the state of Florida.

9.2 Light Transmitting Plastics forming part of the models identified in this report have been shown to have a self-ignition temperature greater than 650°F when tested in accordance with ASTM D 1929-12, A smoke development index less than 450 when tested in accordance with ASTM E 84-2013A, and a combustibility classification of CC2 when tested in accordance with ASTM D 635-10.

9.3 High Velocity Hurricane Zones (HVHZ)

Models 160 DS, 290 DS, 300 DS, Smart LED and 750 DS have been additionally tested to show compliance with the requirements of the 2014 Florida Building Code for use in locations designated as High Velocity Hurricane Zones. Testing has shown;

9.3.1 Sufficient resistance to windborne debris, as stated in Section 1626 of the Florida Building Code when tested to FBC Test Protocol 4.TAS 201-94.

9.3.2 Sufficient resistance to wind forces as determined by Section 1620 of the Florida Building Code when tested to FBC Test Protocol TAS 202-94.

9.3.3 Sufficient resistance to cyclic wind pressure loading as determined by Sections 1625, Table 1625.4 and Table 1626 of the Florida Building Code when tested to FBC Test Protocol TAS 203-94.

9.3.4 Sufficient weathering resistance of plastics with outdoor exposure when tested to ASTM G 155 for a period of 4500 hours and subsequent testing to ASTM D 638.

9.4 Conclusion:

The Solatube Tubular Daylighting Devices 160 DS, 290 DS, Smart LED and 750 DS models described in Sections 2.0 through 7.0 of this Research Report, comply with the 2014 *Florida Building Code for High Velocity Hurricane Zones.*

10.0 CODE COMPLIANCE RESEARCH REPORT USE

10.1 Approval of building products and/or materials can only be granted by a building official having legal authority in the specific jurisdiction where approval is sought.

10.2 Code Compliance Research Reports shall not be used in any manner that implies an endorsement of the product by Intertek.

10.3 Reference to the https://bpdirectory.intertek.com is recommended to ascertain the current version and status of this report.

TABLE 1 – MAXIMUM ALLOWABLE DESIGN LOADS AND APPLICABLE CODES

Model No	Dia. (inch)	Dome Thickness (inch)	IBC, IRC		FBC
			Wind Loads (psf)	Snow Load [4] (psf)	Wind Loads [3] (psf)
160 DS	10	0.125	+70 -60	+150	+70 -70
Smart LED					
290 DS	14	0.125			
300 DS-C	14	0.125			
330 DS-O[2]	21	0.168	+70 -70		
330 DS-C[2]	21	0.168			
750 DS-O	21	0.210			
750 DS-C	21	0.210			

[1] Positive (+) loads are directed inward; negative (-) are directed outward.

[2] Models 330 DS are not approved for use in High Velocity Hurricane Zones as defined by the FBC.

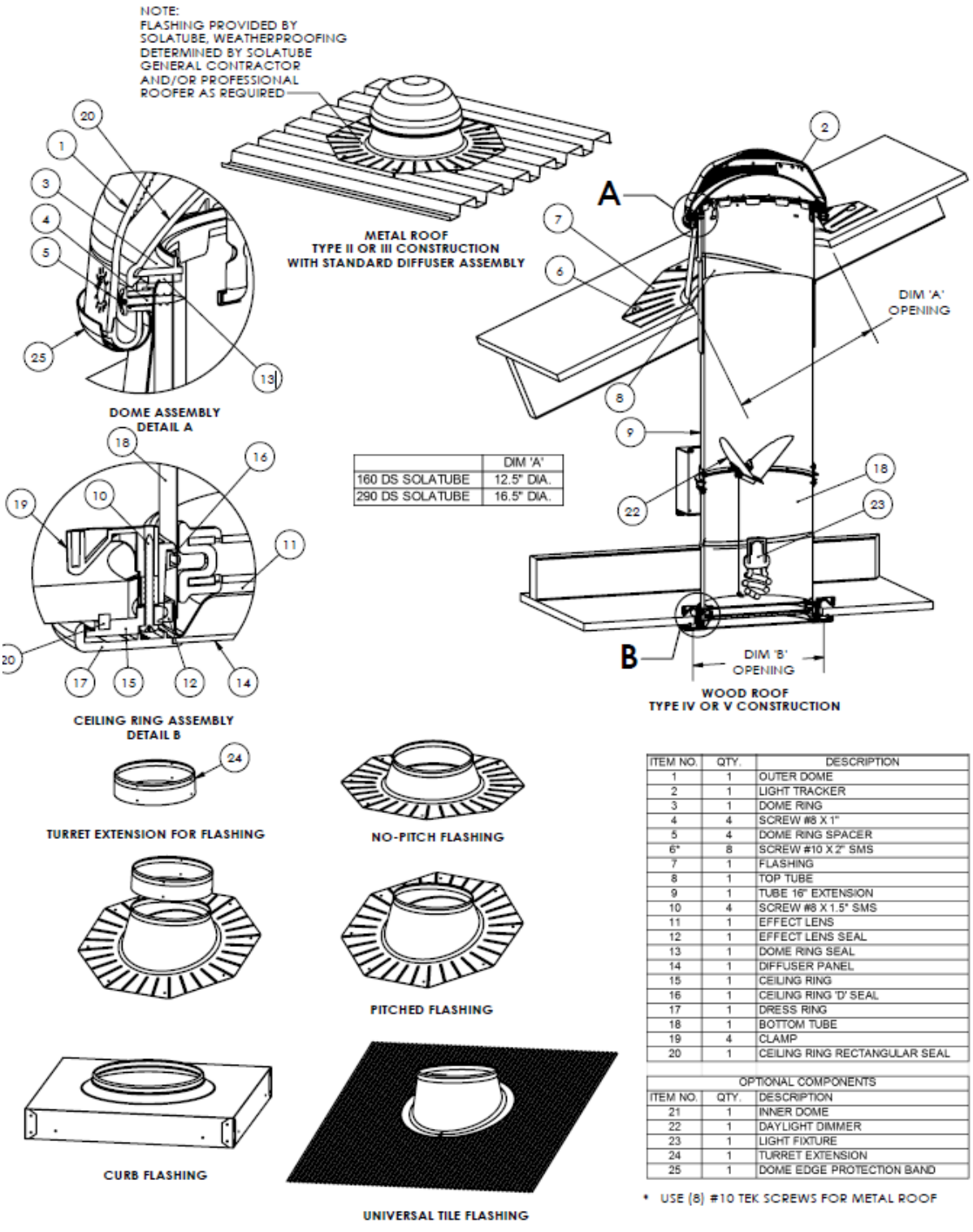
[3] Values indicated are positive and negative design pressure ratings for use with the FBC.

[4] Allowable design loads for consideration of water penetration are limited to those values indicated under Wind Loads.

TABLE 2 – ANCHORAGE DESCRIPTIONS FOR RECOGNIZED WIND UPLIFT DESIGN PRESSURES

Model #s	Anchorage	Substrate	Anchor Description and Quantity
160 DS 290 DS 300 DS Smart LED	Metal Flange to wood curb	SPF (S.G.≥ .42) wood curb	Qty 8 #10 x 2” Wood Screw
	Metal Flange to wood deck	5/8” Type 2 Plywood	Qty 8 #10 x 2” Wood Screw
		15/32” Type 2 Plywood	
		19/32” Type 2 Plywood	
		7/16” OSB	
	Metal Flange to Metal Curb	22 gauge steel 33ksi Min Yield	Qty 8 #10 TEKS
	Metal Flange to Metal Deck	22 gauge steel 33ksi Min Yield	Qty 8 #10 TEKS
330 DS-O[1] 330 DS-C[1] 750 DS-O 750 DS-C	Metal Flange to wood curb	SPF (S.G.≥ .42) wood curb	Qty 8 #10 x 2” Wood Screw
	Metal Flange to wood deck	5/8” Type 2 Plywood	Qty 16 #10 x 2” Wood Screw
		15/32” Type 2 Plywood	
		19/32” Type 2 Plywood	
		7/16” OSB	
	Metal Flange to Metal Curb	22 gauge steel 33ksi Min Yield	Qty 8 #10 TEKS
	Metal Flange to Metal Deck	22 gauge steel 33ksi Min Yield	Qty 16 #10 TEKS
	Alum Flange to Metal Deck (Non-Corrugated Roof Type)	26 gauge steel Roof Deck	Qty 16 4.8mm Zinc-Coated Steel Rivets

[1] Models 330 DS are not approved for use in High Velocity Hurricane Zones as defined by the FBC.



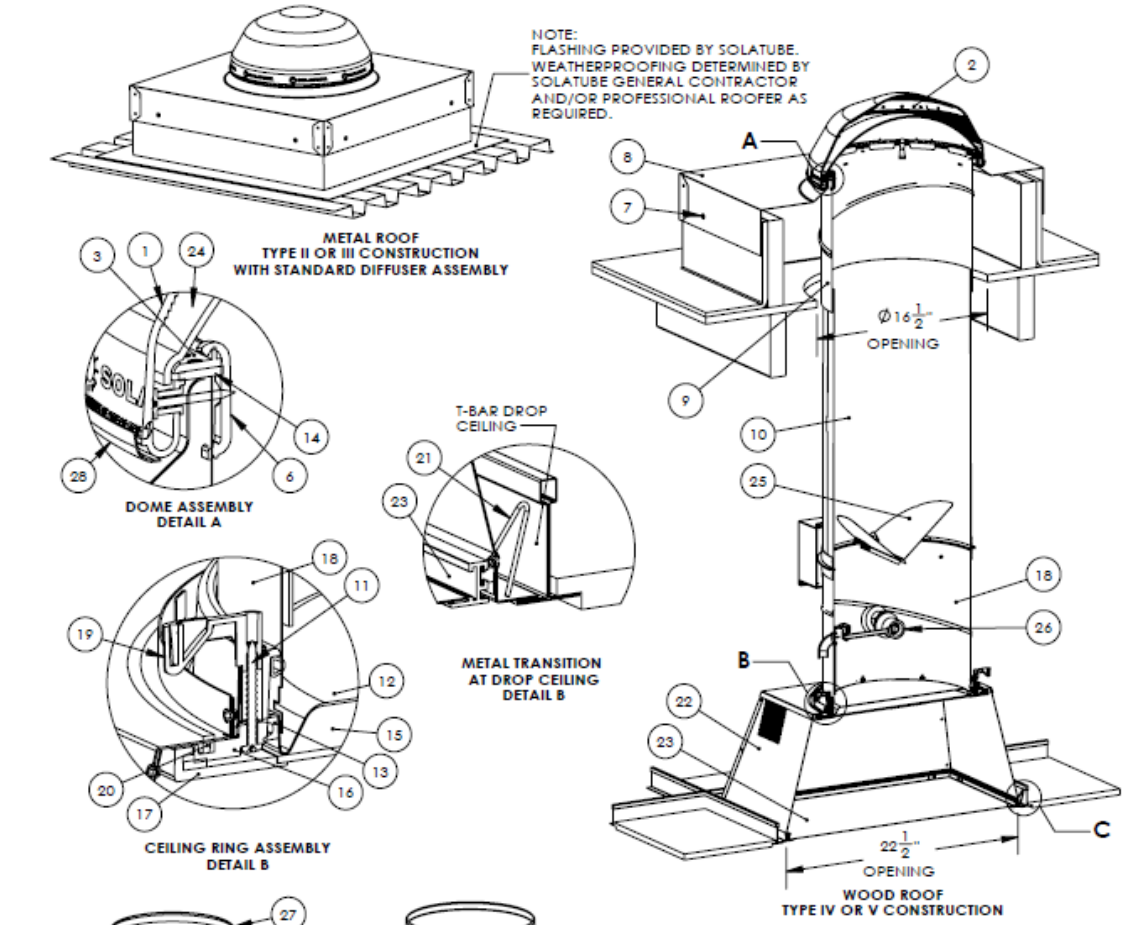
	DIM 'A'
160 DS SOLATUBE	12.5" DIA.
290 DS SOLATUBE	16.5" DIA.

ITEM NO.	QTY.	DESCRIPTION
1	1	OUTER DOME
2	1	LIGHT TRACKER
3	1	DOME RING
4	4	SCREW #8 X 1"
5	4	DOME RING SPACER
6*	8	SCREW #10 X 2" SMS
7	1	FLASHING
8	1	TOP TUBE
9	1	TUBE 16" EXTENSION
10	4	SCREW #8 X 1.5" SMS
11	1	EFFECT LENS
12	1	EFFECT LENS SEAL
13	1	DOME RING SEAL
14	1	DIFFUSER PANEL
15	1	CEILING RING
16	1	CEILING RING 'D' SEAL
17	1	DRESS RING
18	1	BOTTOM TUBE
19	4	CLAMP
20	1	CEILING RING RECTANGULAR SEAL

OPTIONAL COMPONENTS		
ITEM NO.	QTY.	DESCRIPTION
21	1	INNER DOME
22	1	DAYLIGHT DIMMER
23	1	LIGHT FIXTURE
24	1	TURRET EXTENSION
25	1	DOME EDGE PROTECTION BAND

* USE (8) #10 TEK SCREWS FOR METAL ROOF

FIGURE 1 - 160 DS & 290 DS SOLATUBE WITH DETAILS

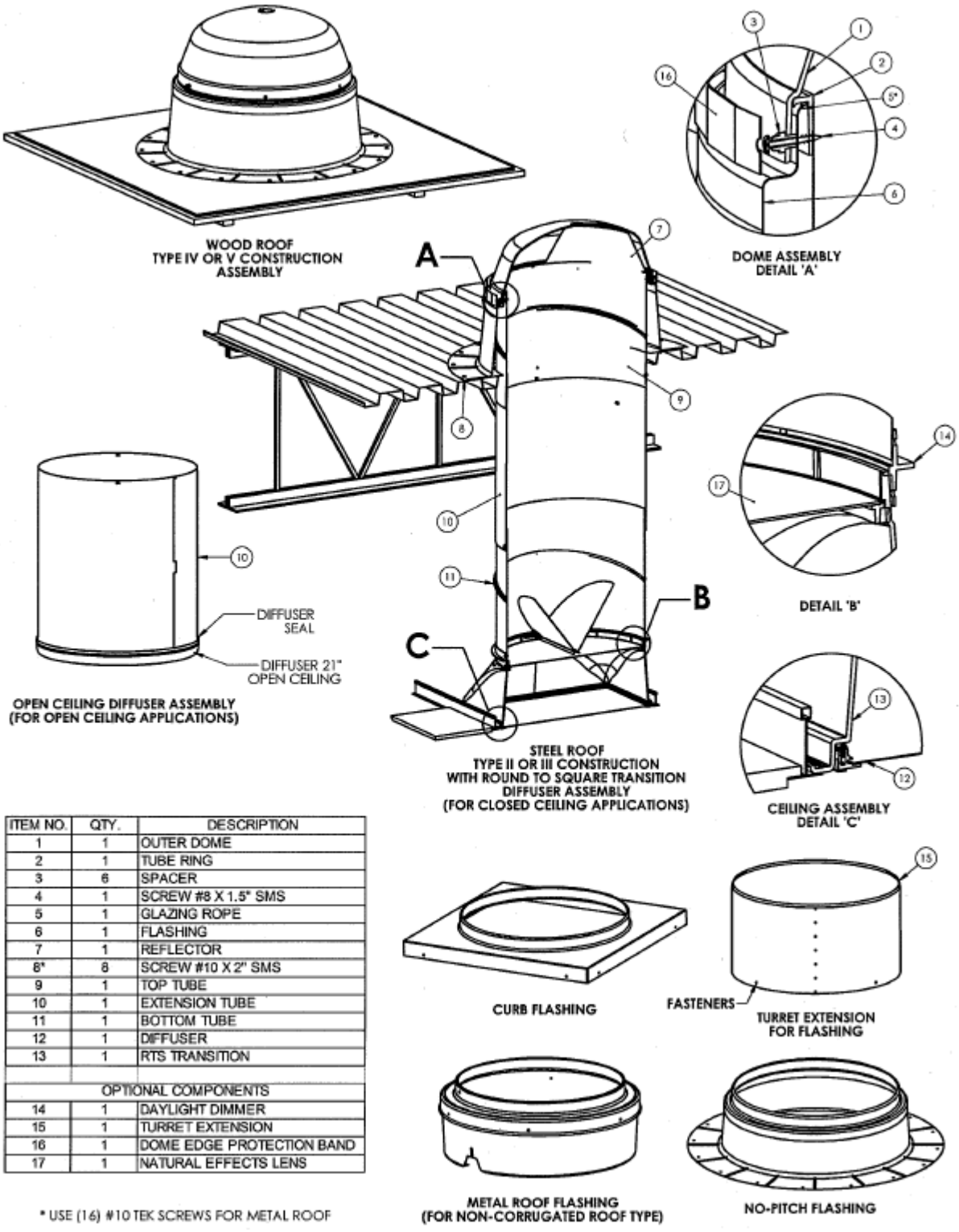


ITEM NO.	QTY.	DESCRIPTION
1	1	OUTER DOME
2	1	LIGHT TRACKER
3	1	DOME RING
4	4	SCREW #8 X 1"
5	4	DOME RING SPACER
6	4	TOP TUBE CLIP
7*	8	SCREW #10 X 2" SMS
8	1	FLASHING
9	1	TOP TUBE
10	1	EXTENSION TUBE
11	4	SCREW #8 X 1.5" SMS
12	1	EFFECT LENS
13	1	EFFECT LENS SEAL
14	1	DOME RING SEAL
15	1	DIFFUSER PANEL
16	1	CEILING RING
17	1	DRESS RING
18	1	BOTTOM TUBE
19	4	CLAMP
20	1	CEILING RING RECT. SEAL
21	4	V-CLIP
22	1	METAL TRANSITION
23	1	METAL TRANS. DIFFUSER ASSY.

AL COMPONENTS		
ITEM NO.	QTY.	DESCRIPTION
24	1	INNER DOME
25	1	DAYLIGHT DIMMER
26	1	LIGHT FIXTURE
27	1	TURRET EXTENSION
28	1	DOME EDGE PROTECTION BAND

*USE (8) #10 TEK SCREWS FOR METAL ROOF

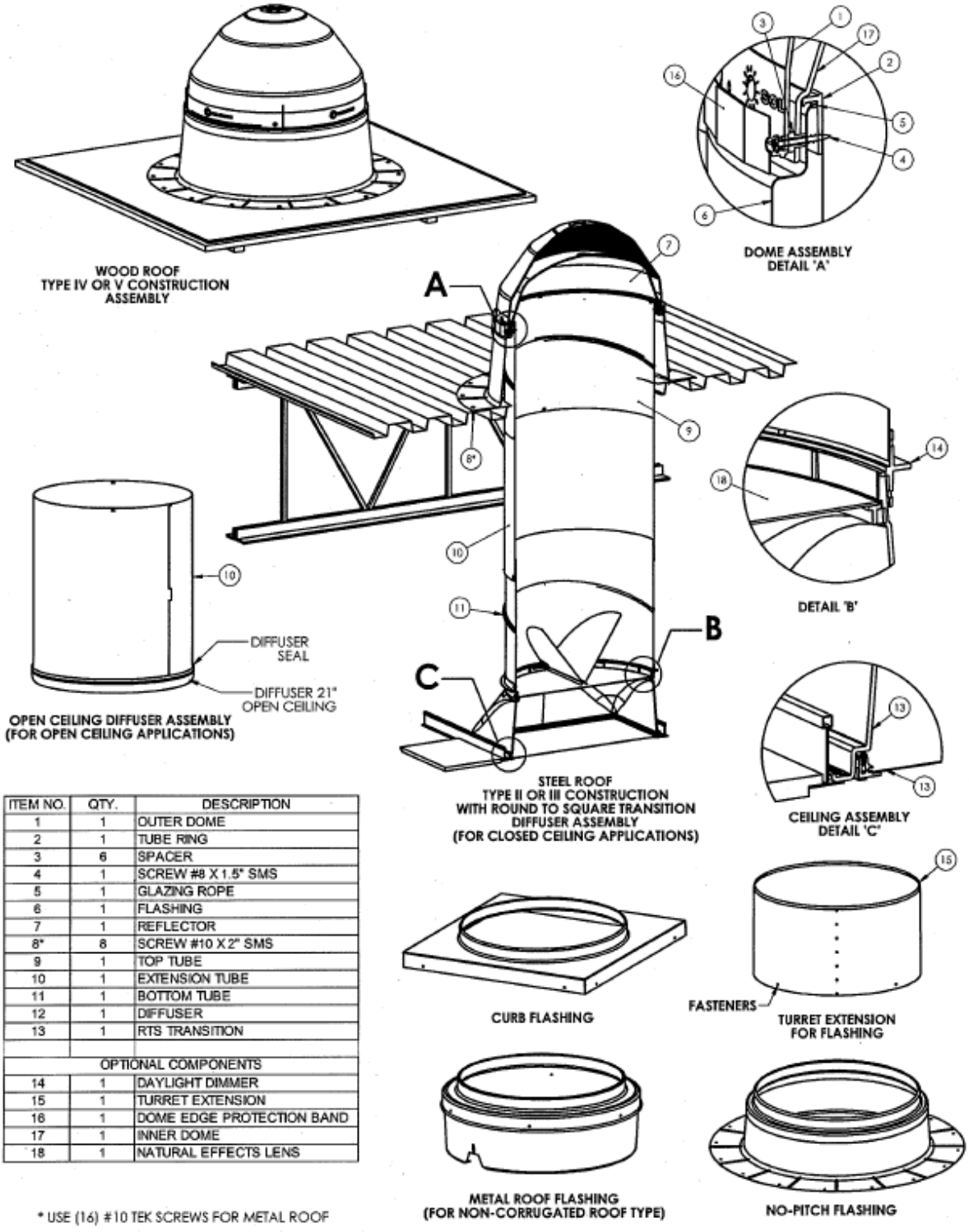
FIGURE 2 - 300 DS SOLATUBE WITH DETAILS



ITEM NO.	QTY.	DESCRIPTION
1	1	OUTER DOME
2	1	TUBE RING
3	6	SPACER
4	1	SCREW #8 X 1.5" SMS
5	1	GLAZING ROPE
6	1	FLASHING
7	1	REFLECTOR
8*	8	SCREW #10 X 2" SMS
9	1	TOP TUBE
10	1	EXTENSION TUBE
11	1	BOTTOM TUBE
12	1	DIFFUSER
13	1	RTS TRANSITION
OPTIONAL COMPONENTS		
14	1	DAYLIGHT DIMMER
15	1	TURRET EXTENSION
16	1	DOME EDGE PROTECTION BAND
17	1	NATURAL EFFECTS LENS

* USE (16) #10 TEK SCREWS FOR METAL ROOF

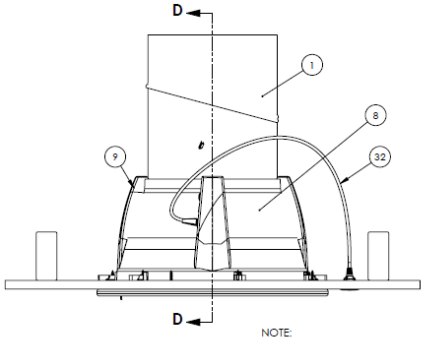
FIGURE 3 - 330 DS SOLATUBE WITH DETAILS

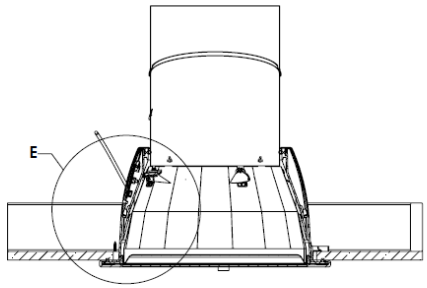


ITEM NO.	QTY.	DESCRIPTION
1	1	OUTER DOME
2	1	TUBE RING
3	6	SPACER
4	1	SCREW #8 X 1.5" SMS
5	1	GLAZING ROPE
6	1	FLASHING
7	1	REFLECTOR
8*	8	SCREW #10 X 2" SMS
9	1	TOP TUBE
10	1	EXTENSION TUBE
11	1	BOTTOM TUBE
12	1	DIFFUSER
13	1	RTS TRANSITION
OPTIONAL COMPONENTS		
14	1	DAYLIGHT DIMMER
15	1	TURRET EXTENSION
16	1	DOME EDGE PROTECTION BAND
17	1	INNER DOME
18	1	NATURAL EFFECTS LENS

* USE (16) #10 TEK SCREWS FOR METAL ROOF

FIGURE 4 - 750 DS SOLATUBE WITH DETAILS

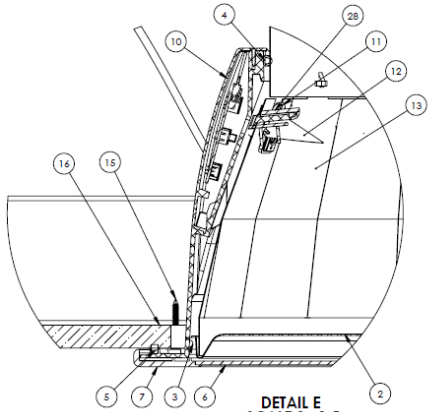




SECTION D-D

NOTE:

1. LED LIGHT KIT SHOWN ASSEMBLED TO 160 DS BOTTOM TUBE.
2. FOR UPPER ASSEMBLY INSTALLATION VIEWS SEE FIGURE 1.
3. EVALUATION OF THESE LIGHT FIXTURES FOR COMPLIANCE TO THE APPLICABLE ELECTRICAL CODES IS NOT PART OF THIS REPORT.



DETAIL E
SCALE 1 : 1.5

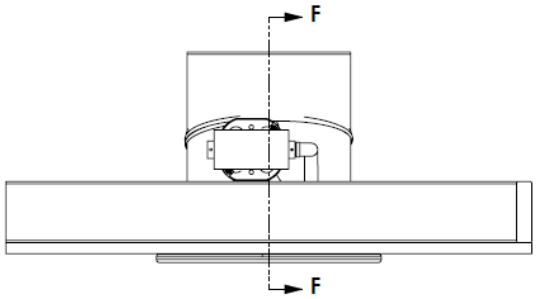
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	300606	160DS BOTTOM TUBE	1
2	421345	NATURAL/SOFTENING EFFECT LENS 290 DS	1
3	600290	DIFFUSER SEAL 290 DS	1
4	600445	D SEAL HOLLOW	1
5	600620	FOAM SEAL RECTANGULAR 3/16" X 1/4"	1
6	410330	DIFFUSER PANEL 290 DS	1
7	410310	DRESS RING 290 DS	1
8	400300	AMPLIFIER HOUSING	1
9	400310	COVER COLLIMATOR STANDARD	1
10	400320	COVER COLLIMATOR PCBA	1
11	400345	HOLDER AWNING	4
12	400355	AWNING	4
13	300755	FACET COLLIMATOR ASSEMBLY	1
14	700285	SCREW #4-40 X 1/2" OVAL-PHIL HEAD (NOT SHOWN)	4
15	700450	SCREW #8 X 1-3/4" SMS PHIL PAN A/B THREAD	6
16	410220	CLAMP	6
17	700485	SCREW 1-5/8" PHIL BUGLE (NOT SHOWN)	4
18	500011	CONTROLLER LED PCBA (NOT SHOWN)	1
19	500012	WIRE HARNESS LED ARRAY (NOT SHOWN)	1
20	500545	STRAIN RELIEF DRIVER (NOT SHOWN)	1
21	500565	STANCHION DC COVER (NOT SHOWN)	1
22	500650	SCREW #8-32 X 1/4" (GROUND) (NOT SHOWN)	1
23	500660	WASHER #8 GROUND CUP (NOT SHOWN)	1
24	504035	STANCHION DRIVER (NOT SHOWN)	1
25	504115	WIRE HARNESS DRIVER (NOTSHOWN)	1
26	504335	WIRE NUT # 18-#12 (NOT SHOWN)	3
27	700195	RIVET TUBULAR 1/8 x 5/32 TRUSS ZINC (NOT SHOWN)	6
28	500025	LIGHT SENSOR ASSEMBLY	1
29	600203	GLUE HOT MELT (NOT SHOWN)	0.001
30	601107	THERMAL CHIMNEY 1/2 (NOT SHOWN)	2
31	700175	ROMEX CLAMP CONNECTOR 3/8" (NOT SHOWN)	1

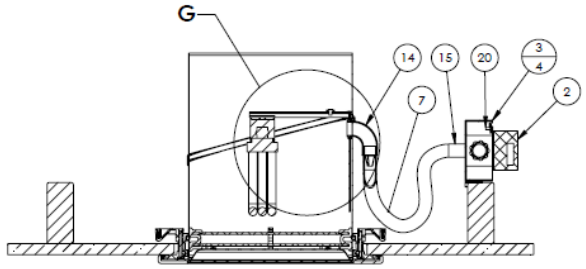
OPTIONAL COMPONENTS			
ITEM NO.		DESCRIPTION	QTY.
32		OCCUPANCY SENSOR	1

Notes:

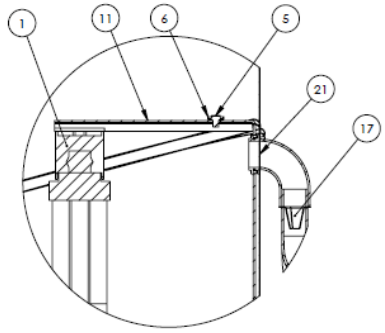
1. LED light kit shown assembled to 160DS bottom tube.
2. See Figure 1 for upper assembly
3. Evaluation of these assemblies for compliance to electrical codes is not part of this report.

FIGURE 5 – SMART LED FOR 160 DS SOLATUBE





SECTION F-F



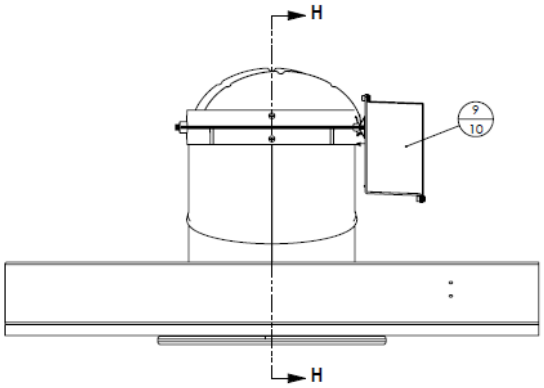
DETAIL G

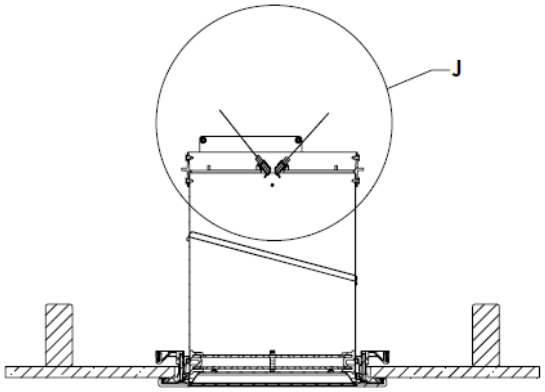
ITEM NO.	DESCRIPTION	QTY.
1	LAMP HOLDER 4-PIN	1
2	BALLAST, ELECTRIC 26W	1
3	JUNCTION BOX 4" W/BRACKET	1
4	JUNCTION BOX 4" COVER	1
5	SCREW #8-32 X 1/4"	1
6	WASHER #8 GROUND CUP	1
7	CONDUIT FLEXIBLE 3/8" X 48"	1
8	WIRE LEAD BLACK 18 AWG 62" (NOT SHOWN)	1
9	WIRE LEAD WHITE 18 AWG 62" (NOT SHOWN)	1
10	WIRE LEAD GREEN 18 AWG 62" (NOT SHOWN)	1
11	BRACKET CFL 26 WATT	1
12	ZIP TIE, HELICAL WRAP (NOT SHOWN)	1
13	WASHER FENDER 1/4" X 1-1/4" (NOT SHOWN)	1
14	CONNECTOR 90 DEG 3/8	1
15	CONNECTOR STRAIGHT 3/8	1
16	SCREW HEX #8 X .75" (NOT SHOWN)	4
17	BUSHING ANTI-SHORT RED	1
18	NUT WIRE 73B (NOT SHOWN)	6
19	SLEEVE CRIMP 10-18 GA (NOT SHOWN)	1
20	SCREW GROUND 10-32 X .375	1
21	CONDUIT FOAM SEAL 1/8" H X 3/4"W	4

Notes:

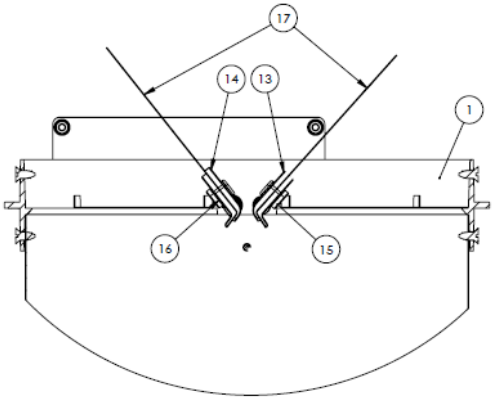
1. Universal light kit shown assembled to bottom tube.
2. See Figure 1 for upper assembly
3. Evaluation of these light fixtures for compliance to electrical codes is not part of this report.

FIGURE 6 - TYPICAL SOLATUBE LIGHT KIT ASSEMBLY FOR 160DS & 290DS





SECTION H-H



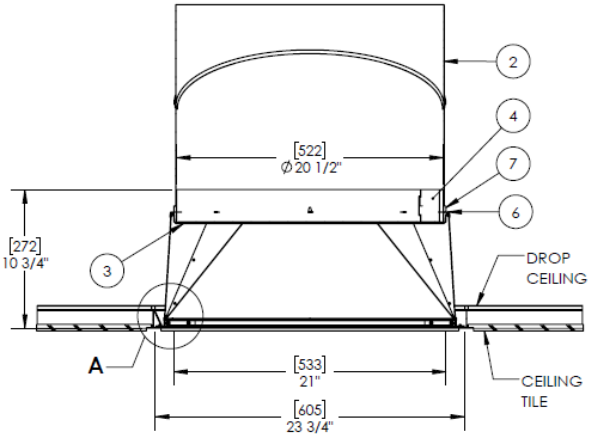
DETAIL J

ITEM NO.	DESCRIPTION	QTY.
1	RING 10" DAYLIGHT DIMMER	1
2	POWER SUPPLY (NOT SHOWN)	1
3	RETAINER, E-RING, 5/16 (NOT SHOWN)	4
4	PCB, MOTOR CONTROL (NOT SHOWN)	1
5	MOTOR GEARED (NOT SHOWN)	1
6	CAM, DRIVE MECHANISM (NOT SHOWN)	1
7	DOG, DRIVE MECHANISM (NOT SHOWN)	1
8	LID, DRIVE MECHANISM (NOT SHOWN)	1
9	MOUNT, JUNCTION BOX	1
10	COVER, JUNCTION BOX	1
11	SPACER, NYLON 1/2"	1
12	CABLE CLAMP, DLD (NOT SHOWN)	1
13	CLIP, RIGHT	2
14	CLIP, LEFT	2
15	CLIP, BACK RIGHT	2
16	CLIP, BACK LEFT	2
17	DISK, 10" DIMMER	2
18	SCREW TRILOB #4 X 3/16 (NOT SHOWN)	4
19	SCREW TRILOB #6 X 3/8 (NOT SHOWN)	8
20	SCREW TRILOB #8 X 3/8 (NOT SHOWN)	8
21	SCREW TRILOB #8 X 1.0" (NOT SHOWN)	4
22	SCREW TRILOB #12 X 1/2 (NOT SHOWN)	2

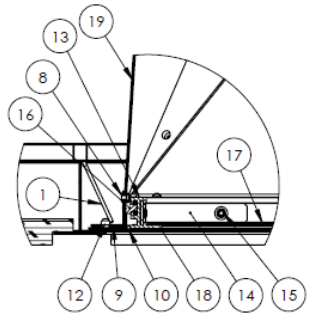
Notes:

1. Daylight dimmer kit shown assembled to bottom tube.
2. See Figure 1 for upper assembly
3. Evaluation of these light fixtures for compliance to electrical codes is not part of this report.

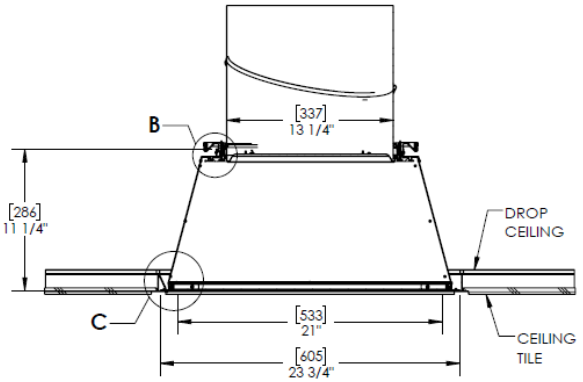
FIGURE 7 - TYPICAL SOLATUBE DAYLIGHT DIMMER ASSEMBLY FOR 160DS, 290DS, 330DS, & 750D



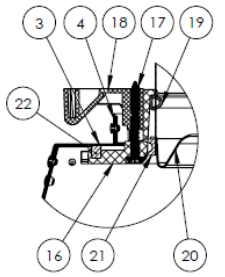
ITEM NO.	QTY.	DESCRIPTION
1	4	CLIP 21" TRANS. HOLD DOWN
2	1	TUBE 21" BOTTOM
3	1	NAT EFFECT LENS 330 DS OTS
4	1	TRANSITION ADAPTER BAND 330/750 DS
5	4	CLIP NAT EFF LENS METAL TRANSITION (NOT SHOWN)
6	1	TRANSITION BOX CAP 330/750 DS
7	1	FOAM SEAL RECTANGLE
8	24	RIVET 1/8 X 1/4 BLIND, MULTI
9	4	TRANSITION TRIM SECTION
10	2	TRANSITION TRIM CORNER BRACE (NOT SHOWN)
11	2	TRANSITION TRIM LEVER
12	10	RIVET 1/8 X 1/4 BLIND, MULTI WHITE
13	4	EXTRUSION ALUM PAINTED MITERED
14	4	CORNER KEY
15	8	SET SCREW 8-32 X 1/8 CUP PT
16	4	FOAM SEAL T-SLOT .250 X .270
17	1	DIFFUSER PANEL
18	1	TAPE FOAM 21" DIFFUSER
19	4	TRANS PANEL DIMPLED 330/750 DS



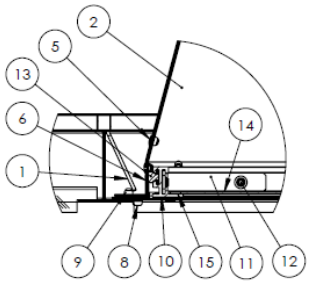
DETAIL A
SCALE 1 : 2



ITEM NO.	QTY.	DESCRIPTION
1	4	CLIP 21" TRANS. HOLD DOWN
2	4	TRANSITION PANEL DIMPLED 300 DS
3	1	TRANSITION BOX CAP 300 DS
4	1	TRANSITION CAP BELT 300 DS
5	33	RIVET 1/8 X 1/4 BLIND, MULTI
6	4	TRANSITION TRIM SECTION
7	2	TRANSITION TRIM CORNER BRACE (NOT SHOWN)
8	2	TRANSITION TRIM LEVER
9	9	RIVET 1/8 X 1/4 BLIND, MULTI WHITE
10	4	EXTRUSION ALUM PAINTED MITERED
11	4	CORNER KEY
12	8	SET SCREW 8-32 X 1/8 CUP PT
13	4	FOAM SEAL T-SLOT .250 X .270
14	1	DIFFUSER PANEL
15	1	TAPE FOAM 21" DIFFUSER
16	1	CEILING RING 290DS
17	4	SCREW #8 x 1.5"
18	4	FLAG
19	1	D SEAL HOLLOW
20	1	290 DS NATURAL EFFECT LENS
21	1	SEAL
22	1	FOAM SEAL RECTANGULAR 3/16" X 1/4"
26	1	TUBE BOTTOM BLANK 290 DS
27	1	TUBE BOTTOM BLANK 290 DS



DETAIL B
SCALE 1 : 2



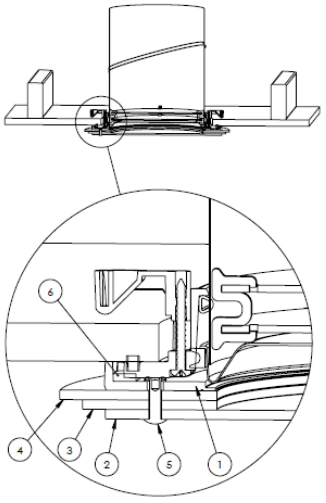
DETAIL C
SCALE 1 : 2

330 DS and 750 DS

300 DS

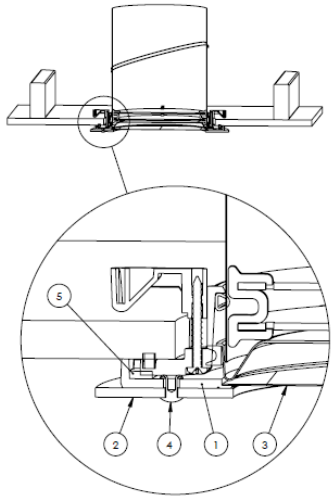
FIGURE 8 – TYPICAL SOLATUBE METAL TRANSITION ASSEMBLY FOR 300 DS, 330 DS, AND 750 DS

'TIER DROP' DIFFUSER ASSEMBLY



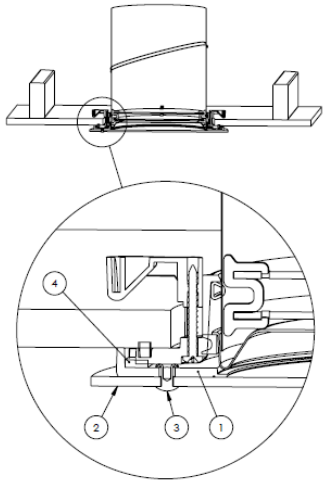
TIER DROP DIFFUSER ASSEMBLY COMPONENTS				
ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	1	410685	DRESS RING WITH GROOVE 160 DS	ACRYLIC
2	1	400235	ACRYLIC BOTTOM DISK 160 DS	ACRYLIC
3	1	400240	ACRYLIC MIDDLE 160 DS	ACRYLIC
4	1	400245	ACRYLIC TOP 160 DS	ACRYLIC
5	3	721250	RIVET 3/16" X 24/32"	STAINLESS STEEL
6	1	420520	DRESS RING SEAL 160 DS	PE FOAM

'OPTIVIEW' DIFFUSER ASSEMBLY



OPTIVIEW DIFFUSER ASSEMBLY COMPONENTS				
ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	1	410685	DRESS RING WITH GROOVE 160 DS	ACRYLIC
2	1	400225	ACRYLIC OPTIVIEW DISK 160 DS	ACRYLIC
3	1	420060	DIFFUSER 160 PANEL OPTIVIEW	POLYCARBONATE
4	3	721130	RIVET 3/16" X 12/32"	STAINLESS STEEL
5	3	420520	DRESS RING SEAL 160 DS	PE FOAM

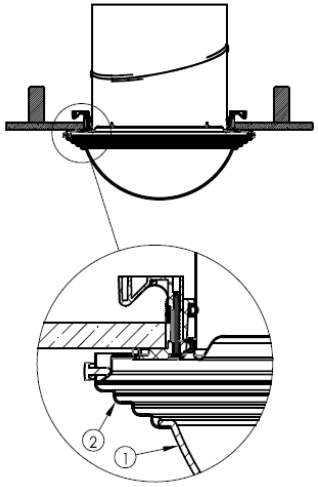
'JUST FROST' DIFFUSER ASSEMBLY



JUST FROST DIFFUSER ASSEMBLY COMPONENTS				
ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	1	410685	DRESS RING WITH GROOVE 160 DS	ACRYLIC
2	1	400215	ACRYLIC JUSTFROST DISK 160 DS	ACRYLIC
3	3	721130	RIVET 3/16" X 12/32"	STAINLESS STEEL
4	3	420520	DRESS RING SEAL 160 DS	PE FOAM

160 DS Decorative Fixture Options

'AURORAGLO' DECORATIVE FIXTURE ASSEMBLY

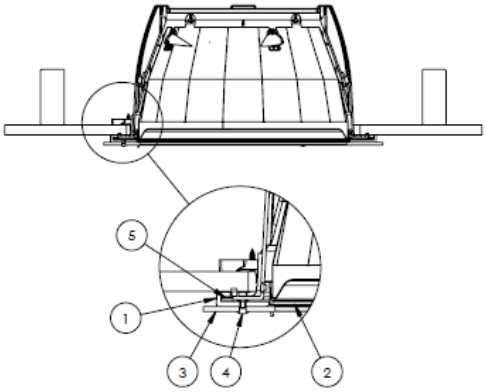


AURORAGLO DECORATIVE FIXTURE ASSEMBLY COMPONENTS		
ITEM NO.	QTY.	DESCRIPTION
1	1	GLASS LENS
2	4	METAL TRIM RING

290 DS Decorative Fixture Options

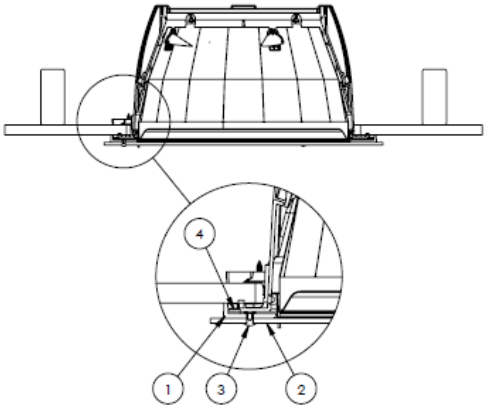
FIGURE 9 – SOLATUBE 160 & 290 DS DECORATIVE FIXTURES

'OPTIVIEW' DIFFUSER ASSEMBLY



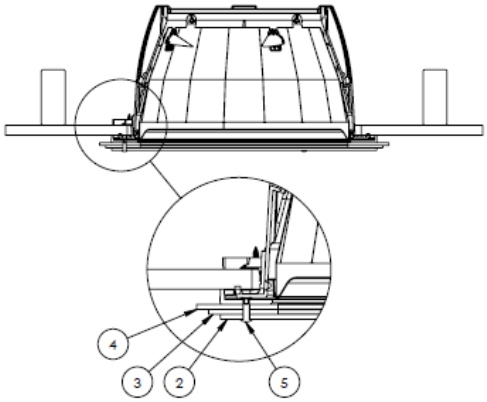
OPTIVIEW DIFFUSER ASSEMBLY COMPONENTS				
ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	1	410715	DRESS RING WITH GROOVE 290 DS	ACRYLIC
2	1	420080	DIFFUSER 14" PANEL OPTIVIEW	POLYCARBONATE
3	1	400230	ACRYLIC OPTIVIEW DISK 290DS	ACRYLIC
4	3	721130	RIVET BARREL 3/16 X 12/32 SS	STAINLESS STEEL
5	1	420610	DRESS RING SEAL 290 DS	PE FOAM

'JUST FROST' DIFFUSER ASSEMBLY



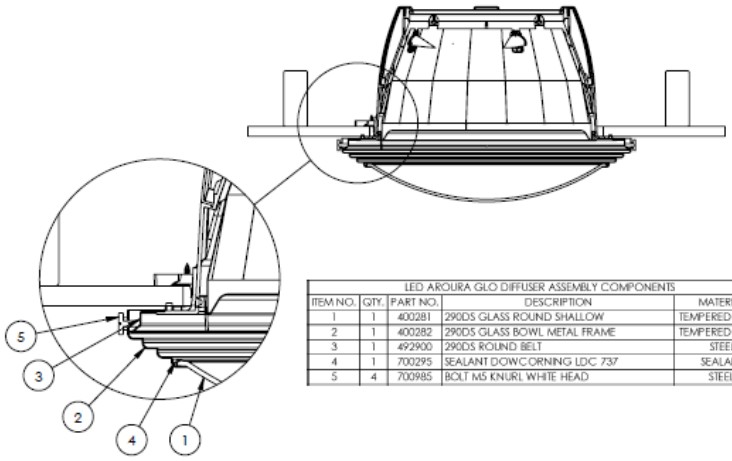
JUST FROST DIFFUSER ASSEMBLY COMPONENTS				
ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	1	410715	DRESS RING WITH GROOVE 290 DS	ACRYLIC
2	1	400220	ACRYLIC JUSTFROST DISK 290 DS	ACRYLIC
3	3	721130	RIVET BARREL 3/16 X 12/32 SS	STAINLESS STEEL
4	1	420610	DRESS RING SEAL 290 DS	PE FOAM

'TIER DROP' DIFFUSER ASSEMBLY



TIER DROP DIFFUSER ASSEMBLY COMPONENTS				
ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	1	410715	DRESS RING WITH GROOVE 290 DS	ACRYLIC
2	1	400250	ACRYLIC BOTTOM DISK 290 DS	ACRYLIC
3	1	400255	ACRYLIC MIDDLE DISK 290 DS	ACRYLIC
4	1	400260	ACRYLIC TOP DISK 290 DS	ACRYLIC
5	3	721250	RIVET BARREL 3/16 X 24/32 SS	STAINLESS STEEL
6	1	420610	DRESS RING SEAL 290 DS	PE FOAM

'AURORA GLO' DIFFUSER ASSEMBLY



LED AROURA GLO DIFFUSER ASSEMBLY COMPONENTS				
ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	1	400281	290DS GLASS ROUND SHALLOW	TEMPERED GLASS
2	1	400282	290DS GLASS BOWL METAL FRAME	TEMPERED GLASS
3	1	492900	290DS ROUND BELT	STEEL
4	1	700295	SEALANT DOWCORNING LDC 737	SEALANT
5	4	700985	BOLT M5 KNURL WHITE HEAD	STEEL

FIGURE 10 – SMART LED DECORATIVE FIXTURES