Solatube® Fire Solutions Guide

Overview

Understanding fire codes and their impact on Solatube Daylighting Systems under various circumstances as well as having a working knowledge of alternative solutions is essential when planning to execute Solatube installation projects. This guide covers building standards related to fires, how those codes restrict the use of Solatube products, and some potential solutions.

Keep in mind, there is not one single issue to evaluate. There are different codes, type of construction, building occupancy, as well as distinct areas of a building structure that must be considered.

This report addresses these areas separately, providing possible solutions (both Solatube as well as third party solutions) when Solatube Daylighting Systems are involved.

Warranty information and technical support of all non-Solatube components will be provided by the product manufacturers. Any questions regarding non-Solatube components listed in this guide should be directed to the manufacturer.

Part No. 951823 v1.1

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Resources / References

Most code sections in this guide have been obtained from the California adaptations
2015 International Building Code (IBC)
2018 International Mechanical Code (IMC)
2019 California Green Building Code (CALGreen)
2015 International Wildland-Urban Interface Code (IWUIC)
2015 International Fire Code (IFC)

These standards are the most recognized governing bodies for building construction. The International Code Council (ICC) is the author of all the "International" Codes. In all cases, the code standards may be either rejected, adopted, or adopted with amendments at the regional and local level by the Authority Having Jurisdiction (AHJ). In all cases, the code standards may be either rejected, adopted, or adopted with amendments at the regional and local level by the AHJ. We recommend that you find out what the AHJ have determined to enforce in the form of regulations and ordinances.

Some solutions referenced in this guide are Solatube products. Others are available from third party sources. Solatube International Inc. has not formally tested third party solutions. These are provided as a reference for potential solutions when fire codes effect your project. **We encourage that you consult with the architect, engineer, building official, fire marshal, or other AHJ when considering third party options. The AHJ will have the final say on what is accepted for each project.**

Disclaimer: At the time of this publication, the third party products listed in this guide were commercially available. Please check with appropriate vendor for current availability and specifications. Contact information for third party vendors is provided at the end of this guide.

Potential Solutions

Roof Assemblies

Solatube International Approved Solutions

The Solatube Dome Edge Protection Band on Plastic a Domed Solatube fulfills the requirements of IBC 2610.2, "Edges of light-transmitting plastic skylights or domes shall be protected by metal or other approved noncombustible material" and thereby meets the exception in IBC 1505.1, "Exception: Skylights and sloped glazing that comply with IBC Chapter 24 or IBC 2610". Thus, regulations permit Solatubes with dome-edge-protection bands on Class A, B, or C roof covering applications without any additional provision.

See also: CCRR 0131 Section 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 or A, B, or C.

160 DS / 290 DS Dome Edge Protection Band

330 DS / 750 DS Dome Edge Protection Band

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In addition, Solatube International tested configurations of Solatube 330 DS and 750 DS according to ASTM E108-07a, indicating the additional assurance that the 11" High Flashing provides. The test was conducted by an ANSI accredited third party laboratory with the Target: Class B (1-hour extended) test . The test report shows that the samples passed the requirements of ASTM E108-07a. The test exceeded the standard by the application of four Burning Brands, which were consumed in the same location in sequence, whereas the standard applies only two Burning Brands at separate locations in sequence. In addition to the prescribed test method, Solatube International specified that the test run for an extended period of 60 min.

The ASTM E108 Standard Test Methods for Fire Tests of Roof Coverings covers the measurement of the relative fire characteristics of roof coverings exposed to simulated fire sources originating outside the building.

In order to qualify for the results achieved in this test, the product configuration must include any of the following:
No other Solatube product configurations were submitted for testing. Other product configurations are not covered by this test report. Please contact your Solatube International representative with any questions.

1. Solatube 330 DS Dome
2. 750 DS Dome
3. 750 DS Dual Dome
4. Solatube 11" High Flashing
5. Solatube Dome Edge Protection Band

Additionally, Solatube International tested configurations of Solatube 330 DS, 750 DS, and M74 DS in accordance with FM (Factory Mutual) 4431 Approval Standard for Skylights. FM 4431 includes a modified version of ASTM E-108, Fire Tests of Roof Coverings. Successful testing was conducted and Solatube was issued compliance certification for Class A roof covering at a 5 in 12 roof pitch.


FM APPROVED

Certificate of Compliance

This certificate is issued for the following:

M74 DS, 330 DS and 750 DS Tubular Daylighting Devices

Prepared for:

Solatube International Inc
2210 Oak Ridge Way
Vista, CA
United States

FM Approvals Class: 4431 (Skylights)

Approval Identification: 3054351 Approval Granted: 4/5/2016

To verify the availability of the Approved product, please refer to www.approvalguide.com

Said Approval is subject to satisfactory field performance, continuing Surveillance Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.

Cynthia Frank
AVP - Manager of Materials
FM Approvals
1151 Boston-Providence Turnpike
Norwood, MA 02062

FM Approvals

Testing conducted on M74 DS at the FM Global Research Campus in Glocester, RI.

Testing conducted on 330 DS (Polycarbonate Dome) at the FM Global Research Campus in Glocester, RI.

Testing conducted on 750 DS with Polycarbonate Inner Dome at the FM Global Research Campus in Glocester, RI.

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Ceiling Finishes

Solatube Solutions

The following meet the provisions of IBC 2606.7.2 and thereby comply with IBC Chapter 8

M74 DS - Acrylic Prismatic Diffuser (CCRR-0193: Diffuser may be used in all occupancies where it is ≤10% of specific ceiling area in which it is attached)

160 DS – Acrylic Just Frost Ceiling Mounted Diffuser (Intertek Test Report: H1674.01-106-16)

290 DS – Acrylic Just Frost Ceiling Mounted Diffuser (Intertek Test Report: H1674.01-106-16)

No other Solatube product configurations were submitted for testing. Other configurations are not covered by these test reports. Please contact your Solatube International representative with any questions.

Ceiling Membrane - Roof/Ceiling Assembly

Potential Solutions

The Ceiling Membrane Penetration must be protected with a shaft constructed from the Ceiling to the Roof Deck or Slab using the same systems used in the Approved Fire-Resistance-Rated Ceiling Assembly. Be careful to tie-in to the Roof and Ceiling according to the method prescribed by the system to meet the performance specified.

Fire-Resistance-Rated Roof-Assembly - Fire Window Assembly

Potential Solutions

In the first case, a shaft must enclose the Solatube TDD and or Skylight from the Ceiling up to the roof deck or slab. The Shaft walls and the ceiling must meet or exceed the fire-resistance-rating of the roof deck or slab. No rating is required at the top of the shaft.

In the second case, the supporting construction (Posts, Columns, Beams, Rafters, Purlins, Interior side of the Deck, etc.) must meet or exceed the fire-resistance-rating of the roof deck or slab.

Dwelling Floor Penetration

Potential Solutions

Penetrations shall be installed as tested in the approved fire-resistance-rated assembly. Encase the Solatube where it transitions through the fire-resistance-rated floor assembly and space above the floor to the roof deck above in an outer shaft matching the fire-resistance-rating of floor assembly.

Fire and Smoke Protection Features

Corridors, Interior Exit Enclosures

Potential Solutions

If is it desirable for a Solatube Daylighting System to penetrate a corridor ceiling consult with the architect, engineer, and or building official to determine which type of corridor construction is involved:

If the corridor fire partitions extend from the top of the floor assembly below to the underside of the floor or roof slab or deck above, the Solatube Daylighting System should be allowed to penetrate the corridor ceiling without additional fire protection.

If the corridor fire partitions extend only from the top of the floor assembly below to the underside of the corridor ceiling above and the ceiling is constructed with the same fire-resistance-rating as required for the corridor walls, it should be permissible for the corridor ceiling to be penetrated by the Solatube Daylighting System if one of the following occurs:

1. An approved fire partition enclosing the Solatube TDD or Skylight extends from the top of the ceiling assembly to the underside of the floor or roof sheathing, slab or deck above.
2. An approved corridor fire/smoke ceiling damper is installed which will close the ceiling penetration in the event of a fire.
3. An approved Fire-rated flexible Insulation blanket enclosing the Solatube TDD or Skylight extends from the top of the ceiling assembly to the underside of the floor or roof sheathing, slab or deck above.

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Potential 3rd Party Solutions

When Listed by UL or others, Corridor Dampers are approved for use where air ducts penetrate or terminate at horizontal openings in the ceilings of fire-resistance-rated corridors, where the corridor ceiling is permitted to be constructed as required for the corridor walls.

IBC 717.5.4.1 Corridors
In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in IBC 1.11 regulated by the Office of the State Fire Marshal, duct and air transfer openings that penetrate corridors shall be protected with dampers as follows: A corridor damper shall be provided where corridor ceilings, constructed as required for the corridor walls as permitted in IBC 708.4, Exception 3, are penetrated.

> Exception 3: Fire partitions serving as a corridor wall shall be permitted to terminate at the upper membrane of the corridor ceiling assembly where the corridor ceiling is constructed as required for the corridor wall.

IBC 717.3.2.4 Corridor Damper Ratings
Corridor dampers shall have the following minimum ratings:
One hour fire-resistance rating.
Class I or II leakage rating as specified in IBC 717.3.2.2.

IBC 717.3.1 Damper testing
Corridor dampers shall comply with requirements of both UL 555 and UL 555S. Corridor dampers shall demonstrate acceptable closure performance when subjected to 150 feet per minute (0.76 mps) velocity across the face of the damper during the UL 555 fire exposure test.

Theoretically, Corridor Dampers may also be used with Solatube TDD to maintain the fire-resistive ratings of the Corridor Ceiling in the event of a fire. However, their use is not practical with Solatube TDD because the closure mechanism (in the open condition) would significantly block light transmission.

Fire-rated flexible Insulation blanket composed of high temperature fibers classified as a component in firestop designs for fire resistance rated floors, ceilings, and walls. A Fire-rated flexible Insulation wrap with fire rated sealant may be used to provide a fire-rated enclosure for the Solatube TDD. The material supplier may be able to provide an Engineering Judgement for specific projects. Consult with the material supplier and the building official, architect, or other AHJ on the project to confirm application suitability before proceeding.
3M™ Fire Barrier Duct Wrap 615+
3M Fire Barrier Sealant CP 25WB+
FyreWrap® Elite® 1.5

Air Plenum Penetrations

Potential 3rd Party Solutions
Fire blanket (Plenum Wrap) solutions have been approved in several applications. A method of attachment for fire blankets is necessary. Appropriate attachment needs to be discussed with the blanket manufacturer and the Authority Having Jurisdiction (AHJ) for each application.
Morgan Advanced Material - Thermal Ceramics
FireMaster® PlenumWrap™ Plastic Pipe System PlenumWrap®+
Intertek Listing No. 28346
Intertek Drawing Design Number: TC_FRD 120-19 (OPL PP 108 P)

3M™
Fire Barrier Plenum Wrap 5A+
Technical Data Sheet 5A+ Data Sheet
Intertek Listing No: Spec ID 26265
Intertek Drawing Design Number 3MU/FRD 120-16I
Intertek Certificate of Compliance - 3M Fire Barrier Plenum Wrap 5A+

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Unifrax
Plenum Wrap FyreWrap® 0.5 Plenum Insulation
High temperature insulation blanket designed to provide single layer, flexible enclosure around combustible items located within fire-rated return air plenums.
Intertek Listing No: Spec ID: 32959
Intertek Drawing Design Number UNI/BI 20-03

International Wildland-Urban Interface Code

Solatube International Solutions

To meet requirements of the Wildland-Urban Interface (WUI) Code for roof coverings and requirements of IBC 708A.2.1:

Exterior windows, skylights and exterior glazed door assemblies shall comply with one of the following requirements:

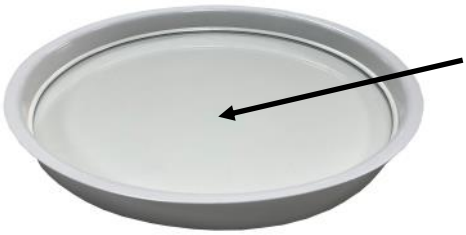
1. Be constructed of multipane glazing with a minimum of one tempered pane meeting the requirements of Section 2406 Safety Glazing, or
2. Be constructed of glass block units, or
3. Have a fire-resistance rating of not less than 20 minutes when tested according to NFPA 257, or
4. Be tested to meet the performance requirements of SFM Standard 12-7A-2

The Solatube Rooftop Fire Glazing meets the prescriptive method of Option 1 of IBC 708A.2.1 when used in conjunction with the Solatube Dome Edge Protection Band.

The CalFire Office of the California State Fire Marshal (SFM) has approved certain inspection agencies that are required to approve products for use in the (WUI) areas. Approved products are published in the SFM Building Materials Listing Program (BML).

The SFM states: If meeting prescriptive requirements of IWUIC 101.2 and IBC 708A.2.1 , it is not necessary to list products on the SFM Building Listing Program. It is ultimately up to Local Jurisdiction to accept listed or non-listed solutions.

Solatube International has reviewed in length the Solatube WUI solution with the SFM and Cal Fire. (Please note that this does not constitute SFM or Cal Fire acceptance.)
If the Local Official needs assistance please contact Cal Fire or your Office of the State Fire Marshal as they can step you them through the prescriptive process.



160 / 290 / 300 DS
Rooftop Fire Glazing

330 / 750 DS
Rooftop Fire Glazing

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Fire Code Review & Potential Solutions

Healthcare Facilities

Introduction

Fire regulations for installations of Solatube TDD & Skylights in Health Care Facilities are administered by the Authority Having Jurisdiction (AHJ). Determinations based on published Codes & Regulations.
The National Fire Protection Association (NFPA) 101 Life Safety Code (LSC) & NFPA 99 Health Care Facilities Code (HCFC) have special relevance; the Centers for Medicare & Medicaid Services (CMS) stipulate that basic fire & life safety qualification for facilities participating in Medicare & Medicaid programs depends upon compliance with LSC & HCFC.

The following is a list of suggested solutions, when Solatube TDDs are used in healthcare facilities, to meet compliance requirements. Note: For full details of each building type and damper type, see information in attached appendix.

Ceiling Protection for Structural Members

Primary Structural Members supporting ≥2 floors, ≥1 floor & roof, or load, or non-load-bearing wall ≥2 stories high, must be protected by Individual Encasement (IBC 704.3) (NFPA 220 5.1.4). If less, may be protected at ceiling (IBC 711.2.3) (NFPA 220 5.1.5). Secondary Members must be protected by individual encasement. (IBC 704.4). If TDD/Skylight penetrates ceiling, and ceiling provides Fire Resistance for Structural Member, penetration must be protected by Through-Penetration Firestop System (IBC 714.5.1.2)
TDD Solution for Ceiling Penetrations: Fire Damper

Horizontal Assemblies

If TDD/Skylight penetrates ceiling, and ceiling provides *Fire Resistance or Smoke* protection for a Horizontal Assembly, penetration must be protected. (IBC 714.5) (NFPA 101 8.3.4)
TDD Solution for Ceiling Penetration: Pending requirement, select either Smoke, Fire, or Combination Smoke/Fire Damper. Specify Leak Class for Smoke or Combination Smoke/Fire Damper (See appendix for leak class).

Smoke Barrier

Smoke Barriers (Continuous membrane separating smoke compartments; outside wall to outside wall, barrier to barrier, & floor slab to roof, including above suspended ceilings) must subdivide every story used by persons receiving care, treatment or sleeping into ≥two smoke compartments. Barriers must subdivide other stories with occupant load ≥50 into ≥two smoke compartments (IBC 407.5). Per (IBC 709): *A 1-Hour fire-resistance rating is required for smoke barriers* (IBC 709.3).
TDD Solution: Combination Fire/Smoke Damper. Specify Leak Class (See appendix for leak class).

Smoke Partition

Smoke Partitions (IBC 710) must resist passage of smoke. Unless required elsewhere in the code, smoke partitions are not required to have a *fire-resistance rating* (IBC 710.3). *Smoke partitions* are permitted to extend no further than floor to ceiling if ceiling resists passage of smoke (IBC 710.4).
TDD Solution: Smoke Damper. Specify Leak Class per UL 5555S (See appendix for leak class).

Corridors

If hall ceiling is penetrated, determine whether it is part of Corridor (enclosed exit access providing egress). Corridors must have Fire Partitions (IBC 708) & Smoke Partitions, (from floor/ceiling to roof assy.) (IBC 708.4) (IBC 709.4)

Every aisle, passageway, corridor, exit discharge, exit location, and access must be in accordance with Means of Egress Separate from other parts of building, min 1-hr rating NFPA 101 (7.1.3.1). Fire barriers may be continuous from the floor to the bottom of the Ceiling provided the construction material forming the bottom of the (Ceiling) has fire rating ≥fire barrier NFPA 101 (8.3.1.2).
TDD Solution, Corridor Damper.

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Appendix

Solatube Solutions

1. TDD Roof Openings
2. Dampers - TDD Penetrations of Fire Resistance Rated Ceiling or Roof Ceiling Assemblies
3. Chases - TDD Penetrations of Fire Resistance Rated Ceiling or Roof Ceiling Assemblies

TDD Penetrations of Fire Resistance Rated Ceiling

Smoke Damper

Listed device by Leak Class: Resists smoke passage. Auto-control (smoke detection) & if required Fire Command Center control. Primary function: Smoke Dampers sense smoke electrically, thus always actuated. Smoke Dampers (IBC Chapter 9). No heat-response limit or fire resistance (may be aluminum). Controlled by smoke detection system, & where required, capable of being operated from FSCS which has override switch & status indicator lights to display damper's open or closed position.

Underwriters Laboratories Standard UL555S Leakage Classifications Table 1:				
Leakage Classification	**Leakage, cfm/sq-ft at Standard Air Conditions**			**Temperature Categories**
	4.5 in. wg.	8.5 in. wg.	12.5 in. wg.	
I	8	11	14	250°F, 350°F
II	20	28	35	250°F, 350°F
III	80	112	140	250°F, 350°F

There are >100 UL Listed Damper Mfg. Search at UL Product iQ (EMME Category) Mfg. & Model w/spec performance. Please note that any damper may need adaptation. If adaption is necessary, obtain vendor approval.

Fire Damper

Listed device installed in ducts & air transfer openings designed to close on heat detection & resist flame passage. Class for static system (shut in event of fire), or dynamic system (operate during fire). Does not restrict radiant heat & smoke. Close at (165°F).
Types:

1. Vertical curtain fire dampers. Gravity pulls the blades closed when link melts.
2. Horizontal curtain fire dampers. Spring-loaded to pull the curtain blades closed when link melts.
3. Vertical or horizontal Dynamic Fire Dampers. Close against air pressure as fan may still be on.
4. Single or multi-blade fire dampers. Horizontal or vertical. Heavier duty than curtain dampers.

EST 1% of large multi-section Fire Dampers use actuator to drive open & spring to close. (IBC Chapter 7).

Combination Smoke/Fire Damper

Listed device: Closes automatically on detection of heat & resists flame/smoke passage & maintains compartmentation. Controlled by smoke detection system, & where required, capable of being operated from Firefighter's Smoke Control Station (FSCS). Primary function: Fire Dampers only have mechanical method of sensing heat, however Smoke Dampers sense smoke electrically, thus always actuated. Smoke Dampers (IBC Chapter 9) are connected to FSCS panel while Fire Dampers (IBC Chapter 7) are not. FSCS has override switch & status indicator lights to display damper's open or closed position.
There are >100 UL Listed Damper Mfg. Search at UL Product iQ (EMME Category) Mfg. & Model w/spec performance. Please note that any damper may need adaptation. If adaption is necessary, obtain vendor approval.

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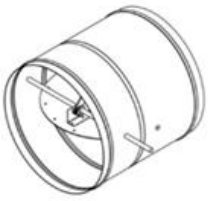
Corridor Damper

Listed device: Where duct terminates at Fire-Rated Corridor ceiling constructed as Corridor walls. Fire & Smoke Damper tested horizontally at low speed; & sleeved for ceiling install (IBC Chapter 7).
There are >100 UL Listed Damper Mfg. Search at UL Product iQ (EMME Category) Mfg. & Model w/spec performance. Please note that any damper may need adaptation. If adaption is necessary, obtain vendor approval.

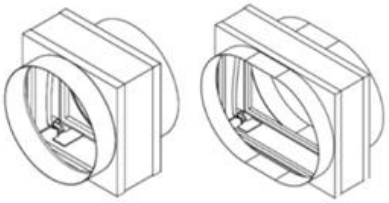
Ceiling Radiation Damper

Listed device installed in ceiling membrane of fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit radiative heat transfer through occupied spaces & ceiling-roof voids. Not tested to restrict Smoke & flames. Fusible link closes Damper (at 165°F). Blades close to seal opening (IBC Chapter 7).

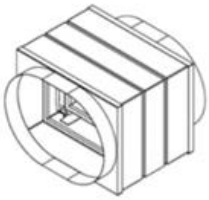
Damper Styles



Round Blade



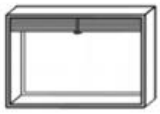
Butterfly Style



Round and Oval Duct Connections

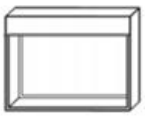
Curtain Style - interlocking blades.

- **A-type** - blades and frames IN the airstream.
  - Low velocity/pressure systems.
- **B-type** - blades OUT of the airstream.
  - Medium velocity/pressure systems.
- **C-type** - blades and frames OUT of airstream.
  - High velocity/pressure systems.



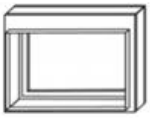
Frame and Blades in airstream

A-type



Blades out of airstream

B-type



Frame and Blades out of airstream

C-type

Institutions & Associations

Facility Guidelines Institute (FGI)

Keystone to health care planning, design, & construction. Pertinent highlights:

1. Illuminating Engineering Society (IES) & Facility Guidelines Institute (FGI) Memorandum of understanding enabling collaboration on consensus-based guidelines & publications.
2. American Telemedicine Association Lighting is underappreciated in telemedicine encounters
3. Designing End-of-Life Care to Enhance Quality of Life, Daylight preferred over electric light
4. Common Mistakes in Designing Psychiatric Hospitals: Replace 2ft x 4ft fluorescent w/round or oval vandal-resistant fixture; improve safety & character of facility.
5. Behavioral Health Design Guide: FGI Guidelines contain window test reference: Design to limit opportunity for patients (to) break windows & inflict harm. Glazing in patient-accessible areas: Window Systems Psych Applications - Resist Human Impact (AAMA 501.8) Class 1.4 (ASTM F1233)

3M Fire Protection Products
Fire Barrier Duct Wrap 615+, Fire Barrier Wrap 15A+, Fire Barrier Sealant 25WB+
www.mmm.com

Morgan Advanced Material - Thermal Ceramics
FireMaster® PlenumWrap™ Plastic Pipe System
http://www.morganthermalceramics.com

Unifrax
FyreWrap Elite 1.5 Duct Insulation—Air Distribution System
www.unifrax.com

USG Sheetrock
Sheetrock Brand Firecode Core Gypsum Panels
www.usg.com

Contact Information

CertainTeed Drywall
CertainTeed Type X Gypsum Board
https://www.certainteed.com/drywall

CAL FIRE
www.fire.ca.gov

Office of the State Fire Marshal
CAL FIRE
www.osfm.fire.ca.gov