

\*\*\*\*\*  
USACE / NAVFAC / AFCEC / NASA UFGS-08 60 45 (February 2012)  
-----  
Preparing Activity: USACE Superseding  
UFGS-08 62 00 (August 2009)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2015

\*\*\*\*\*

SECTION TABLE OF CONTENTS

DIVISION 08 - OPENINGS

SECTION 08 60 45

[SKYLIGHTS][ AND ][TRANSLUCENT PANELS]

02/12

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 DELIVERY, STORAGE, AND HANDLING
- 1.6 WARRANTY

PART 2 PRODUCTS

- 2.1 [SKYLIGHTS][ AND ][TRANSLUCENT PANELS]
- 2.2 GLASS-FIBER PANELS
  - 2.2.1 Weatherability
  - 2.2.2 Non Combustible Grid Core
  - 2.2.3 Adhesive
  - 2.2.4 Panel Construction
- 2.3 THERMOPLASTIC POLYCARBONATE PANELS
- 2.4 COMMON PANEL REQUIREMENTS
  - 2.4.1 Appearance
  - 2.4.2 Panel Fabrication
  - 2.4.3 Thermal Performance
  - 2.4.4 Condensation Index Rating
- 2.5 [SKYLIGHT][ AND ][TRANSLUCENT PANEL] SYSTEMS
  - 2.5.1 Glass Glazed Skylights and Roof Windows
    - 2.5.1.1 Fixed Skylight
    - 2.5.1.2 Emergency Escape and Rescue Roof Window
    - 2.5.1.3 Balcony Roof Window Featuring Dual-Sash Operation
  - 2.5.2 [Plastic Glazed Unit Skylight][ and ][Translucent Panels]
    - 2.5.2.1 Dome
    - 2.5.2.2 Pyramid
    - 2.5.2.3 Vault
  - 2.5.3 [Framed Skylights][ and ][Translucent Panels]
- 2.6 FLEXIBLE SEALING TAPE

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 ERECTION

-- End of Section Table of Contents --

\*\*\*\*\*  
USACE / NAVFAC / AFCEC / NASA UFGS-08 60 45 (February 2012)  
-----  
Preparing Activity: USACE Superseding  
UFGS-08 62 00 (August 2009)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2015

\*\*\*\*\*

### SECTION 08 60 45

[SKYLIGHTS][ AND ][TRANSLUCENT PANELS]  
02/12

\*\*\*\*\*

NOTE: This guide specification covers the requirements for skylights and translucent panels manufactured from glass-fiber or thermoplastic polycarbonate.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

\*\*\*\*\*

## PART 1 GENERAL

### 1.1 SUMMARY

Provide commercially available [roof windows] [unit skylights [flat glass] [domed] [pyramidal] [vaulted]] [metal or wood framed skylights] which satisfy all requirements contained in this section and have been verified by load testing and independent design analyses (if required) to meet specified design requirements. Provide environmentally preferable products and work practices, applicable to skylights, considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and/or disposal of the products or services used in the skylights. The skylight system shall be UV-stabilized, shatter proof and energy efficient. The plastics used in the manufacture of the skylights shall be light transmitting plastics for daylighting applications. Systems shall meet requirements of UFC 4-010-01.

## 1.2 REFERENCES

\*\*\*\*\*

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

\*\*\*\*\*

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

### ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

### AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2603 (2002) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2604 (2010) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AAMA 2605 (2011) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

AAMA 611 (1998; R 2004) Voluntary Specification for Anodized Architectural Aluminum

AAMA/WDMA/CSA 101/I.S.2/A440 (2011) Standard/Specification for Windows, Doors, and Skylights

### ASTM INTERNATIONAL (ASTM)

ASTM C297/C297M (2004; R 2010) Flatwise Tensile Strength of Sandwich Constructions

ASTM D1002	(2010) Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
ASTM D1003	(2013) Haze and Luminous Transmittance of Transparent Plastics
ASTM D1037	(2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D1929	(2014) Standard Test Method for Determining Ignition Temperature of Plastics
ASTM D2244	(2015) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2843	(2010) Density of Smoke from the Burning or Decomposition of Plastics
ASTM D3841	(1997; E 2008; R 2008) Standard Specification for Glass Fiber-Reinforced Polyester Plastic Panels
ASTM D572	(2004; R 2010) Rubber Deterioration by Heat and Oxygen
ASTM D635	(2014) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E108	(2011) Fire Tests of Roof Coverings
ASTM E283	(2004; R 2012) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330/E330M	(2014) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E661	(2003; R 2009) Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads
ASTM E695	(2003; R 2009) Measuring Relative Resistance of Wall, Floor, and Roof

Construction to Impact Loading

ASTM E72 (2014a) Conducting Strength Tests of  
Panels for Building Construction

ASTM E84 (2014) Standard Test Method for Surface  
Burning Characteristics of Building  
Materials

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC04 (2012) Acceptance Criteria for Sandwich  
Panels

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2012) International Building Code

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (2014) Procedure for Determining  
Fenestration Product U-Factors

NFRC 200 (2014) Procedure for Determining  
Fenestration Product Solar Heat Gain  
Coefficient and Visible Transmittance at  
Normal Incidence

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01 (2012) DoD Minimum Antiterrorism Standards  
for Buildings

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.23 Guarding Floor and Wall Openings and Holes

UNDERWRITERS LABORATORIES (UL)

UL 972 (2006; Reprint Jul 2011) Standard for  
Burglary Resisting Glazing Material Type

1.3 SUBMITTALS

\*\*\*\*\*

**NOTE: Review submittal description (SD) definitions  
in Section 01 33 00 SUBMITTAL PROCEDURES and edit  
the following list to reflect only the submittals  
required for the project.**

**The Guide Specification technical editors have  
designated those items that require Government  
approval, due to their complexity or criticality,  
with a "G." Generally, other submittal items can be  
reviewed by the Contractor's Quality Control  
System. Only add a "G" to an item, if the submittal  
is sufficiently important or complex in context of  
the project.**

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

\*\*\*\*\*

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G[, [\_\_\_\_\_]]

SD-03 Product Data

[SKYLIGHTS][ AND ][TRANSLUCENT PANELS]; G[, [\_\_\_\_\_]]  
Warranty

SD-06 Test Reports

Test Reports

SD-07 Certificates

Systems  
Qualifications

1.4 QUALITY ASSURANCE

- a. Provide documentation of Qualifications for the following: The manufacturer shall be a company specializing in the manufacture of the specified products with a minimum of [5] [10] years documented experience. The installer shall have documented experience of [5] [\_\_\_\_\_] years minimum performing the work specified.

- b. Before fabrication, provide a full service mock-up of [each type of skylight] [one skylight unit] [\_\_\_\_\_] complete with glass and AAMA certification label for structural purposes and NFRC temporary and Permanent Label for certification of thermal performance rating for review of skylight construction and quality of hardware operation. Glass and glazing shall conform to the applicable requirements of Section 08 81 00 GLAZING.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

System modules shall be factory assembled to the greatest extent possible. Panels shall be shipped to the jobsite in rugged shipping units and shall be ready for erection. All skylights shall have conspicuous decals affixed warning individuals against sitting or stepping on the units. Skylight panels shall be stored on the long edge, several mm inches above the ground, blocked and under cover to prevent warping. Deliver unit skylights in manufacturer's original containers, dry, undamaged, with seals and labels intact. All products shall be delivered, stored and protected in accordance with manufacturer's recommendations.

#### 1.6 WARRANTY

Provide to the Government the manufacturer's complete warranty for materials, workmanship, and installation. The warranty shall be for [5] [\_\_\_\_\_] years from the time of project completion and shall not be prorated. The warranty shall guarantee, but shall not be limited to, the following:

- a. [Light transmission and color of the panels shall not change after exposure to heat of 149 degrees C 300 degrees F for 25 minutes. ][In accordance with ASTM D2244, panels shall not darken more than 3.0 Delta E units after 5 years of outdoor weathering in South Florida at 45 degrees facing south. Document compliance with this requirement in submitted Test Reports.]
- b. There is no delamination of the panel affecting appearance, performance, weatherability or structural integrity of the panels or the completed system.
- c. There is no fiberbloom on the panel face.
- d. Change in light transmission of no more than 6 percent in accordance with ASTM D1003, and in color (yellowing index) no more than 10 points in comparison to the original specified value over a 10 year period.
- e. Provide a single source warranty for the glazing panels and the framing system. Third party warranty for the glazing panels will not be accepted.

### PART 2 PRODUCTS

#### 2.1 [SKYLIGHTS][ AND ][TRANSLUCENT PANELS]

\*\*\*\*\*

**NOTE: A polyvinyl fluoride film coating may be specified for the exterior surface of skylight panels when longer wearability is considered necessary. For fire rated construction, panels with fire ratings consistent with the overall**



construction of the building should be specified.  
Retain appropriate bracketed statements and  
corresponding paragraphs below and delete the others.

The designer must consider the differences and  
performance characteristics of the two materials:  
glass-fiber reinforced polyester and extruded  
cellular thermoplastic polycarbonate before making  
the selection to meet specific project requirements.

\*\*\*\*\*

Skylight panels shall be fabricated of [glass-fiber reinforced polyester]  
[or] [extruded cellular thermoplastic polycarbonate] panels conforming to  
the specified requirements and other appropriate lab test specified  
criteria, weighing not less than 2.4 kg/square meter 8 ounces/square foot.  
Submit certified Test Reports from independent testing laboratory for each  
type and class of panel system. Reports shall verify that the material  
meets specified performance requirements. Previously completed test  
reports will be acceptable if they are current and indicative of products  
used on this project. Where a Class A, B or C roof is part of the project,  
a listing certificate for roof covering systems category shall be provided  
certifying that the product complies with the safety standards of ASTM E108  
and ICC IBC. Size and color of skylight panels shall be as indicated.

## 2.2 GLASS-FIBER PANELS

Glass-fiber reinforced polyester panels shall conform to ASTM D3841, Class  
[\_\_\_\_\_] and to the requirements of AAMA/WDMA/CSA 101/I.S.2/A440.

### 2.2.1 Weatherability

The exposed faces of fiberglass sandwich type panels shall have a permanent  
glass veil erosion barrier embedded integrally to provide maximum long term  
resistance to reinforcing fiber exposure. The exterior face sheet shall be  
uniform in strength and be resistant to penetration by pencil point.

### 2.2.2 Non Combustible Grid Core

The aluminum I-beams shall be 6063-T6 with provisions for mechanical  
interlocking of muntin-mullion and perimeter to prevent high and low  
intersections which do not allow full bonding surface to contact with face  
material. Width of I-beam shall be no less than 11 mm 7/16 inch. I-beam  
grid shall be machined to tolerances of not greater than plus or minus 0.05  
mm 0.002 inch for flat panels. Panels shall withstand 650 degrees C 1200  
degrees F fire for a minimum of one hour without collapse or exterior  
flaming.

### 2.2.3 Adhesive

The laminate adhesive shall be heat and pressure resin-type engineered for  
structural sandwich panel use. Adhesive shall pass testing requirements  
specified by the International Conference of Building Officials'  
"Acceptance Criteria for Sandwich Panel Adhesive". Minimum strength shall  
be:

- a. Tensile Strength of 5.2 MPa 750 psi in accordance with ASTM C297/C297M  
after two exposures to six cycles each of the aging conditions  
prescribed in ASTM D1037.

- b. Shear Strength, after exposure to five separate aging conditions in accordance with ASTM D1002, shall be:
- (1) 3.7 MPa 540 psi at 50 percent relative humidity and 23 degrees C 73 degrees F.
  - (2) 5.5 MPa 800 psi under accelerated aging in accordance with ASTM D1037 at room temperature.
  - (3) 1.7 MPa 250 psi under accelerated aging in accordance with ASTM D1037 at 83 degrees C 182 degrees F.
  - (4) 9.7 MPa 1400 psi after 500 hour Oxygen Bomb in accordance with ASTM D572.
  - (5) 690 kPa 100 psi at 83 degrees C 182 degrees F.

#### 2.2.4 Panel Construction

Provide panels consisting of fiberglass faces laminated to an aluminum I-beam grid core and deflecting no more than 48 mm 1.9 inches at 147 kg per square meter in 3 m 30 psf in 10 feet in accordance with ASTM E72, without a supporting frame. Quality control inspections and required testing, conducted at least once each year, shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with ICC-ES AC04 or equivalent.

#### 2.3 THERMOPLASTIC POLYCARBONATE PANELS

The system shall be manufactured from translucent polycarbonate panels designed for architectural applications. Provide panels consisting of a polycarbonate resin with a permanent, co-extruded, ultra-violet protective layer; this layer shall be co-extruded by the manufacturer during the original extrusion of the panel and shall be a permanent part of the exterior and interior layers. Pot-applied coatings or films of dissimilar materials are unacceptable. Panel width shall not exceed 600 mm 2 feet to ensure best performance for wind uplift, vibration, oil canning and visual appearance. The following manufacturing requirements shall be met:

- a. Extruded in one single formable length. Transverse sections are unacceptable. The panels shall be manufactured with upstands which are integral to the unit, and the upstands shall be 90 degrees to the panel face (standing seam dryglazed concept). Welding or gluing of upstands or standing seam is unacceptable.
- b. Mullions shall be dry glazed profiles, using no sealant, welding, adhesives or gaskets; mullions shall be thermally broken and continuous for panel length.
- c. For structural performance, the use of adhesives, plastic or sonic welding or sealant is not allowed.
- d. For longevity, the minimum ratio of panel weight to thickness shall be [ 2.44 kg/m<sup>2</sup> for 10 mm 0.5 psf for 0.4 inch] [3.3 kg/m<sup>2</sup> for 16 mm 0.68 psf for 0.63 inch] [4.4 kg/m<sup>2</sup> for 55, 75, and 100 mm double glazed 0.91 psf for 2.2, 3, and 4 inch double glazed] thick panel.
- e. Extruded panel includes integral extruded multi-cells, and truss-like structural core for resistance to buckling. The panel's exterior skins

shall be interconnected and spaced apart by supporting ribs, perpendicular to the skins, at a spacing not to exceed 4 mm 0.16 inches (truss-like construction). In addition, the space between the two exterior skins in a cross section shall be divided by multiple parallel intermediate surfaces, at a spacing not to exceed 4 mm 0.16 inches.

- f. Interior flame spread classification shall be Class [I] [II] in accordance with ASTM E84.
- g. Smoke density no greater than 70 in accordance with ASTM D2843.
- h. The exterior and interior faces shall be an approved light transmitting panel with a CCl fire rating classification in accordance with ASTM D635.
- i. Self-ignition greater than 570 degrees C 1058 degrees F in accordance with ASTM D1929.
- j. Fire rated roof assembly translucent panels shall be successfully evaluated for fire from exterior exposure per [ASTM E108] [\_\_\_\_\_] to meet Class [A] [B] [C] rating. The panel shall be listed by an independent recognized listing laboratory.

## 2.4 COMMON PANEL REQUIREMENTS

### 2.4.1 Appearance

The face sheets shall be uniform in color to prevent splotchy appearance. Faces shall be completely free of ridges and wrinkles which prevent proper surface contact. Clusters of air bubbles/pinholes which collect moisture and dirt are not acceptable.

### 2.4.2 Panel Fabrication

Panel construction shall meet the following requirements:

- a. Light transmission [\_\_\_\_\_] percent; color [\_\_\_\_\_].
- b. Assembled panel thickness [\_\_\_\_\_] mm inches.
- c. Grid size shall be [\_\_\_\_\_] [as indicated].

### 2.4.3 Thermal Performance

\*\*\*\*\*

**NOTE:** Skylight properties are critical to energy performance and comfort. Specify low U value (rate of heat transfer) to reduce winter heat loss and low solar heat gain coefficient to reduce summer solar heat gain.

Energy Star labeling is applicable to residential units only. For nonresidential applications, designer shall input SHGC and U values based on ASHRAE 90.1, using either prescriptive envelope option or energy performance modeling as applicable to project design. Coordinate with Section 08 81 00 GLAZING. Designer must verify availability and adequate competition for products meeting bracketed energy performance requirements before specifying

and edit as needed.

\*\*\*\*\*

Non-residential skylights (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-unit Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_\_] determined according to NFRC 200 procedures and a U-factor maximum of [\_\_\_\_\_] W/m<sup>2</sup>-KBtu/hr-ft<sup>2</sup>-F in accordance with NFRC 100. Residential skylights (including frames and glass) shall be Energy Star qualified products as appropriate to [Northern][North/Central][South/Central][Southern] climate zone. To meet Energy Star criteria for the [Southern climate zone, thermal properties of windows shall not exceed a U-factor of 4.0 W/m<sup>2</sup>-K 0.70 Btu/hr-ft<sup>2</sup>-F determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 0.30 determined according to NFRC 200.][ South-Central climate zone, thermal properties of windows shall not exceed a U-factor of 3.2 W/m<sup>2</sup>-K 0.57 Btu/hr-ft<sup>2</sup>-F determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 0.30 determined according to NFRC 200.][ North-Central climate zone, thermal properties of windows shall not exceed a U-factor of 3.1 W/m<sup>2</sup>-K 0.55 Btu/hr-ft<sup>2</sup>-F determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 0.40 determined according to NFRC 200.][ Northern climate zone, thermal properties of windows must not exceed a U-factor of 3.1 W/m<sup>2</sup>-K 0.55 Btu/hr-ft<sup>2</sup>-F determined according to NFRC 100.]

#### 2.4.4 Condensation Index Rating

\*\*\*\*\*

NOTE: Determination of the resistance of the skylight unit to the formation of condensation in any form, referred to as the Condensation Index, should be accomplished using the NFRC approved software tool THERM. Refer to paragraph Condensation Index Rating in Section 08 52 00 WOOD WINDOWS for examples and guidance.

\*\*\*\*\*

The condensation index rating shall be [\_\_\_\_\_] as determined using National Fenestration Rating Council approved software THERM.

#### 2.5 [SKYLIGHT][ AND ][TRANSLUCENT PANEL] SYSTEMS

\*\*\*\*\*

NOTE: A wide variety of skylight configurations, features, fastening systems, and accessories is commercially available. Unique details of the roof system, which could affect the skylight installation, will be shown on the contract drawings. It is not possible to indicate all possible combinations and selections which may be utilized in adapting this guide specification to a particular project; therefore, careful editing is necessary to assure that the project is properly and adequately specified.

Since the skylight becomes an integral element of the roofing system after installation, it must meet or exceed the roof requirements for fire protection, insulation value, energy efficiency rating, thermal performance, air infiltration, and water penetration.

\*\*\*\*\*

Submit manufacturer's certificate that the systems meet or exceed specified requirements. Systems shall be evaluated and listed (the whole [skylight][ and ][translucent panel] as a unit, not just a glazing material in the unit) by the recognized building code authorities: ICC and SBCCI-Public Safety Testing and Evaluation Services Inc. Product ratings determined using NFRC 100 and NFRC 200 shall be authorized for certification and properly labeled by the manufacturer. Provide [skylight][ and ][translucent panel] systems meeting the following requirements:

- a. Integral perimeter framing system assembly shall be by the manufacturer.
- b. Exterior panel faces shall be [crystal] [clear matte] [white] [\_\_\_\_\_] in color. Interior panel faces shall be [crystal] [clear matte] [white] [\_\_\_\_\_] in color.
- c. Air infiltration at 75 Pa 1.57 psf shall be less than [0.2] [\_\_\_\_\_] L/s/m<sup>2</sup> [0.04] [\_\_\_\_\_] cfm/ft<sup>2</sup> and at 300 Pa 6.24 psf shall be less than [0.36][0.5] [\_\_\_\_\_] L/s/m<sup>2</sup> [0.07][0.1] [\_\_\_\_\_] cfm/ft<sup>2</sup> in accordance with ASTM E283.
- d. Water penetration at test pressure of 718 Pa 15 psf shall be zero in accordance with ASTM E331.
- e. Manufacturer shall be responsible for maximum system deflection, in accordance with the applicable building code, and without damage to system performance. Deflection shall be calculated in accordance with engineering principles.
- f. Proper weepage elements shall be incorporated within the perimeter framework of the glazing system for drainage of any condensation or water penetration.
- g. System shall accommodate movement within the system; movement between the system and perimeter framing components; dynamic loading and release of loads; and deflection of supporting members. This shall be achieved without damage to system or components, deterioration of weather seals and fenestration properties specified.
- h. The exterior panel face shall repel an impact of[ 68 N-m 50 foot-pounds without fracture or tear when impacted by a 83 mm diameter, 2.3 kg 3.25 inch diameter, 5 pound free falling ball dropped from a vertical distance of 3 m 10 feet][ 271 N-m 200 foot-pounds without fracture or tear when impacted by a 83 mm diameter, 2.3 kg 3.25 inch diameter, 5 pound free falling ball dropped from a vertical distance of 12 m 40 feet ] when tested in accordance with UL 972.
- i. System shall meet the fall through requirements of 29 CFR 1910.23 as demonstrated by testing in accordance with ASTM E661 or ASTM E695, thereby not requiring supplemental screens or railings.
- j. Exposed aluminum color shall be [a [\_\_\_\_\_] shade] selected from the manufacturer's standard range. Corrosion resistant finish shall be [oven dried Kynar 500, [50 percent fluoropolymer, two coat high-performance organic finish in accordance with AAMA 2604][70 percent fluoropolymer, two coat superior-performance organic finish in accordance with AAMA 2605]] [baked-on enamel coating in accordance with AAMA 2603 with a total dry film thickness not less than 20 µm 0.8 mil]

[[high-performance organic finish in accordance with AAMA 2604  
][superior-performance organic finish in accordance with AAMA 2605]  
with total dry film thickness of not less than 30  $\mu\text{m}$  1.2 mils][anodized  
finish complying with AA DAF45 and AAMA 611 must be [Architectural  
Class II (10  $\mu\text{m}$  to 18  $\mu\text{m}$  0.4 mil to 0.7 mil), designation  
AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34,  
electrolytically deposited color]][Architectural Class I (18  $\mu\text{m}$  0.7 mil  
or thicker), designation AA-M10-C22-[A41, clear (natural)] [A42,  
integral color] [A44, electrolytically deposited color] anodized.]].

k. The system shall require no scheduled recoating to maintain its performance or for UV resistance.

l. Design criteria shall be:

(1) Wind Load [\_\_\_\_]; snow load [\_\_\_\_].

(2) Frame Blast Loads: Framing shall be designed to resist 2.4 kPa  
50 pounds per square foot blast load at L/160 deflection.

(3) Anchor Blast Loads: Anchors shall be designed to resist 4.8 kPa  
100 pounds per square foot blast load.

m. Extruded aluminum shall be 6063-T6 and 6063-T5; all fasteners shall be stainless steel or cadmium plated steel.

#### 2.5.1 Glass Glazed Skylights and Roof Windows

Roof windows shall withstand dead and live loads caused by pressure and uplift of wind acting normal to the plane of roof and tested by an ICC listed, independent testing and quality control inspection agency to an allowable downward pressure of [0.57-8.71] [\_\_\_\_] MPa [12-182] [\_\_\_\_] psf and an uplift pressure of [1.05-5.03] [\_\_\_\_] MPa [22-105] [\_\_\_\_] psf measured in accordance with ASTM E330/E330M, as recommended by the manufacturer for the type of window tested. Roof window shall be of the following type:

##### 2.5.1.1 Fixed Skylight

Fixed skylight featuring a select wood frame, mortise and tenon joints, gaskets to drain any condensation to the outside, a choice of tempered clear, laminated, insulated daylight area. The protective exterior cladding shall be [aluminum] [copper] for protection and low profile appearance. The skylight shall have a [ventilation flap that opens to allow air circulation and contains a filter within the flap to keep dust and insects out] [ventilating panel and insect screen with an operator hook that allows easy opening and closing, with control rods, for out-of-reach installations or smooth-turning handle for within-reach installation].

##### 2.5.1.2 Emergency Escape and Rescue Roof Window

Emergency escape and rescue roof window which opens [45] [\_\_\_\_] degrees to satisfy egress requirements for emergency escape. When the unit is closed, a ventilation flap can be opened to allow in fresh air. For easy cleaning from inside the room, the sash rotates completely inward. Insect screen and sunscreen accessories are available.

### 2.5.1.3 Balcony Roof Window Featuring Dual-Sash Operation

The top sash opens for maximum ventilation and also pivots completely inward for easy cleaning from inside the room; the bottom sash opens outward to create a roof balcony. When the window is closed, a ventilation flap allows fresh air circulation. Insect screen and sunscreen accessories are available.

### 2.5.2 [Plastic Glazed Unit Skylight][ and ][Translucent Panels]

#### 2.5.2.1 Dome

Dome skylights shall be factory assembled units each consisting of [a single dome or sealed double domes with a 1.5 mm 0.06 inch extruded aluminum frame and 1.5 mm 0.06 inch] [sealed double or triple domes with 1.5 mm 0.06 inch extruded aluminum frame with a polyurethane thermal break to prevent condensation on the interior portion of the frame and 1.75 mm 0.07 inch] extruded aluminum retainer cap. Submit Manufacturer's descriptive data, catalog cuts and certificate stating that products meet or exceed specified requirements. The skylight shall have an integral condensation gutter with weep hole slots to provide sufficient drainage to the outside. Dome shall be [clear] [white] [bronze] [\_\_\_\_\_]. For self-flashing domes, the curbs, treated wood nailer, and insulation shall be the manufacturer's standard. Uniform design load capacity of composite dome and frame shall meet or exceed [1.9] [1.4] [\_\_\_\_\_] MPa [40] [30] [\_\_\_\_\_] psf snow load. Insulated curbs with PVC thermal barriers connecting the top and bottom of the inner and outer walls are available.

#### 2.5.2.2 Pyramid

Pyramid skylights are, for all practical purposes, just a configuration alternative to the dome skylights; the requirements specified above for the domes shall apply to the pyramids. Pyramid skylight units are available from 1.2 to 6 m 4 to 20 foot square and can be used for both self-flashing or curb mount installations; 22 and 40 degrees are standard. Maximum horizontal thrust load on the pyramid curb shall be [0.4 to 1.5 kN 90 to 330 lbs (1 panel per side)] [1.8 to 3.2 kN 410 to 730 lbs (2 panels per side)] [3.8 to 5.8 kN 850 to 1300 lbs (4 panels per side)] depending on size. Pyramids are available in grid and tandem models.

#### 2.5.2.3 Vault

Vault skylights shall be [single] [double] glazed. Barrel vault height, for low rise vaults, shall be 10 percent of the vault width, and 50 percent of the vault width for half round vaults; outside curbs shall be provided by the Contractor in accordance with the manufacturer's details. Vaults shall support a 1.4 or 1.9 MPa 30 or 40 psf roof snow or live load, and a negative 1.2 MPa 25 psf wind load plus dead load; rafter spacing shall be determined by load requirements but shall not exceed 900 mm 36 inches on center for 1.9 MPa 40 psf and 1200 mm 48 inches on center for 1.4 MPa 30 psf. Sill members shall weep water infiltration and condensation, and shall be factory slotted at anchors for thermal movement. All gaskets shall be EPDM. All units over 2.2 m 87 inches shall be shipped unassembled for access to anchors from roof level.

### 2.5.3 [Framed Skylights][ and ][Translucent Panels]

Framed skylights shall [be designed to [\_\_\_\_\_] size] [span up to [3.4] [\_\_\_\_\_] m [12] [\_\_\_\_\_] feet in a single pitch and up to [6] [\_\_\_\_\_] m [20]

[\_\_\_\_\_] feet in a double pitch configuration]; rafter and purlin spacing shall be determined by loading requirements. Skylights manufactured in prefabricated sections easy to install are available in a wide range of standardized pitches. Framing members shall be [tubular] [I-beams]; deflection of rafters shall not exceed [L/175] [L/180] [\_\_\_\_\_] of the rafter span. A registered professional engineer shall size all framing members and design all structural connections; submit a copy of the calculations. Framing shall include a primary gutter system with secondary gutters to control water infiltration and condensation runoff from the underside of the glazing material and channel it to the exterior. Skylight structural members shall be designed for a live load of [\_\_\_\_\_] MPa psf and wind load of [\_\_\_\_\_] MPa psf; no objectionable distortion or stress in fastenings and joinery due to expansion and contraction shall be induced when subjected to a 55 degree C 100 degree F temperature change.

## 2.6 FLEXIBLE SEALING TAPE

Sealing tape shall be manufacturer's standard pre-applied to closure system at the factory under controlled conditions.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Field verify all submitted opening sizes, dimensions and tolerances; preparation of openings shall include isolating dissimilar materials from aluminum system to avoid damage by electrolysis. The installer shall examine area of installation to verify readiness of site conditions and to notify the Contractor about any defects requiring correction. Verify when structural support is ready to receive all specified work and to convene a pre-installation conference, if approved by the Contracting Officer, including the Contractor, skylight installer and all parties directly affecting and affected by the specified work. Do not commence work until conditions are satisfactory.

### 3.2 ERECTION

Erect translucent skylight system in accordance with the approved shop drawings supplied by the manufacturer. Submit drawings showing fabrication details, materials, dimensions, installation methods, anchors, and relationship to adjacent construction. Fastening and sealing shall be in accordance with the manufacturer's shop drawings. All panel protection shall be removed and, after other trades have completed work on adjacent materials, panel installation shall be carefully inspected and adjusted, if necessary, to ensure proper installation and weather-tight conditions. All staging, lifts and hoists required for the complete installation and field measuring shall be provided. System shall be installed clean of dirt, debris or staining and thoroughly examined for removal of all protective material prior to final inspection of the designated work area. Snow rakes shall not be used on roof windows/skylights.

-- End of Section --