SECTION 13 34 13 (13 34 13)
PRE-ENGINEERED GLASS STRUCTURES

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-engineered greenhouses.

B. Pre-engineered canopies.

C. Pre-engineered sunrooms.

D. Accessories.

E. Glass and glazing.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 03 41 16 - Precast Concrete Slabs.

C. Section 04 27 23 - Cavity Wall Unit Masonry.

D. Section 05 40 00 - Cold-Formed Metal Framing.

E. Section 06 10 00 - Rough Carpentry.

F. Section 06 20 00 - Finish Carpentry.

G. Section 07 21 19 - Foamed-In-Place Insulation.

H. Section 07 46 16 - Aluminum Siding.

I. Section 07 60 00 - Flashing and Sheet Metal.

J. Section 07 90 00 - Joint Protection.

1.3 REFERENCES

A. American Welding Society (AWS): Structural Welding Code.

B. ASTM International (ASTM):
1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
2. ASTM B308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
3. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
4. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure

Differences Across the Specimen.
5. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.

C. Fenestration and Glazing Industry Alliance (FGIA):
1. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
2. AAMA 611 - Voluntary Specifications for Anodized Architectural Aluminum.
3. AAMA 1503 - Voluntary Test Method For Thermal Transmittance And Condensation Resistance Of Windows, Doors, And Glazed Wall Sections.

D. Glass Association of North America (GANA): Glazing manual.

E. National Accreditation and Management Institute, Inc. (NAMI).

F. National Glass Association (NGA).

G. National Greenhouse Manufacturer's Association (NGMA).

H. National Sunroom Association (NSA).

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data:
1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.

C. Selection Samples: Two complete color chip sets representing manufacturer's full range of stocked colors with a standard size of 2 x 3 inches (50 x 75 mm).

D. Verification Samples: Two representative units of each type, size, color and finish.
1. Aluminum Finish: Two samples, minimum size of 2 x 3 inches (50 x 75 mm), representing actual material and color.
2. Wood Finish: Two samples, minimum size of 2 x 5 inches (50 x 127 mm), representing actual product and color.
3. Glazing: Two samples, minimum size of 12 x 12 inches (300 x 300 mm), representing specified glass, including coatings and frit patterns.
4. Assembly Sample: One sample demonstrating connection details with a maximum size of 12 x 12 x 12 inches (305 x 305 x 305 mm). Glazing included as offered by glass supplier. Sample developed to best represent the specified product.

E. Shop Drawings: Detailed drawings prepared specifically for the project by manufacturer. Include information not fully detailed in manufacturer's standard product data, including, but not limited to wall elevations and detail sections of every typical composite member.
1. Show opening dimensions, framed opening tolerances, profiles, product components, anchorages, and accessories.
2. Include details of materials, construction, finish, fastener locations, glazing, hardware arrangements and relationship with adjacent construction.
3. Include schedule identifying each unit, with marks or numbers referencing Drawings.

4. Show surrounding substrates and relevant conditions.

F. Maintenance Manuals: Manufacturer's maintenance manuals.

G. Warranty: Manufacturer's warranty online registry..

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum twenty (20) years documented experience in fabrication and erection of pre-engineered glass structures for projects of similar scope.
   1. Manufacturer must use an extruded aluminum system comprised of domestically produced aluminum and is fabricated and assembled in the USA.
   2. Manufacturer must be recognized by NAMI.
   3. Manufacturer must be a member in good standing of the National Sunroom Association (NSA).
   4. Manufacturer must be a member in good standing of the National Greenhouse Manufacturer's Association (NGMA).
   5. Manufacturer must be a member in good standing of the National Glass Association (NGA).

B. Installer Qualifications: Company experienced in performing Work of this section that has specialized in installation of work similar in scope and complexity required for this project for a minimum of twenty (20) years.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
   1. Intent of mock-up is to demonstrate surface preparation techniques, quality of workmanship and visual appearance.
   2. Approximate Size: 2 x 2 ft (610 x 610 mm).
   3. Refinish mock-up area as required to produce acceptable work.
   4. Do not continue with remaining work until workmanship, color, and sheen are approved by Architect.
   5. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
   6. Do not alter or remove mock-up until work is completed or removal is authorized.
   7. Retain mock-up during construction as standard for comparison with completed work.
   8. Incorporate accepted mock-up as part of the Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Convene a conference, by phone, approximately two weeks before scheduled commencement of the Work. Attendees to include Architect, Contractor and trades involved. Agenda to include schedule, responsibilities, critical path items and approvals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations. Store products in manufacturer's original unopened packaging, covered to protect factory finishes from damage, precipitation, and construction dirt until ready for installation. Store materials off construction grounds in a secure location that is a dry, covered area and protected from weather conditions.

B. Inspect and report any freight damages to the manufacturer immediately.

C. Protect from damage due to weather, excessive temperature, and construction operations.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

B. Perform structural silicone sealant work when air temperature is between 40 - 120 degrees F (4 - 49 degrees C).

1.9 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against defects in materials and workmanship.
   1. Warranty Period for Pre-Engineered Glass Structures: 10 year for cases of normal use.
   2. Warranty for Frame Finish:
      a. Anodized Finishes: Provide a warranty of 5 years.
      b. Stock Color AAMA 2605 Finishes: 2-3 coats powder or liquid dependent on color and/or application, provide paint manufacturer's warranty for color and film integrity for at least 15 years from date of application.
      c. Custom Color AAMA 2605 Finishes: 2-3 coats powder or liquid dependent on color and/or application, provide paint manufacturer's warranty for color and film integrity for at least 15 years from date of application.
      d. Stock Color AAMA 2604 Finishes: 2 coats powder or liquid, provide warranty for color and film integrity for 10 years from date of application.
      e. Custom Color AAMA 2604 Finishes: 2 coats powder or liquid, provide paint manufacturer's warranty for cracking and pulling integrity for 10 years from date of application.
      f. Custom AAMA 2603 Finishes: 1 coat liquid only, thermosetting acrylic resin finishes, provide warranty for cracking and pulling integrity for 5 years from date of application.
      g. Stock Color AAMA 2603 Finishes: 1 coat liquid only, provide paint manufacturer's warranty for cracking and pulling integrity for at least 5 years from date of application.
      h. Custom Warranty Period: ____ years, to be approved and accepted in writing by manufacturer based on project's scope and application.
   3. Warranty for Glazing: Provide glazing manufacturer's standard warranty against defective materials, delamination, seal failure, and defects in manufacturing for up to 20 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

B. Acceptable Manufacturer: Solar Innovations Architectural Glazing Systems, which is located at: 31 Roberts Rd.; Pine Grove, PA 17963; ASD Toll Free: 800-618-0669; Phone: 570-915-1500; Fax: 800-618-0743; Fax: 570-915-6083; Email: skylight@solarinnovations.com; Web: www.solarinnovations.com

C. Substitutions: Not permitted.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements and the following criteria.

2.2 Structural Calculations: For products specified; stamped by a professional engineer licensed in the state in which the Project is located.

2.3 PERFORMANCE REQUIREMENTS

A. Air and Water Leakage Performance:
1. Design, fabricate, assemble, and erect the aluminum glazed system to be permanently free of significant air leakage.
2. Significant leakage to be defined as a differential test pressure amounting to 20 percent of specified strength performance pressure required with operable windows doors, or joints, if any, sealed to prevent crack leakage.
3. Significant Air Leakage: No more than 0.30 cfm per sq ft (91.4 L per min per sq m) projected area of module, determined by ASTM E283.
   a. Supply certified testing reports adhering to the requirements set forth by ASTM E283 at the required pressure of 1.57 psf (75 Pa).
   b. Supply certified testing reports adhering to the requirements set forth by ASTM E283 at the required pressure of 6.24 psf (300 Pa).
4. Significant Water Leakage: Any uncontrolled penetration of water, determined by ASTM E331; at test pressure equal to 15 percent of positive wind pressure design, but not less than 6 psf (287 Pa).

B. Structural Performance: Structural performance as tested in accordance with ASTM E330; with no glass breakage or permanent damage to fasteners, anchors, hardware, or actuating mechanisms.
1. Normal wall deflection not exceeding 1/175 of clear span for span lengths of 162 inches (4115 mm) or less and 1/240 plus 1/4 inch (6 mm) for others. Restrict deflection to 3/4 inch (19 mm) maximum for individual glazing lites.
2. Parallel to wall deflection not exceeding 75 percent of glass edge clearance. Restrict deflection to L/360 or 1/8 inch (3 mm) maximum. Restrict deflection to 1/16 inch (1.6 mm) maximum above doors and/or windows. Increasing the deflection to 1/8 inch (3 mm) to be permitted if the door operation is not affected.
3. Deflection of the entire assembly, including, but not limited to, glass, not to exceed 1-1/2 inches (38 mm).

C. Thermal Performance: Tested values, certifications, and simulation protocols.
1. U-Value: Unit complies with U-value, NFRC rating, or simulation in accordance with NFRC 100 protocol, shown in manufacturer's published data for glazing and sill specified.
   a. U-Value: ___.
2. Solar Heat Gain Coefficient: Unit to comply with the Solar Heat Gain Coefficient NFRC rated, or simulation in accordance with NFRC 200 protocol, shown in manufacturers published data for the glazing and sill specified.
   a. SGHC: ___.
3. Visible Light Transmittance: Unit to be simulated for complete system visible light transmittance for the specific system details including glazing and required sill.
   a. Visible Light Transmittance: ___.
4. Testing Results: SI5200 Lean To Structure as manufactured by Solar Innovations Architectural Glazing Systems. NCTL-110-20222-1
   a. Air Infiltration Test (ASTM E283):
      1) Force of 1.6 psf (75 Pa): 0.06 cfm per sq ft (18 L per min per sq m) infiltration.
      2) Force of 6.2 psf (300 Pa): 0.14 cfm per sq ft (42 L per min per sq m) infiltration.
   b. Air Exfiltration Test (ASTM E283/ ASTM E547):
      1) Force of 1.6 psf (75 Pa): 0.05 cfm per sq ft (15 L per min per sq m) infiltration.

2) Force of 6.2 psf (300 Pa): 0.11 cfm per sq ft (33 L per min per sq m) infiltration.

c. Water Penetration Test (ASTM E331): Water pressure of 15.0 psf (718 Pa) and 5.0 gal per hour per sq ft (204 L per hour per sq m), no leakage.

d. Uniform Structural Load Test (ASTM E330):
   1) Positive Design Pressure: 65 psf (3112 Pa)

e. Florida Product Approval: Impact FL Approval No. Pending

2.4 PRE-ENGINEERED GLASS STRUCTURES

A. Pre-Engineered Glass Structures:
1. Basis of Design: SI5002 Conservatory as manufactured by Solar Innovations Architectural Glazing Systems.
2. Basis of Design: SI5004 Greenhouse as manufactured by Solar Innovations Architectural Glazing Systems.
3. Basis of Design: SI5007 Sunroom as manufactured by Solar Innovations Architectural Glazing Systems.
4. Basis of Design: SI5207 Pool Enclosure as manufactured by Solar Innovations Architectural Glazing Systems.
5. Basis of Design: SI5201 Glazed Walkway as manufactured by Solar Innovations Architectural Glazing Systems.
6. Basis of Design: As scheduled and indicated on Drawings.
7. Dimensions: As indicated on Drawings.
8. Dimensions:
   a. Width: _____.
   b. Length: _____.
   c. Projection: _____.
   d. Ridge Height: _____.
9. Roof Pitch: As indicated on Drawings.
10. Roof Pitch: _____.
11. Eave Height: As indicated on Drawings.
12. Eave Height: _____.
13. Eaves: As indicated on Drawings.
14. Eaves: Straight eave.
15. Eaves: Curved eave.
16. Eaves: None.
17. Configuration: As indicated on Drawings.
18. Configuration: Double pitch / even span.
19. Configuration: Lean-to.
20. Configuration: Conservatory nose.
21. Configuration: Custom, as indicated on Drawings.
22. Configuration: Ridge mount.
23. Configuration: Flat.
24. Drainage: Overlapping construction creates positive drainage within profiles.
25. Framing Members: As indicated on Drawings.
26. Framing Members: Aluminum.
27. Framing Members: Solid wood interior, aluminum exterior; aluminum base plate and pressure cap system.
28. Framing Members Thickness: Minimum .125 inch (3.2 mm) wall thickness for structural members.
29. Framing Members Thickness: As determined by manufacturer based on design loading, cross sectional configuration, and fabrication requirements.
30. Framing System: As indicated on Drawings.
31. Framing System: SI5207 LD System for conservatories and sunrooms as manufactured by Solar Innovations Architectural Glazing Systems.
    a. Size: As indicated on Drawings.

b. Size: 2 x 2 inches (50 x 50 mm), not including glazing depth.
c. Size: 2 x 2-13/16 inches (50 x 71 mm), not including glazing depth.
d. Size: 2 x 5-1/2 inches (50 x 140 mm), not including glazing depth.
e. Size: 2 x 8 inches (50 x 203 mm), not including glazing depth.

32. Framing System: SI5257 HD System for conservatories and sunrooms as manufactured by Solar Innovations Architectural Glazing Systems.
    a. Size: As indicated on Drawings.
    b. Size: 2-1/2 x 4 inches (64 x 102 mm), not including glazing depth.
    c. Size: 2-1/2 x 6 inches (64 x 152 mm), not including glazing depth.
    d. Size: 2-1/2 x 7 inches (64 x 178 mm), not including glazing depth.
    e. Size: 2-1/2 x 8 inches (64 x 203 mm), not including glazing depth.
33. Framing System: SI5204 Commercial System for greenhouses, sunrooms, and conservatories as manufactured by Solar Innovations Architectural Glazing Systems.
    a. Size: As indicated on Drawings.
    b. Size: 2 x 2 inches (50 x 50 mm), not including glazing depth.
    c. Size: 2 x 2-13/16 inches (50 x 71 mm), not including glazing depth.
    d. Size: 2 x 5-1/2 inches (50 x 140 mm), not including glazing depth.
    e. Size: 2 x 8 inches (50 x 203 mm), not including glazing depth.
34. Framing Member Cross Section: As required to accomplish performance criteria.
35. Framing Member Cross Section: _____.
36. Sills: As indicated on Drawings.
37. Sills: Standard sills.
38. Sills: Heavy sills.
39. Muntins: As indicated on Drawings.
40. Muntins: Standard muntins.
41. Muntins: 2-tier purlins.
42. Cover Caps: As indicated on Drawings.
43. Cover Caps: Flat cap.
44. Cover Caps: Beveled cap.
45. Cover Caps: Ogee cap.
46. Bay Centers: As indicated on Drawings.
47. Bay Centers: 30.5 inches (774.7 mm).
48. Bay Centers: 38 inches (965.2 mm).
49. Bay Centers: Custom, _____.
50. Basic Mullion and Purlin Design: As indicated on the Drawings.
51. Basic Mullion and Purlin Design: Uniform bay widths; dimension as recommended by manufacturer.
52. Glazing Accessories:
    a. Type: As indicated on Drawings.
    b. Type: Decorative mullions.
    c. Type: Interior grids, 3/16 x 5/8 inch (4.76 x 15.87 mm).
    d. Type: Simulated divided lites, 3/8 x 5/8 inch (9.52 x 15.87 mm).
    e. Type: Applied grids, 3/4 inch (19 mm) traditional grid.
    f. Type: Applied grids, 1-1/4 inch (32 mm) traditional grid.
    g. Type: Applied grids on monolithic glazing, 7/8 inch (22 mm) colonial grid.
    h. Type: Applied grids, 7/8 inch (22 mm) ogee grid.
    i. Type: Applied grids, 3/4 inch (19 mm) low profile grid.
    j. Type: Interior muntin grid on insulated glazing.
    k. Type: Interior and exterior applied grids with simulated divided lites (SDL), low profile grid.
    l. Type: Interior and exterior applied grids with simulated divided lites (SDL), Ogee grid.
    m. Type: Interior and exterior applied grids with simulated divided lites (SDL), traditional grid.
    n. Type: Interior and exterior applied grids with simulated divided lites (SDL), 1-1/4 inch (32 mm) traditional grid.

o. Type: Interior and exterior applied grids, arched grid.
p. Type: Interior and exterior applied grids, gothic grid.
q. Type: Interior and exterior applied grids, double gothic grid.
r. Type: Interior and exterior applied grids, English grid.
s. Type: Interior and exterior applied grids, traditional grid.
t. Type: Interior and exterior applied grids, cross grid.
u. Type: Decorative raised panels.

53. Screens:
    a. Type: As indicated on Drawings.
    b. Type: SI1000 Fixed screens as manufactured by Solar Innovations Architectural Glazing Systems.
    c. Type: SI1000 Operable screens as manufactured by Solar Innovations Architectural Glazing Systems.
    d. Type: SI1000 B-Series Horizontally Retractable Screen System as manufactured by Solar Innovations Architectural Glazing Systems.
    e. Type: SI1000 S-Series Motorized SC4500 Mastershade Vertically Retractable Screen System as manufactured by Solar Innovations Architectural Glazing Systems.
    f. Framing: Aluminum, 1 x 1 inch (25 x 25 mm).
    g. Screen Materials: As indicated on the Drawings.
    h. Screen Materials: Standard gray colored charcoal.
    i. Screen Materials: Fiberglass.
    j. Screen Materials: Aluminum.
    k. Screen Materials: Custom pet screens.
    l. Screen Materials: Black Tuffscreen mesh.
    m. Size: As indicated on the Drawings.
    n. Size: _____.
    o. Mounting and Configuration: As indicated on Drawings.
54. Accessories: As indicated on Drawings.
55. Accessories:
    a. Ridge vents, with thermal break.
    b. Eave vents, with thermal break.
    c. Awning windows, with thermal break.
    d. Casement windows, with thermal break.
    e. Operable skylights, with thermal break.
    f. Terrace doors, with thermal break.
    g. French doors, with thermal break.
    h. Pivot windows, with thermal break.
    i. Tilt turn windows, with thermal break.
    j. Hopper windows, with thermal break.
    k. Appliques.
    l. Corners.
    m. Corner posts.
    n. Ridge crests.
    o. Moldings.
    p. Decorative crowns.
    q. Decorative gutters.
    r. Palladian.
    s. Trim.
    t. Grids.
    u. Finials.
    v. Transom windows (fixed/operable)
    w. Shading systems; coordinate with building electrical service for wiring.

B. Greenhouse Operations Equipment:
    1. Ventilation:

a. Eave and Ridge Vent Operators:
    1) Arm and Rod operators
    2) Linear Actuator Motors: Designed specifically for the vent application; must be moisture resistant.
b. Horizontal Air Flow Fans (HAF):
    1) Shown on approved greenhouse Shop Drawings.
    2) Size and Location: Determined by the professional opinion of the greenhouse manufacturer and is to be shown on the approved greenhouse Shop Drawings.
c. Exhaust Fans: Supply and mount exhaust fans as shown on approved greenhouse Shop Drawings.
    1) Shown on approved greenhouse Shop Drawings.
    2) Size and Location: Determined by the professional opinion of the greenhouse manufacturer and is to be shown on approved greenhouse Shop Drawings.
d. Air Intake Shutters:
    1) Shown on approved greenhouse Shop Drawings.
    2) Size: Matched to required exhaust fans.

2. Cooling:
    a. Evaporative Coolers: Supply and mount evaporative coolers as shown on approved greenhouse Shop Drawings. Coolers to be manufactured by Champion or Essick Air or greenhouse manufacturer approved equal and sized accordingly to structure requirements by greenhouse manufacturer. Size and models to be represented on approved greenhouse Shop Drawings. Greenhouse Contractor will supply ducting into greenhouse based upon approved greenhouse Shop Drawings. General Contractor is responsible for supply of mounting pad location on level ground. Wiring hookup and plumbing hookup to be provided by other trades.
3. Heating:
    a. Natural Gas or LP Heaters: Supply and mount heater as shown on approved Shop Drawings. Gas heater to be manufactured by Modine or greenhouse manufacturer approved equal. Gas heater to be sized and located by greenhouse manufacturer and represented on approved greenhouse Shop Drawings.
4. Shading Systems:
    a. Vertical or Sloped Shade System:
        1) Shown on approved greenhouse Shop Drawings.
        2) Greenhouse shading system to be manufactured with Phifer Shearweave Solar shades or greenhouse manufacturer approved equal.
        3) Coordinate wiring with building electrical service.
    b. Horizontal Shade System:
        1) Shown on approved greenhouse Shop Drawings.
        2) Greenhouse shading system to be manufactured with Phifer Shearweave Solar shades or greenhouse manufacturer approved equal.
        3) Coordinate wiring with building electrical service.
5. Lighting:
    a. Grow Lights:
        1) Designed to provide adequate lighting for approved greenhouse bench layout.
        2) Switchable ballast for both metal halide and high pressure sodium bulb units.
        3) Mounted and located by greenhouse manufacturer.
        4) Shown on approved greenhouse Shop Drawings.
        5) Outfitted with molded plugs.
        6) Coordinate wiring of lighting circuit with.
    b. Task Lights: By others, coordinate with building electrical service.

6. Humidification:
    a. Foggers: Supply and mount atomizing/fogging fans as shown on approved greenhouse Shop Drawings.
    b. Size: Foggers to be sized and located by greenhouse manufacturer.
    c. Foggers manufactured by Jaybird Manufacturing or greenhouse manufacturer approved equal.
    d. Coordinate plumbing and wiring with other trades.
7. Watering Systems:
    a. Drip Irrigation:
        1) Bench mounted drip irrigation system manufactured by Dramm, Phytotronics or greenhouse manufacturer approved equal.
        2) System provides adequate drippers and punch tool to install future drippers to be supplied with system.
        3) Installed drippers outfitted with a shut-off mechanism for the individual nozzles.
        4) Coordinate plumbing and wiring with other trades.
    b. Misting Irrigation:
        1) Bench mounted misting irrigation system manufactured by Dramm, Phytotronics or greenhouse manufacturer approved equal.
        2) System provides adequate coverage for bench area.
        3) Coordinate plumbing and wiring with other trades.
8. Environmental Control System:
    a. Supply and mount a fully-functional control system with electrical control cabinets built specifically for the greenhouse based on the approved greenhouse Shop Drawings.
    b. Capable of controlling each zone independently using interior zone data and/or exterior data supplied by a weather station included in the control system.
    c. Includes PC interface software package.
    d. Includes complete electrical drawings and prints for final hook-up.
    e. Represented on the approved Shop Drawings for system mounting location.
    f. Mounting of sensors and weather station to be the responsibility of greenhouse manufacturer.
    g. Coordinate wiring of control system, sensors, and weather station with building electrical service.
    h. One day of training and on site commissioning to be completed by the control system manufacturer.
9. Greenhouse Benches:
    a. Manufacturer of greenhouse also to be manufacturer of greenhouse bench system.
    b. Greenhouse benches to be shown on approved greenhouse Shop Drawings.
    c. If bench mounted irrigation is selected, irrigation system to also be represented on the approved greenhouse Shop Drawings.
    d. Greenhouse bench layout to be coordinated between greenhouse manufacturer and Architect for final approval.

C. Materials:
1. Aluminum Flashing and Closures:
    a. Alloy and Temper: As indicated on Drawings.
    b. Alloy and Temper: 6063-T1
    c. Alloy and Temper: 6063-T4
    d. Alloy and Temper: 6063-T5.
    e. Alloy and Temper: 6063-T6.
    f. Alloy and Temper: 6061-T6.
    g. Sheet Aluminum Finish: Matching system components.
    h. Thickness: Minimum 0.040 inch (1 mm) thick.
    i. Attachment: Secured with concealed fastening method or fastener with head

finished to match system components.

j. Snap-on Covers and Miscellaneous Non-Structural Trim: Minimum thickness as recommended by manufacturer.

2. Wood: Solid wood mahogany; laminated members permitted for structural purpose, except in high moisture environments.
   a. Wood Compliance: FSC Certified components.
3. Insulation: Expanded polystyrene insulation at filler panels and sheet metal members.
4. Internal Reinforcing:
   a. Structural Aluminum Compliance: ASTM B308.
   b. Carbon Steel Compliance: ASTM A36.
5. Structural Glazing Sealant: Manufacturer's standard, black.
6. Perimeter Sealant: As indicated on Drawings.
7. Perimeter Sealant: Manufacturer's standard, color to match framing finish.
8. Perimeter Sealant: Manufacturer's standard, color as selected from manufacturer's standard range.
9. Glazing: As indicated on Drawings.
10. Glazing: Single pane, 3/16 inch (5 mm) float glass.
11. Glazing: Single pane, 1/4 inch (7 mm) float glass.
12. Glazing: Single pane, polycarbonate.
13. Glazing: Custom, single pane, _____.
14. Glazing: Double pane glazing, 1 inch (25 mm) insulated glass unit.
    a. Outboard Glazing Lites: As indicated on Drawings.
    b. Outboard Glazing Lites: 3/16 inch (5 mm) tempered clear glass with LoE 272 low-emissivity coating on surface two.
       1) Visible Light Transmittance: 72 percent.
       2) Solar Heat Gain Coefficient: 0.41.
    c. Outboard Glazing Lites: 3/16 inch (5 mm) tempered clear glass with LoE 366 low-emissivity coating on surface two.
       1) Visible Light Transmittance: 65 percent.
       2) Solar Heat Gain Coefficient: 0.27.
    d. Outboard Glazing Lites: 3/16 inch (5 mm) tempered clear glass with LoE 340 low-emissivity coating on surface two.
       1) Visible Light Transmittance: 39 percent.
       2) Solar Heat Gain Coefficient: 0.18.
    e. Vertical Inboard Glazing Lites: 3/16 inch (5 mm) tempered clear glass.
    f. Sloped Inboard Glazing Lites: 5/16 inch (8 mm) annealed clear laminated glass with an .060 PVB interlayer.
    g. Air spacer: Stainless steel spacer with dual seals of polyisobutylene/silicone and filled with argon gas.
15. Glazing: Specialty, electrochromic glass; can be controlled through a building automation system or manually; shading, glare, and HVAC can be controlled.
16. Glazing: Specialty, thermochromic.
17. Glazing: Specialty, Solera Glass light diffusion glazing system.
18. Glazing: Specialty, Lumira Polycarbonate filled polycarbonate panels.
19. Glazing: Decorative, _____.
20. Glazing: Decorative, Pattern 62.
21. Glazing: Decorative, single glue chip.
22. Glazing: Decorative, glue chip.
23. Glazing: Decorative, English reeded.
24. Glazing: Decorative, satin/acid etch.
25. Glazing Gaskets: Compatible with glazing sealant.
    a. Compliance: ASTM C864.
    b. Design Compression type, replaceable, EPDM gaskets; with solid strand cord to prevent shrinkage.
    c. Color: Manufacturer's standard, black.
26. Setting Blocks, Edge Blocks, and Spacers: As recommended by manufacturer and

compatible with insulated glass.

27. Fasteners: Aluminum and stainless steel, not causing electrolytic action or corrosion.
28. Fasteners: Zinc Cadmium-plated, acceptable in locations as approved by manufacturer.
29. Finish for Exposed Fasteners: To match finish of aluminum frame.

D. Finishes:
1. Aluminum Glazing Frames: As scheduled and indicated on Drawings.
2. Aluminum Glazing Frames: Dual color, as indicated on Drawings.
3. Aluminum Glazing Frames: Dual finish, as indicated on Drawings.
4. Aluminum Glazing Frames: Mill finish, unfinished.
5. Aluminum Glazing Frames: Manufacturer's standard white stock finish, AAMA 2603.
6. Aluminum Glazing Frames: Manufacturer's standard bronze stock finish, AAMA 2603.
7. Aluminum Glazing Frames: Manufacturer's standard clear anodized finish, Class I AAMA 611.
8. Aluminum Glazing Frames: Manufacturer's standard dark bronze anodized, Class 1 AAMA 611.
9. Aluminum Glazing Frames: Manufacturer's Designer black finish, AAMA 2603.
10. Aluminum Glazing Frames: Manufacturer's Designer sandstone finish, AAMA 2603.
11. Aluminum Glazing Frames: Manufacturer's Designer natural clay finish, AAMA 2603.
12. Aluminum Glazing Frames: Manufacturer's Designer Hartford green finish, AAMA 2603.
13. Aluminum Glazing Frames: Copper cladding.
14. Aluminum Glazing Frames: Lead coated copper cladding.
15. Aluminum Glazing Frames: 304 stainless steel cladding with No. 4 satin finish.
16. Aluminum Glazing Frames: 304 stainless steel cladding with No. 8 mirror finish.
17. Aluminum Glazing Frames: Powder coating solids finish, bone white, AAMA 2604.
18. Aluminum Glazing Frames: Powder coating solids finish, fashion gray, AAMA 2604.
19. Aluminum Glazing Frames: Powder coating solids finish, colonial gray, AAMA 2604.
20. Aluminum Glazing Frames: Powder coating solids finish, military light blue, AAMA 2604.
21. Aluminum Glazing Frames: Powder coating solids finish, burgundy, AAMA 2604.
22. Aluminum Glazing Frames: Powder coating solids finish, charcoal, AAMA 2604.
23. Aluminum Glazing Frames: Powder coating solids finish, bone white, AAMA 2605.
24. Aluminum Glazing Frames: Powder coating solids finish, fashion gray, AAMA 2605.
25. Aluminum Glazing Frames: Powder coating solids finish, colonial gray, AAMA 2605.
26. Aluminum Glazing Frames: Powder coating solids finish, military light blue, AAMA 2605.
27. Aluminum Glazing Frames: Powder coating solids finish, burgundy, AAMA 2605.
28. Aluminum Glazing Frames: Powder coating solids finish, charcoal, AAMA 2605.
29. Aluminum Glazing Frames: Powder coating metallics finish, champagne, AAMA 2604.
30. Aluminum Glazing Frames: Powder coating metallics finish, cosmic gray, AAMA 2604.
31. Aluminum Glazing Frames: Powder coating metallics finish, light bronze, AAMA 2604.
32. Aluminum Glazing Frames: Powder coating metallics finish, copper, AAMA 2604.
33. Aluminum Glazing Frames: Powder coating metallics finish, champagne, AAMA 2605.
34. Aluminum Glazing Frames: Powder coating metallics finish, cosmic gray, AAMA 2605.
35. Aluminum Glazing Frames: Powder coating metallics finish, light bronze, AAMA 2605.
36. Aluminum Glazing Frames: Powder coating metallics finish, copper, AAMA 2605.
37. Aluminum Glazing Frames: Acacia 1001, Light DS 716 textured faux wood finish.
38. Aluminum Glazing Frames: Acacia 1001, Light DS 402 smooth faux wood finish.
39. Aluminum Glazing Frames: Acacia 1001, Dark DS 733 textured faux wood finish.
40. Aluminum Glazing Frames: Acacia 1001, Dark DS 403 smooth faux wood finish.
41. Aluminum Glazing Frames: Cherry 1402 DS 716 textured faux wood finish.
42. Aluminum Glazing Frames: Cherry 1402 DS 402 smooth faux wood finish.
43. Aluminum Glazing Frames: Cherry 1402 DS 733 textured faux wood finish.
44. Aluminum Glazing Frames: Cherry 1402 DS 403 smooth faux wood finish.

45. Aluminum Glazing Frames: Dark walnut 1802 DS 733 textured faux wood finish.
46. Aluminum Glazing Frames: Dark walnut 1802 DS 403 smooth faux wood finish.
47. Aluminum Glazing Frames: Douglas fir 1501 DS 716 textured faux wood finish.
48. Aluminum Glazing Frames: Douglas fir 1501 DS 402 smooth faux wood finish.
49. Aluminum Glazing Frames: Knotty pine 2103 DS 716 textured faux wood finish.
50. Aluminum Glazing Frames: Knotty pine 2103 DS 402 smooth faux wood finish.
51. Aluminum Glazing Frames: Oak assi 2501 DS 733 textured faux wood finish.
52. Aluminum Glazing Frames: Oak assi 2501 DS 403 smooth faux wood finish.
53. Aluminum Glazing Frames: Teak 2601 DS 706 textured mahogany faux wood finish.
54. Aluminum Glazing Frames: National walnut 1806 DS 706 textured mahogany faux wood finish.
55. Aluminum Screen Frames: Finish as indicated on Drawings.
56. Aluminum Screen Frames: _____.
57. Aluminum Screen Frames: Finish to match frames.
58. Wood Finish: As indicated on Drawings.
59. Wood Finish: Unfinished.
60. Wood Finish: Manufacturer's standard water based sealer, ICA 3-coat clear, consisting of impregnating agent, base coat, and top coat.

E. Fabrication:
1. Fabricate components in accordance with approved Shop Drawings.
2. Major fabrication must done at the manufacturing location.
3. Install gaskets and tapes at factory.
4. Disassemble only to the extent necessary for shipping and handling limitations.
5. Manufacturer is to be notified of any field modification prior to the activity commencing.
6. Welding is to comply with standards set forth by the American Welding Society.
7. Factory-grind exposed welds smooth and flush with adjacent surfaces prior to finish application; restore mechanical finish.
8. Isolation membrane materials to be used to separate dissimilar metals to prevent galvanic corrosion/action between materials.
9. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weather tight. Ensure slip joints make full, tight contact and are weathertight.
10. Steel Components:
    a. Clean surfaces after fabrication and immediately prior to application of primer in accord with manufacturer's recommendations.
    b. Apply specified shop coat primer in accordance with manufacturer's instructions to provide 1.0 mil (0.05 mm) minimum dry film thickness.
11. Fabricate components true to detail and free from defects impairing appearance, strength or durability.
12. Provide contoured exterior horizontal or purlin glazing retainers to minimize water, ice, and snow buildup.
13. Fabricate with removable sill and head stop.
14. Reinforce components at anchorage and support points, joints, and attachment points for interfacing work.
15. Accurately size glazing to fit openings allowing for clearances as set forth by the "Glazing Manual" published by the Glass Association of North America (GANA).
16. Cut glass clean and carefully. Nicks and damaged edges will not be accepted. Replace glass with damaged edges.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Prepare substrates in strict accordance with the approved Shop Drawings, using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions. Thoroughly clean surfaces and substrates prior to installation.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals and in proper relationship with adjacent construction.
   1. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.
   2. Provide attachments and shims to permanently fasten system to building structure.
   3. Maintain dimensional tolerances and alignment with adjacent work.
   4. Anchor securely in place, allowing for required movement, including but limited to expansion and contraction.
   5. Install glazing sealants in accordance with manufacturer's instructions, including but not limited to surface preparations.
   6. Set sill members in bed of sealant. Set other members with internal sealants to provide weather tight construction.
   7. Install flashings, bent metal closures, corners, gutters, and other accessories as detailed on Shop Drawings and required for complete installation.
   8. Clean surfaces and install sealant in accordance with sealant manufacturer's instructions and guidelines.

3.3 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.4 TESTING AND ADJUSTING

A. Adjust hinge set, locksets, and other hardware for proper operation. Lubricate using a manufacturer approved lubricant compatible with frame coatings.

B. Greenhouse installer to complete a water test to the AAMA 501.2 standard with AAMA standard equipment with Architect or general Contractor in presence.

3.5 TRAINING

A. Greenhouse installer to provide one onsite day of training on operations and maintenance of the greenhouse structure in the presence of all requested parties.

B. Greenhouse installer to coordinate onsite visit, commissioning, and training of greenhouse control system by greenhouse control system manufacturer.

3.6 CLEANING AND PROTECTION

A. Clean and protect products in accordance with the manufacturer's recommendations.

1. Remove temporary coverings and protection of adjacent work areas.
2. Clean and dress sealant prior to installation completion.
3. Clean glass prior to installation completion.
4. Clean the entire enclosure one time at the completion of the installation. Cleaning to include surface cleaning of aluminum framing and glass and cleanup of construction debris.

B. Touch-up, repair or replace damaged products before Substantial Completion.
   1. Areas with Abraded Surface Finish: Clean and touch-up with air dry paint, as approved and furnished by window manufacturer, color to match factory applied finish.

END OF SECTION