

## **Guide Specification for Pre-Engineered Skylight System**

### **SECTION 08630 - METAL FRAMED SKYLIGHTS**

#### **PART 1 – GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Engineering, design and drafting of the entire skylight system.
- B. Fabrication and warranty of the skylight system.
- C. Skylight glass and glazing materials.
- D. Skylight related flashings, anchors, brackets and insulation.
- E. Skylight metal finishes.

##### **1.02 RELATED SECTIONS**

- A. Section 07720: Roof Accessories: Manufactured Curbs
- B. Section 06100: Rough Carpentry: Wood Roof Curbs
- C. Section 07500 Membrane Roofing

##### **1.03 REFERENCES**

- A. The Aluminum Association, Inc. (AA): SAS-30, Specifications for Aluminum.
- B. American Architectural Manufacturers Association (AAMA).
  - 1. 501.1: Standard Test Method for Metal Curtain Walls for Water Penetration Using Dynamic Pressure.
  - 2. 501.2: Field Check of Metal Curtain Walls for Water Leakage.
  - 3. 2604: Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
  - 4. 606.1: Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
  - 5. 607.1: Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

6. 809.2: Voluntary Specification for Non-Drying Sealants.
7. GDSG-1: Glass Design for Sloped Glazing.
8. SDGS-1: Structural Design Guidelines for Aluminum Framed Skylights.
9. TSSGG-1: Two Sided Structural Glazing Guidelines for Aluminum Framed Skylights.
10. TIR-A9-1991: Metal Curtain Wall Fasteners.

C. American Society for Civil Engineers (ASCE).

1. ASCE 7-95: Minimum Design Loads in Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM).

1. A 193: Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.
2. A 307: Specification for Carbon Steel Externally Threaded Standard Fasteners.
3. B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. B 211: Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.
5. B 221: Specification for Aluminum-Alloy Extruded Bar, Rod, Wire, Shape and Tube.
6. C 1036: Specification for Flat Glass.
7. C 1048: Specification for Heat-Treated Flat Glass.
8. E 283: Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
9. E330: Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
10. E331: Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
11. E 773: Test Method for Seal Durability of Sealed insulating Glass Units.
12. E 774: Specification for Sealed Insulating Glass Units.

E. Glass Association of North America (GANA): Glazing Manual.

F. Insulating Glass Certification Council (IGCC): Classification of Insulating Glass Units.

G. U.S. Consumer Product Safety Commission (CPSC): 16 CFR 1202 Architectural Glazing Standards and Related Materials.

#### 1.04 SYSTEM DESCRIPTION

##### A. Design Requirements:

1. Extruded aluminum framing members shall have an integral gutter system for positive drainage of condensation to the exterior of the skylight through a series of strategically positioned weep holes.
2. The skylight system shall utilize flush glazed exterior joints on all horizontal purlins.
3. Rafters shall have a screw slot for the attachment of exterior retainer bars with ¼-20 stainless steel screws at 9" on center.
4. The aluminum sill and hip rafter extrusion design shall allow for the insertion of fiberglass insulation to improve the overall thermal performance of the skylight unit.
5. The framing system shall utilize extruded hinged components at the sill, hip and / or ridge locations.
6. Mechanical fasteners shall be used at all connection points in lieu of welded joints to eliminate the potential weakening of the aluminum extrusions at critical locations.
7. Snap-in perimeter flashing design shall facilitate installation after the skylight has been permanently installed on the roof curb.

##### B. Performance Requirements:

1. Structural members, glazing material and connections shall be designed, fabricated and installed in accordance with the local building code, ASCE 7-95 (section 2.4) and are pre-engineered to support the following structural loads:
  - a. Self-supporting load of 10 pounds per square foot.
  - b. Maximum Ground Snow Load of 50 pounds per square foot.
  - c. Minimum Live Load of 20 pounds per square foot.
  - d. Wind loads resulting from a 120MPH, 3-second gust speed with pressure determined by ASCE 7-95 "*Minimum Design Loads for Buildings and other Structures.*"

2. The deflection on any structural member in the plane normal to glass surface when subjected to the specified loads shall not exceed  $L/175$  of its clear span. Deflection within the length of any individual glass panel shall not exceed  $\frac{3}{4}$ ".
3. Parallel to glazing plane deflection of framing member when carrying full design load shall not exceed an amount reducing the glazing unit bite below 75% of the design dimension and shall not reduce the edge clearance to less than  $\frac{1}{8}$ " nor shall it damage or impair the function of any joint seal.
4. Provide for expansion and contraction of components resulting from an ambient temperature change of 180 degrees F (+/- 90 degrees F) without causing buckling, excessive stresses on glazing, structural elements or fasteners, failure of seals, reduction of performance or other detrimental effects.
5. No water penetration shall occur when system is tested in accordance with ASTM E 331 using a differential static air pressure of 20% of inward acting (positive) design wind load, but not less than 10 psf. Water penetration is defined as the appearance of uncontrolled water other than condensation occurring on the interior surface of any part of the skylight.
6. Air infiltration shall be limited to not more than 0.01cfm. per square foot of assembly when tested in accordance with ASTM E 283 at 6.24psf. static air pressure difference.
7. Where permitted by code, a  $\frac{1}{3}$  increase in allowable stress for wind or seismic load shall be acceptable, but not in combination with any reduction applied to combined loads. In no case shall the allowable values exceed the yield stress.

## **1.05 SUBMITTALS**

- A. Submit one set of shop drawings showing plans and details required to fully describe the skylight construction for the architect's review and approval.
- B. Submit one set of manufacturer's product specification concerning product fabrication, performance, installation and maintenance. Performance data shall include the structural calculations as stated above in section 1.04 B. (1) as prepared by a structural engineer qualified in the design of self supporting skylights in accordance with ASCE 7-95 and with AA SAS-30.
- C. Submit results of infiltration tests as described in section 1.04 B (5)&(6) stated above.

## 1.06 QUALITY ASSURANCE

- A. Work of this section is to be designed and fabricated by a company with a minimum of ten (10) years of continuous, uninterrupted experience in work of similar scope and magnitude.
- B. Job site erection and / or glazing shall be performed by a qualified installer (as selected by the contractor, sub-contractor or owner) in strict compliance with the manufacturer's comprehensive installation instructions.
- C. **(Select for Pre-Assembled / Pre-Glazed Units Only)** Factory assembly and glazing shall be conducted by the manufacturer's own experienced and trained personnel in a clean, climate controlled and protected environment.

## 1.07 WARRANTY

- A. Submit a written warranty, executed by the skylight manufacturer, certifying that the skylight is to be free of defects in design, materials and fabrication for a period of five (5) years from the date of purchase.
- B. Warrant glass against defective materials, delamination, seal failure and defects in manufacture for a period of five (5) years in accordance with the glass manufacturer's standard warranties. Glass breakage is not warranted.
- C. Warrant finishes against peeling, checking, cracking, flaking or blistering for a period of five (5) years in accordance with the coating manufacturer's standard warranty.
- D. Warrant structural sealants for a period of ten (10) years in accordance with the sealant manufacturer's standard warranties.

## PART 2 – PRODUCTS

### 2.01 MANUFACTURERS

- A. ESKYLIGHT.COM, Inc. Telephone 905-228-9982, FAX 905-228-9929,  
[www.eSkylight.com](http://www.eSkylight.com)

### 2.02 MATERIALS

- A. Principal framing members: Fabricated from 6063-T5, 6063-T6 or 6061-T6 extruded aluminum. Sizes, shapes and profiles per ESkylight.com, Inc. standard components.
- B. Snap on covers and non-supporting trim .030" minimum thickness 6063-T6 extruded aluminum.
- C. Structural formed metal members shall be ASTM B 209 5052-H34 or ASTM B 221 6061-T6 aluminum.

D. Gaskets shall be continuous and shall be an extruded EPDM, silicone compatible rubber, shore A hardness: 70 (+/-5), tensile strength: 950 psi, color: black.

E. Setting blocks shall be an extruded EPDM, silicone compatible rubber, shore A hardness: 85 (+/-5), color: black.

F. Fasteners:

1. Fasteners for attachment of exterior retainer bars shall be ASTM A 193 B8 300 series stainless steel screws.
2. Fasteners used to connect framing members shall be ASTM A 193 B8 300 series stainless steel or ASTM B 2100 2024-T4 aluminum.
3. Fasteners used to anchor the skylight to the support structure shall be ASTM A 193 B8 300 stainless steel screws.

G. Perimeter Flashing:

1. ASTM B 209 5005-H34 or 5052-H34 aluminum, .030" minimum thickness. Exposed flashing shall be finished to match skylight framing.

H. Exposed metal finish shall comply with the following: **(Select one)**

1. Class I clear anodic coating: Type AAM10C22A41, anodized coating, 0.7 mil thickness minimum, in compliance with AAMA 607.1. Color:
2. Fluoropolymer coating (2-coat): 50% Kynar ® resin base fluoropolymer finish in compliance with AAMA 2604. Color:
3. Fluoropolymer coating (2-coat): 70% Kynar ® resin base fluoropolymer finish in compliance with AAMA 2604. Color

I. Sealants:

1. Structural flush glazed joints shall be a high performance silicone sealant selected by the skylight manufacturer and applied in accordance with the sealant manufacturer's instructions. Color: black.
2. Weatherseal joints shall be a neutral cure medium modulus silicone sealant selected by the skylight manufacturer and applied in accordance with the sealant manufacturer's instructions. Color: black.
3. Unexposed, low movement flashing joints shall be a non-drying, non-skinning, non-oxidizing, non-bleeding curtain wall sealant selected by the skylight manufacturer and meeting AAMA 809.2.

J. Glass:

1. Standard certification requirements:
  - a. Float Glass: ASTM C 1036.

- b. Heat Treated Glass: ASTM C1048, with surface stress of 5000psi, +/- 1500psi.
- c. Laminated Glass: Two lites of equal thickness bonded with a polyvinyl butyral (PVB) interlayer, meeting criteria of ANSI Z97.1-1984 and CPSC 16 CFR 1201 for safety glazing.
- d. Insulating Glass: CBA rated by the Insulating Glass Certification Council when tested in accordance with ASTM E 773 and E 774. Dual edge seals with silicone secondary seal. Exterior lite is to be heat strengthened; interior lite to be heat strengthened laminated glass.

2. Performance Requirements:

- a. Probability of breakage not to exceed 8/1000 for vertical glass and 1/1000 for sloped glass upon first application of design pressures or due to anticipated thermal stresses.

3. Glazing Unit Composition:

- b. **(Select for tinted glass option only)** Tinted Glass:
- c. **(Select for ceramic frit option only)** Ceramic Frit :  
**(Select One)** 1/8" holes, 1/8" dots or 1/8" horizontal lines (white only).

## 2.03 FABRICATION

- A. Retainer bars shall be attached with gasketed stainless steel fasteners spaced at a maximum of 9" on center.
- B. Setting blocks and spacers shall be located and sized in accordance with the GANA Glazing Manual. At no point shall the glazing come in contact with the metal frame or fasteners.
- C. The skylight shall have properly located condensation gutters and weep holes provided for drainage of condensation to the exterior.
- D. **(Select for Pre-Assembled / Pre-Glazed Units Only)** Factory assembly and glazing shall be conducted by the manufacturer's own experienced and trained personnel prior to shipment to job site.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Prior to installation, inspect the structural support and adjacent construction to verify that they are properly prepared to receive the work. Notify the general contractor of

any errors or deviations prior to installation. No work shall proceed until all errors and deviations are corrected.

### **3.02 PREPARATION**

- A. Surface contact between aluminum and dissimilar materials shall receive a protective coating of asphaltic paint or elastomeric isolator to prevent electrolytic action.

### **3.03 INSTALLATION**

- A. Job site erection and glazing shall be performed by a qualified installer (as selected by the general contractor, sub-contractor or owner) in strict compliance with the manufacturer's comprehensive installation instructions.
- B. Install all items plumb, straight, square level and in their elevation, plane and location and in proper alignment with other work.
- C. The skylight shall be designed to accommodate tolerances of the building structural members and clearances shown on final approved shop drawings. All parts of the erected work, when completed, shall be within the following tolerances:
  - 1. Maximum variation from plane or location shown on final shop drawings: 1/8" per 12ft. or 1/2" on any total length.
  - 2. Maximum offset from true alignment between two identical members butting end to end in line: 1/32".
- D. Anchorage to the structure shall be in accordance with final shop drawings. Supporting brackets shall be so designed as to provide three-dimensional adjustment and accurate location of the components.
- E. Sealant materials shall be used in accordance with the manufacturer's printed instructions and shall be applied by mechanics specially trained and experienced in their use. Before applying sealant, all dirt, dust, moisture and all foreign matter shall be completely cleaned from surfaces it will contact. Adjoining surfaces must be masked to obtain a clean and neat appearance. Sealants shall be tooled to fill the joint and provide a smooth finished surface.

### **3.04 PROTECTION AND CLEANING**

- A. At time of installation, clean skylight frames and associated metals and glass per manufacturer's installation and maintenance instructions.
- B. The temporary protection of the skylight during the installation or after the installation is complete (including protection from the work of other trades), shall be the responsibility of the contractor.



**END OF SECTION**

**THE THOMPSON & LICHTNER COMPANY INC.**

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**Air Infiltration / Water Penetration and Structural Performance Test Report**

We transmit herewith the results of air infiltration, water penetration, and structural performance tests conducted on April 6, 2000, for ESkylight.Com, Inc. in Sanford, Maine.

**I. DESCRIPTION OF TEST SPECIMEN**

- TYPE:** Extruded Aluminum-Framed Structurally Glazed Pyramid Skylight
- OVERALL SIZE:** 8' x 8' Pyramid with 30° Pitch to Center Point
- FINISH:** All aluminum frame and flashing members painted with two coats of fluoropolymer coating.
- GLAZING DETAILS:** The sloped glass units were 1-1/8" insulated glass fabricated from a 1/4" clear, heat-strengthened light, a 1/2" dual-sealed airspace, and a 3/8" clear, heat-strengthened, laminated light with a 0.030" PVB interlayer. The sloped glass was set on EPDM gaskets set in slots of the sill, hip, and rafter details. Dow 795 silicone sealant was installed as a structural heel beaded at the sill and hip. At rafters, pressure plates with EPDM gaskets held the lights in place. The EPDM gaskets along the rafter were cap beaded with Dow 795 silicone sealant and the exterior joints at the sill and hips were sealed with Dow 795 silicone sealant with open-celled back-up rod. EPDM setting blocks were used at the sill of the lights (see the manufacturer's notes and details).
- FRAME CONSTRUCTION:** The frame was constructed of extruded aluminum members. The sill and hips were ball-and-socket units with brake formed aluminum hip caps, peak caps, rafter covers, cover plates at the base of the sill, and sill flashing. The mitered joints in the sill were sealed with Dow 795 silicone sealant. The fasteners and washers securing the frame members together were made from 300 Series stainless steel.
- INSTALLATION:** The skylight unit was installed on a wood plate made of two 2 x 4's at the top of a test chamber using 3/8" x 3" lag bolts and clips to secure the plate at the sill at each rafter and hip. The joint between the skylight sill and wood plate was sealed with silicone sealant.

**II. TEST PROCEDURE**

The skylight was tested at the ESkylight.Com, Inc. manufacturing facility in Sanford, Maine. The skylight was installed on top of a test chamber constructed of 2 x 4's placed 16" on center for framing on the floor and walls, with two 2 x 4's used as the plate at the top of the chamber. The frame of the test chamber was sheathed with 3/4" CDX plywood with all joint and fastener penetrations in the chamber sealed with silicone sealant.

Air infiltration testing was conducted in accordance with applicable provisions of ASTM Designation: E 283, "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen." Water penetration testing was conducted in accordance with applicable provisions of ASTM Designation: E 331, "Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference." Structural

performance testing was conducted in accordance with applicable provisions of ASTM Designation: E 330, "Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference." Dials were positioned beneath the peak and midpoints, and at all four hips and the bottom of the hips.

### III. TEST RESULTS

#### A. AIR INFILTRATION @ 6.24 PSF

Measured Air Leakage 2.0 cfm

Calculated Air Leakage 0.028 cfm per square foot

#### B. WATER PENETRATION TESTS

##### 1. WATER PENETRATION @ 6.24 PSF

Water was applied to the exterior of the skylight at the standard rate of 5.0 gallons per hour per square foot while a negative chamber pressure of 6.24 psf was maintained on the interior of the skylight. No water leakage was observed on the interior of the skylight or in the test chamber during or following the 15-minute test period.

##### 2. WATER PENETRATION @ 10.0 PSF

Water was applied to the exterior of the skylight at the standard rate of 5.0 gallons per hour per square foot while a negative chamber pressure of 10.0 psf was maintained on the interior of the skylight. No uncontrolled water leakage was observed on the interior of the skylight or in the test chamber during or following the 15-minute test period.

#### C. STRUCTURAL PERFORMANCE

The skylight was tested for structural performance with a maximum test load of 50 psf in both the positive and negative directions. The following test results were obtained.

##### 1. NEGATIVE LOADING OF 50 PSF

Maximum Movement at the Midpoint of a Hip	0.155" Inward
Change in Position at Center Point	0.080" Inward
Maximum Inward Movement at Base End	0.031" Inward
Maximum Deflection	0.104"

No permanent deformation was observed in the skylight frame members.

##### 2. POSITIVE LOADING OF 50 PSF

Maximum Movement at the Midpoint of a Hip	0.259" Outward
Change in Position at Center Point	0.200" Outward
Maximum Inward Movement at Base End of Hip	0.067" Outward
Maximum Deflection	0.080"

No permanent deformation was observed in the skylight frame members.