SECTION  – metal-framed skylights

1. General
   1. summary
      1. This Section includes the following:
         1. Aluminum framed skylights with retaining caps.
         2. Two-sided, structural sealant glazed, aluminum framed skylights with retaining caps at rafters.
         3. Four-sided, structural sealant glazed, aluminum framed skylights.
      2. Related Requirements:
         1. Section 07 54 19 – Polyvinyl Chloride Roofing (PVC).
         2. Section 07 54 23 – Thermoplastic Olefin Roofing (TPO).
         3. Section 07 92 00 – Joint Sealants.
         4. Section 08 80 00 – Glazing.
   2. PERFORMANCE REQUIREMENTS
      1. General: Provide metal framed skylights capable of withstanding loads and thermal and structural movements indicated without failure. Failure includes the following:
         1. Deflection exceeding specified limits.
         2. Thermal stresses transferred to the building structure.
         3. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing.
         4. Noise or vibration created by thermal and structural movement and wind.
         5. Loosening or weakening of fasteners, attachments, and other components.
         6. Sealant failure.

SPEC NOTE: Delete paragraph below if no structural‑sealant‑glazed skylights. Structural glazing would be found in large atrium skylight, where multiple lites of glass are connected to make the skylight.

* + 1. Structural Sealant Glazing: As follows:
       1. Structural silicone sealant does not carry gravity load of glazing.
       2. Tensile and shear stress in structural silicone sealant joints is less than 138 kPa (20 psi).
       3. Structural silicone sealant joints accommodate thermal and mechanical movement, prevent glazing to glazing contact, and maintain required glazing edge clearances.
       4. Structural silicone sealant fails cohesively before sealant releases from substrate when tested for adhesive compatibility with each substrate and joint condition required.
          1. Adhesive failure occurs when sealant pulls away from a substrate cleanly, leaving no sealant material behind.
          2. Cohesive failure occurs when sealant breaks or tears within a joint but does not separate from each substrate because sealant to substrate bond strength exceeds sealant's internal strength.
    2. Deflection Limits: As follows:
       1. Deflection of the entire length of framing members in direction normal to glazing plane is limited to 1/180 of clear span or 19mm (3/4"), whichever is smaller, unless otherwise indicated.
       2. Deflection of the entire length of framing members for spans exceeding 6m (20') is limited to 1/240 of clear span.
       3. Deflection of framing members in a direction parallel to glazing plane, when carrying full dead load, is limited to an amount not exceeding that which reduces glazing bite below 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 3mm (1/8").
    3. Lateral Support: Compression flanges of flexural members are laterally braced by cross members with minimum depths equal to 50 percent of flexural member depth and by anchors to the building structure. Glazing material does not provide lateral support.
    4. Structural Loads: Provide metal framed skylights, including anchorage, capable of withstanding the effects of the following design loads when supporting full dead loads in accordance with NBC Climatic Design Data (30-year probability):
       1. Wind Loads.
       2. Snow Loads.
       3. Rain Loads.
       4. Live Loads.
       5. Seismic Loads.
    5. Structural Performance: Provide metal framed skylights, including anchorage, capable of withstanding test pressure indicated without material and deflection failures and permanent deformation of structural members exceeding 0.2 percent of span when tested according to ASTM E 330.
       1. Test Pressure: 150 percent of positive and negative wind load design pressures.
       2. Test Duration: As required by design wind velocity; fastest 1 mile (1.609 km) of wind for relevant exposure category.
    6. Thermal Movement: Provide metal framed skylights that allow for thermal movements resulting from the change (range) in ambient and surface temperatures by preventing buckling, sealant failure, and other detrimental effects.
    7. Air Infiltration: Provide metal framed skylights with maximum air leakage of 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface when tested according to ASTM E 283 at a minimum static air pressure differential of 300 Pa (6.24 lbf/sq. ft.).
    8. Water Penetration: Provide metal framed skylights that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 20 percent of positive design wind load, but not less than 300 Pa (6.24 lbf/sq. ft.).
  1. SUBMITTALS
     1. Submit submittals in accordance with Section 01 33 00 – Submittal Procedures.
     2. Action Submittals: Provide the following submittals before starting any work of this Section:
        1. Product Data: Include construction details, material descriptions, dimensions, and profiles of components, and finishes for metal framed skylights.
        2. Shop Drawings: For metal framed skylights. Include plans, elevations, sections, details, and attachments to other Work.
           1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
        3. Samples for Verification: For each exposed aluminum finish required, prepared on 305mm (12") long sections of extrusions or formed shapes in same thickness and material indicated for the Work. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.
        4. Cutaway Sample: Of framing intersection, made from 305mm (12") long lengths of full-size components and showing details of the following:
           1. Primary members.
           2. Joinery.
           3. Anchorage.
           4. Expansion provisions.
           5. Glazing.
           6. Flashing and drainage.
           7. Structural sealant joints.
        5. Preconstruction Test Reports: Indicate and interpret test results for compliance with requirements.
        6. Product Test Reports: From a qualified testing agency indicating skylights comply with requirements, based on comprehensive testing of current products.
        7. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with sealants; include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed for adhesion.
        8. Field Test Reports: Indicate and interpret test results for compliance with requirements.
  2. quality assurance
     1. Installer Qualifications: An experienced installer to assume engineering responsibility who has specialized in installing metal framed skylights similar to those indicated for this Project and who is acceptable to manufacturer.
        1. Engineering Responsibility: Preparation of Shop Drawings, testing program development, test result interpretation, and comprehensive engineering analysis by a qualified professional engineer.
     2. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
     3. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of metal framed skylights. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in service performance.

SPEC NOTE: Delete below if the scope is minimal on the Project. Use only for large sections of skylights.

* + 1. Preconstruction Testing: As follows:
       1. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated.
       2. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing indicated.
       3. Test metal framed skylights for compliance with performance requirements according to specified test methods. Conduct tests using specimen representative of proposed materials and construction including perimeter components, corners, splice joints, sealants, and anchors according to AAMA 501 recommendations adapted to skylights.
       4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

SPEC NOTE: Delete below if the scope is minimal on the Project. Use only for large sections of skylights.

* + 1. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to sealant manufacturer, for testing indicated below, samples of materials that will contact or affect joint sealants.
       1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
       2. Submit not fewer than nine pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
       3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
       4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
    2. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code Aluminum."
    3. Preinstallation Conference: Arrange a pre construction meeting in accordance with Section 01 31 19 – Project Meetings.
    4. Review methods and procedures related to metal framed skylights including, but not limited to, the following:
       1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
       2. Review structural load limitations.
       3. Review skylight curb structural requirements.
       4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
       5. Review required testing procedures.
       6. Review weather and forecasted weather conditions and procedures for unfavorable conditions.
       7. Review protection of adjacent roof areas.
       8. Review preparation and other requirements for installing structural silicone sealant.
  1. SITE CONDITIONS
     1. Field Measurements: Where metal framed skylights are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
        1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating skylights without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.
  2. WARRANTY
     1. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
     2. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of metal framed skylights that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
        1. Structural failures.
        2. Sealant failures.
        3. Failure of systems to meet performance requirements.
        4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
        5. Water leakage; defined as uncontrolled water appearing on normally exposed interior surfaces of skylights from sources other than condensation. Water controlled by flashing and gutters and drained back to the exterior and that cannot damage adjacent materials or finishes is not water leakage.
           1. Warranty Period: Five (5) years from date of Substantial Completion.

1. Products
   1. manufacturerS
      1. Basis-of-Design products are named in this Section; additional manufacturers offering similar aluminum framed skylight systems may be incorporated into the work provided they meet the performance requirements established by the named products.
      2. Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis of Design Materials, manufacturers offering products that may be incorporated into the Work include but are not limited to, the following:
         1. Bristolite Skylights.
         2. Lane Aire Manufacturing Corp.
         3. Lynbrook Glass and Architectural Metals Corp.
         4. Super Sky Products, Inc.
         5. Wasco Products, Inc.
   2. FRAMING MATERIALS
      1. Aluminum: Alloy and temper recommended by manufacturer for use and finish indicated, and as follows:
         1. Extrusions: ASTM B 221 (ASTM B 221M).
         2. Sheet and Plate: ASTM B 209 (ASTM B 209M).
         3. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
      2. Brackets and Reinforcements: Provide manufacturer's standard high strength aluminum brackets and reinforcements. Provide nonstaining, nonferrous shims to install and align skylights.
      3. Concealed and Exposed Flashing: Manufacturer's standard corrosion resistant, nonstaining, nonbleeding flashing; compatible with adjacent materials.
         1. Minimum Thickness: 1.5mm (0.060").
      4. Fasteners and Accessories: Manufacturer's standard corrosion resistant, nonstaining, nonbleeding fasteners and accessories; compatible with adjacent materials.
         1. Movement Joints: Provide slip joint linings, spacers, and sleeves of material and type recommended by manufacturer.
         2. Aluminum Retaining Cap Fasteners: ASTM A 193/A 193M, Series 300 stainless steel screws; type as recommended by manufacturer.
         3. Connections to Supporting Structure: ASTM A 307, zinc coated steel fasteners.
         4. Anchor Bolts: ASTM A 307, Grade A, zinc coated steel anchor bolts.
         5. Concrete or Masonry Inserts: Zinc coated cast iron, malleable iron, or steel inserts; hot dip galvanized according to ASTM A 123.
      5. Framing System Gaskets and Joint Fillers: Manufacturer's standard permanent gaskets and joint fillers for sliding, compression, and nonmoving joints.
      6. Framing System Sealants: Compatible with components with which sealants come in contact and recommended by skylight and sealant manufacturers for this use.
      7. Bituminous Paint: Cold applied asphalt mastic paint complying with SSPC Paint 12, except containing no asbestos, and formulated for 30 mil (0.8 mm) thickness per coat.
   3. GLAZING MATERIALS
      1. Insulating Glass: Refer to Section 08 80 00 - Glazing.
      2. Glazing Gaskets: Manufacturer's standard pressure glazing gaskets of elastomer type and hardness selected by skylight and gasket manufacturers to comply with requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
      3. Spacers, Edge Blocks, and Setting Blocks: Manufacturer's standard permanent nonmigrating type of elastomer type and hardness selected to comply with requirements.
         1. For structural silicone glazing, provide bond breaking spacer gaskets and bonding setting blocks compatible with silicone sealants.
      4. Structural Silicone Sealant: ASTM C 1184, compatible with components with which sealant comes in contact, formulated and tested for use as a structural sealant, and neutral curing.
         1. Colour: Black.
         2. Tensile Strength: 690 kPa (100 psi) minimum.
         3. Provide sealant with modulus of elasticity that will not allow movement of more than 25 percent of joint width, unless less movement is required by skylight systems' design.
      5. Weather seal Sealant: Neutral curing silicone sealant recommended by skylight and sealant manufacturers for this use.
         1. Sealant is capable of withstanding 50 percent movement in both extension and compression (total of 100 percent movement) when tested for adhesion and cohesion under maximum cyclic movement according to ASTM C 719.
         2. Sealant complies with ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and, as applicable to substrates including other sealants with which it comes in contact, O.
         3. Colour: Black.
   4. FABRICATION
      1. Framing Components:
         1. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
         2. Fabricate components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
         3. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter.
         4. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.
         5. Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
         6. Fit and assemble components to greatest extent practicable before finishing.
         7. Fit and secure joints with screw and spline, internal reinforcement, or welding.
         8. Reinforce members as required to retain fastener threads.
         9. Where fasteners are exposed to view from interior, countersink bolt or screw heads and finish to match framing.
         10. Weld components before finishing and in concealed locations to greatest extent practicable to minimize distortion.
         11. Before shipping, shop assemble, mark, and disassemble components that cannot be permanently shop assembled.
      2. Provide continuous aluminum curb with weatherproof expansion joints and locked and sealed or fully welded corners. Locate weep holes in the curb at each rafter connection to drain condensation.
      3. Prepare framing to receive anchor and connection devices and fasteners.
   5. ALUMINUM FINISHES
      1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
      2. Protect finish with strippable protective film.
      3. Concealed Aluminum: As Fabricated Finish (Mill Finish); AA-M10 fabricated mechanical finish.

SPEC NOTE: Select Class 1 finish for highly corrosive exterior environments (sea salt). Select Class 2 finish for standard exposure.

* + 1. Clear Anodized Finish:
       1. Class I Finish: Architectural Class I, clear coating 0.018 mm or thicker in accordance with AAMA 611.
       2. Class II Finish: Architectural Class II, clear coating 0.010 mm or thicker in accordance with AAMA 611.
    2. **[Light Bronze] [Medium Bronze] [Dark Bronze] [Black]** Coloured Anodized Finish:
       1. Class II Finish: Architectural Class II, integrally coloured or electrolytically deposited colour coating 0.010 mm or thicker in accordance with AAMA 611.

SPEC NOTE: Select 2 coat for standard exterior projects; 3 coat for high end finish, corrosive exterior environments; acrylic enamel for interior projects.

* + 1. High Performance Organic Finish:
       1. Two (2) Coat PVDF or FEVE Coating:
          1. Manufacturer's standard 2 coat, thermo-cured system consisting of specially formulated inhibitive primer and colour topcoat and apply coating to exposed metal surfaces in accordance with AAMA 2605 and with coating and resin manufacturers' written instructions.
          2. Colour: **[As indicated in Section 09 06 05 Product and Finish Schedule.] [As selected by Consultant from manufacturer's full product range.]**
          3. Basis of Design Materials: PPG Duranar.
       2. Three (3) Coat Fluoropolymer Thermo-setting Enamel:
          1. All aluminum entrance and storefront framing exposed in the finished work shall have three coat fluoropolymer thermo-setting enamel conforming to AAMA 605.2-90, minimum 1.6 mils dry film thickness.
          2. Pre-treat aluminum after fabrication and apply primer and finish coats in strict accordance with manufacturer's written instructions.
          3. Colour: **[As indicated in Section 09 06 05 Product and Finish Schedule.] [As selected by Consultant from manufacturer's full product range.]**
          4. Basis of Design Materials: PPG 'Duranar XL.
    2. Acrylic Enamel Finish:
       1. One (1) Coat Acrylic Extrusion Coating:
          1. AA C12 Chemical Finish, cleaned with inhibited chemicals; C40 Chemical Finish, conversion coating; Rx Acrylic Coating, manufacturer's standard single coat factory spray applied acrylic coating; prepare, pre treat and apply coating to exposed metal surfaces to 0.020 mm or thicker in accordance with AAMA 2603 and with coating manufacturer's written instructions.
          2. Colour: **[As indicated in Section 09 06 05 "Product and Finish Schedule.”] [As selected by Consultant from manufacturer's full product range.]**
          3. Basis of Design Materials: PPG Duracron.
    3. Steel (Concealed):
       1. Hot-dip galvanized in accordance with CAN/CSA-G164, with minimum coating of 2 oz./sq.ft., or zinc rich paint.
    4. Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete contact. Use bituminous paint, butyl tape or other approved divorcing material.

1. Execution
   1. examination
      1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting skylight performance.
         1. Proceed with installation only after unsatisfactory conditions have been corrected.
   2. PREPARATION
      1. Furnish anchor bolts and inserts for setting in concrete formwork or masonry indicated to support skylights.
      2. Metal Protection: As follows:
         1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
         2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
         3. Where aluminum will contact pressure treated wood, separate dissimilar materials by methods recommended by manufacturer.
   3. INSTALLATION
      1. General: Comply with manufacturer's written instructions for protecting, handling, and installing skylight components.
         1. Fit frame joints to produce hairline joints free of burrs and distortion.
         2. Rigidly secure non-movement joints.
         3. Accommodate thermal and mechanical movements.
         4. Install framing components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
         5. Coordinate installation of insulation and flashings at skylight perimeters to maintain continuity of thermal and water barriers.
         6. Set continuous curbs and flashings in a full sealant bed, unless otherwise indicated. Comply with requirements in Section 07 92 00.
      2. Erection Tolerances: Install skylight components true in plane, accurately aligned, and without warp or rack. Adjust framing to comply with the following tolerances:
         1. Variation from Plane: Limit variation from plane or location shown to 3mm in 3m (1/8" in 10'); 6mm (1/4") over total length.
         2. Alignment: Where surfaces abut in line and at corners and where surfaces are separated by less than 75mm (3"), limit offset from true alignment to less than 0.8mm (1/32"); otherwise, limit offset from true alignment to 3mm (1/8").
      3. Field Glazing: As follows:
         1. Insulating Glass: Comply with requirements in Section 08 80 00 - Glazing.
         2. Structural Silicone Sealant Glazing: Prepare surfaces that will contact sealant and install sealant according to sealant manufacturer's written instructions. Preparation includes, but is not limited to, cleaning and priming. Mechanically fasten glazing in place until sealant cures. Clean excess sealant from surfaces before sealant cures.
      4. Install secondary sealant weather seal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.
   4. FIELD QUALITY CONTROL
      1. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field quality control tests and to prepare test reports.
      2. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field quality control tests and to prepare test reports.
      3. Sealant Adhesion Tests: Test installed sealant in a minimum of two areas and as follows:
         1. Test structural silicone sealant according to field adhesion test method described in AAMA CW 13, "Structural Sealant Glazing Systems (A Design Guide)."
         2. Test weatherseal sealant as recommended in writing by sealant manufacturer.
      4. Water Spray Test: Test skylights for compliance with requirements according to procedures in AAMA 501.2.
      5. Air Infiltration: Test skylights according to AAMA 503, which requires testing according to ASTM E 783.
         1. Static Air Pressure Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
         2. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.
      6. Water Penetration: Test skylights for compliance with requirements according to AAMA 503, which requires testing according to ASTM E 1105.
         1. Uniform Static Air Pressure Difference: 20 percent of positive design wind load, but not less than 300 Pa (6.24 lbf/sq. ft.).
      7. Repair or replace Work that does not meet requirements or that is damaged by testing; repair or replace to comply with specifications.
   5. CLEANING
      1. Clean skylights inside and outside, immediately after installation and after sealants have cured, according to manufacturer's written recommendations.
         1. Remove temporary protective coverings and strippable coatings from prefinished metal surfaces. Remove labels and markings from all components.
      2. Remove excess sealant according to sealant manufacturer's written recommendations.

END OF SECTION