Preparing Activity: USACE Superseding
UFGS-08 60 45 (February 2012)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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08/20

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USACE / NAVFAC / AFCEC / NASA **UFGS-08 60 45 (August 2020)**

Preparing Activity: USACE **Superseding**
UFGS-08 60 45 (February 2012)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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****

SECTION 08 60 45

[SKYLIGHTS][AND][TRANSLUCENT PANELS]
08/20

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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 item(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 UV-stabilized, shatterproof and energy efficient skylight systems. Provide light transmitting plastics in the manufacturing of skylights for daylighting applications. Systems must 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 Reference Identifier (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 611	(2014) Voluntary Specification for Anodized Architectural Aluminum
AAMA 2603	(2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
AAMA 2605	(2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
AAMA/WDMA/CSA 101/I.S.2/A440	(2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

ASTM INTERNATIONAL (ASTM)

ASTM C297/C297M	(2016) Flatwise Tensile Strength of Sandwich Constructions
ASTM D572	(2004; R 2019) Rubber Deterioration by Heat and Oxygen
ASTM D635	(2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

ASTM D1002	(2010; R 2019) 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	(2020) Standard Test Method for Determining Ignition Temperature of Plastics
ASTM D2244	(2021) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2843	(2019) Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics
ASTM D3841	(2016) Standard Specification for Glass Fiber-Reinforced Polyester Plastic Panels
ASTM E72	(2022) Conducting Strength Tests of Panels for Building Construction
ASTM E84	(2023) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E108	(2020a) Standard Test Methods for Fire Tests of Roof Coverings
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330/E330M	(2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	(2000; R 2023) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E661	(2022) Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads

ASTM E695	(2022) Standard Test Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC04	(2012; R 2015) Acceptance Criteria for Sandwich Panels

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2021) International Building Code

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2020) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2020) 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	(2018; with Change 2, 2022) DoD Minimum Antiterrorism Standards for Buildings

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

29 CFR 1910.23	(Nov 2016) Ladders

UNDERWRITERS LABORATORIES (UL)

UL 972	(2006; Reprint Nov 2020) UL Standard for Safety 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, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] 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[, [_____]]

[Recycled Content for Aluminum Framing Materials; S

][Energy Star Label for Residential Skylights; S

] 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 is a company specializing in the manufacture of the specified products with a minimum of [5] [10] years documented experience. The installer has 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 glaze in conformance with the applicable requirements of Section 08 81 00 GLAZING.

1.5 DELIVERY, STORAGE, AND HANDLING

Provide factory assembled system modules to the greatest extent possible. Ship panels to the jobsite in rugged shipping units, ready for erection. Affix conspicuous decals on all skylights warning individuals against sitting or stepping on the units. Store skylight panels 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. Deliver, store and protect all products in accordance with manufacturer's recommendations.

1.6 WARRANTY

Provide the manufacturer's complete warranty for materials, workmanship, and installation. The warranty is for [5] [_____] years from the time of project completion and with no proration. The warranty must guarantee, but not be limited to, the following:

a. [No change in light transmission and color of the panels after exposure to heat of 149 degrees C 300 degrees F for 25 minutes.][In accordance with ASTM D2244, panels do 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.

When editing this section and developing details for skylight systems, Designer must ensure systems meet requirements of UFC 4-010-01.

****

Fabricate skylight panels 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 must 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, provide a listing certificate for roof covering systems category certifying that the product complies with the safety standards of ASTM E108 and ICC IBC. Size and color of skylight panels as indicated.

2.2 GLASS-FIBER PANELS

Provide glass-fiber reinforced polyester panels conforming to ASTM D3841, Class [_____] and to the requirements of AAMA/WDMA/CSA 101/I.S.2/A440.

2.2.1 Weatherability

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

2.2.2 Non Combustible Grid Core

Use 6063-T6 aluminum I-beams 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. I-beam width no less than 11 mm 7/16 inch. Machine I-beam grid to tolerances of not greater than plus or minus 0.05 mm 0.002 inch for flat panels. Panels must withstand 650 degrees C 1200 degrees F fire for a minimum of one hour without collapse or exterior flaming.

2.2.3 Adhesive

Use heat and pressure resin-type laminate adhesive engineered for structural sandwich panel use; which passes testing requirements specified by the International Conference of Building Officials' "Acceptance Criteria for Sandwich Panel Adhesive". Provide with the following minimum strength:

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:

(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

****
NOTE: Use materials with recycled content where appropriate for use. Verify suitability, availability within the region, cost effectiveness and adequate competition before specifying product recycled content requirements. Where it is confirmed panels are readily available with aluminum containing recycled content, include the last bracketed sentences.
****

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. Include manufacturing facilities, sandwich panel components and production sandwich panels in the quality control inspections and required testing, conducted at least once each year, for conformance with ICC-ES AC04 or equivalent. [Provide aluminum framing materials with a minimum recycled content of 20 percent. Provide data identifying percentage of recycled content for aluminum framing materials.]

2.3 THERMOPLASTIC POLYCARBONATE PANELS

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

a. Extruded in one single formable length. Transverse sections are unacceptable. Manufacture the panels with upstands which are integral to the unit, and with the upstands 90 degrees to the panel face (standing seam dry glazed concept). Welding or gluing of upstands or standing seam is unacceptable.

b. Provide dry glazed profiles mullions, using no sealant, welding, adhesives or gaskets; thermally break mullions 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 must be [2.44 kg/m^2 for 10 mm 0.5 psf for 0.4 inch] [3.3 kg/m^{2}for 16 mm 0.68 psf for 0.63 inch] [4.4 kg/m^2 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. Interconnect the panel's exterior skins and space apart by supporting ribs, perpendicular to the skins, at a spacing not to exceed 4 mm 0.16 inches (truss-like construction). In addition, divide the space between the two exterior skins in a cross section by multiple parallel intermediate surfaces, at a spacing not to exceed 4 mm 0.16 inches.

f. Interior flame spread classification is 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 must be an approved light transmitting panel with a CC1 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 must be successfully evaluated for fire from exterior exposure in accordance with [ASTM E108] [_____] to meet Class [A] [B] [C] rating. Provide panel listed by an independent recognized listing laboratory.

2.4 COMMON PANEL REQUIREMENTS

2.4.1 Appearance

Provide face sheets uniform in color to prevent splotchy appearance and 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 must meet the following requirements:

a. Light transmission [_____] percent; color [_____].

b. Assembled panel thickness [_____] mm inches.

c. Grid size [_____][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, refer to UFC 1-200-02, High Performance and Sustainable Building Requirements, for minimum requirements for energy efficiency and meet minimum building envelope requirements of UFC 3-101-01 including fenestrations and glazing.

Select the performance requirements for non-residential skylights and the residential skylights.

****

Provide non-residential skylights (including frames and glass) 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/m2-KBtu/hr-ft2-F in accordance with NFRC 100.

Provide residential skylights (including frames and glass) that are Energy Star labeled products for the [Northern] [North-Central] [South-Central] [Southern] climate zone, or have the following performance characteristics: [Southern climate zone, thermal properties of windows must not exceed a U-factor of 0.60 determined according to NFRC 100, and a solar heat gain coefficient (SHGC) not exceeding 0.28 determined according to NFRC 200.][South-Central climate zone, thermal properties of windows must not exceed a U-factor of 0.53 determined according to NFRC 100, and a solar heat gain coefficient (SHGC) not exceeding 0.28 determined according to NFRC 200.][North-Central climate zone, thermal properties of windows must not exceed a U-factor of 0.53 determined according to NFRC 100, and a solar heat gain coefficient (SHGC) not exceeding 0.35 determined according to NFRC 200.][Northern climate zone, thermal properties of windows must not exceed a U-factor of 0.50 determined according to NFRC 100.][Provide proof of Energy Star label for residential skylights.]

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. In addition, the design must meet the requirements of UFC 1-200-02, High Performance and Sustainable Building Requirements, "Moisture Control" and meet minimum building envelope requirements of UFC 3-101-01 "Architecture" including fenestrations and glazing.

****

The condensation index rating must 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. Design must meet the requirements of UFC 1-200-02, High Performance And Sustainable Building Requirements and meet minimum building envelope requirements of UFC 3-101-01 "Architecture" including fenestrations and glazing.

****

Submit manufacturer's certificate that the systems meet or exceed specified requirements. Provide systems 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 must 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 by the manufacturer.

b. Exterior panel faces [crystal] [clear matte] [white] [_____] in color. Interior panel faces [crystal] [clear matte] [white] [_____] in color.

c. Air infiltration at 75 Pa 1.57 psf less than [0.2] [_____] L/s/m^2 [0.04] [_____] cfm/ft^2 and at 300 Pa 6.24 psf less than [0.36][0.5] [_____] L/s/m^2 [0.07][0.1] [_____] cfm/ft^2 in accordance with ASTM E283.

d. Water penetration at test pressure of 718 Pa 15 psf equals zero in accordance with ASTM E331.

e. Manufacturer is responsible for maximum system deflection, in accordance with the applicable building code, and without damage to system performance. Calculate deflection in accordance with engineering principles.

f. Incorporate weepage elements within the perimeter framework of the

glazing system for drainage of any condensation or water penetration.

g. System must accommodate movement within the system; movement between the system and perimeter framing components; dynamic loading and release of loads; and deflection of supporting members. Achieve this without damage to system or components, deterioration of weather seals and fenestration properties specified.

h. The exterior panel face must 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. Provide system meeting 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.

****

NOTE: The selection of anodic or organic coating is based primarily on the desired appearance: anodized finishes provide a metallic appearance and organic finishes provide a painted or metal-like finish (organic finishes are available in a variety of colors). Only allow both types as a Contractor option when the Designer confirms that the desired appearance is available in both types of finishes.

For organic coatings, to provide enhanced resistant to corrosion, weathering, ozone, and UV radiation utilize superior performance powder coat finishes conforming to AAMA 2605 in humid locations and project locations with an ESC of C3 thru C5; baked enamel finishes conforming to AAMA 2603 may be utilized for non-humid locations and ESC C1 or C2 project locations. Humid locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C and 5C (as identified in ASHRAE 90.1). Refer to UFC 1-200-01 for determination of ESC for a specific project location.

For anodic coatings, specify Architectural Class I for harsh atmospheres where dust, gases, salts, and other destructive elements will attack metal finish. Also specify Class I for humid locations or project locations with Environmental Severity Classifications (ESC) of C3 thru C5. Humid locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C and 5C (as identified in ASHRAE 90.1). Specify Architectural Class II for all atmospheric conditions not requiring Class I.

****

j. Exposed aluminum color must be [a [_____] shade] selected from the manufacturer's standard range. Provide corrosion resistant [baked-on enamel coating in accordance with AAMA 2603 with a total dry film thickness not less than 20 µm 0.8 mil] [superior-performance organic finish in accordance with AAMA 2605] [with total dry film thickness of

not less than 30 µm 1.2 mils][anodized finish complying with AA DAF45 and AAMA 611 must be [Architectural Class II (10 µm to 18 µm0.4 mil to 0.7 mil), designation AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34, electrolytically deposited color]][Architectural Class I (18 µm0.7 mil or thicker), designation AA-M10-C22-[A41, clear (natural)] [A42, integral color] [A44, electrolytically deposited color] anodized.]].

k. Provide a system requiring no scheduled recoating to maintain its performance or for UV resistance.

l. Design criteria:

(1) Wind Load [_____]; snow load [_____].

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

(3) Anchor Blast Loads: Design anchors to resist 4.8 kPa 100 pounds per square foot blast load.

m. Use 6063-T6 and 6063-T5 extruded aluminum; all fasteners of stainless steel or plated steel.

2.5.1 Glass Glazed Skylights and Roof Windows

Provide roof windows to 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.

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. Provide [aluminum] [copper] protective exterior cladding for protection and low profile appearance. The skylight must 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

Provide factory assembled dome skylight 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. Provide the skylight with an integral condensation gutter with weep hole slots to provide sufficient drainage to the outside; and [clear] [white] [bronze] [_____] dome. Use the manufacturer's standard for self-flashing domes, the curbs, treated wood nailer, and insulation. Uniform design load capacity of composite dome and frame must 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 also 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. The maximum horizontal thrust load on the pyramid curb is [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

Provide [single] [double] glazed vault skylights; barrel vault height, for low rise vaults, at 10 percent of the vault width, and 50 percent of the vault width for half round vaults; provide outside curbs in accordance with the manufacturer's details. Vaults must 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 is determined by load requirements but must 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. Provide sill members that are factory slotted at anchors for thermal movement, and weep water infiltration and condensation. Use EPDM gaskets. Ship all units over 2.2 m 87 inches unassembled for access to anchors from roof level.

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

Framed skylights must [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]; determine rafter and purlin spacing by loading requirements. Skylights manufactured in prefabricated sections easy to install are available in a wide range of standardized pitches. Provide [tubular] [I-beam] framing members; deflection of rafters not to exceed [L/175] [L/180] [_____] of the rafter span. A registered professional engineer must size all framing members

and design all structural connections; submit a copy of the calculations. Framing includes 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. Design skylight structural members for a live load of [_____] MPa psf and wind load of [_____] MPa psf; do not induce objectionable distortion or stress in fastenings and joinery due to expansion and contraction when subjected to a 55 degree C 100 degree F temperature change.

2.6 FLEXIBLE SEALING TAPE

Provide manufacturer's standard pre-applied sealing tape 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 includes isolating dissimilar materials from aluminum system to avoid damage by electrolysis. The installer must 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 install any materials that show visual evidence of biological growth due to the presence of moisture. 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. Fasten and seal in accordance with the manufacturer's shop drawings. Remove all panel, after other trades have completed work on adjacent materials. Carefully inspect and adjust panel installation as necessary to ensure proper installation and weather-tight conditions. provide all staging, lifts and hoists required for the complete installation and field measuring. Install system clean of dirt, debris or staining and thoroughly examined for removal of all protective material prior to final inspection of the designated work area. Do not use snow rakes on roof windows or skylights.

-- End of Section --