

## **SECTION #13 34 13.13 – GREENHOUSES**

### **BY SOLAR INNOVATIONS®**

**\*\*\*Note to Specifier:**

**This section is based on the products of Solar Innovations®, which is located at:**

**31 Roberts Road  
Pine Grove, PA 17963  
Phone 800-618-0669; Fax 800-618-0743;  
Email: skylight@solarinnovations.com  
Website: www.solarinnovations.com**

**Solar Innovations® is a leading manufacturer of the highest quality aluminum and wood structures. Their comprehensive product line includes conservatories; greenhouses; solariums; skylights; pool and spa enclosures; folding and stacking glass walls; walkways; canopies; sliding, terrace, pivot, and lift slide doors; and more. Solar Innovations® strives to produce products tailored to each particular need, residential or commercial.**

**This specification includes Solar Innovations®'s greenhouses that are available in any size, design, or color with custom and standard options at comparable prices. If you can imagine it, Solar Innovations® can build it.**

### **PART 1 – GENERAL**

#### **1.01 SECTION INCLUDES**

**\*\*\*Note to Specifier: Delete items below not required for project.**

1. Greenhouses
2. Accessories
3. Glass and glazing

#### **1.02 RELATED SECTIONS**

**\*\*\*Note to Specifier: Delete items below not required for project; add others as required**

- A. Section 033000 – Cast-in-place Concrete – Openings in cast-in-place concrete
- B. Section 034500 – Precast Concrete Wall Panels: Opening in precast concrete wall panels.
- C. Section 048100 – Unit Masonry Assemblies – Openings in masonry
- D. Section 054000 – Cold Formed Metal Framing: Framed Openings
- E. Section 061000 – Rough Carpentry: Framed Openings
- F. Section 062000 – Finish Carpentry: Interior Wood Casing
- G. Section 072100 – Thermal insulation: batt insulation at window perimeter
- H. Section 074600 – Siding and Trim
- I. Section 076200 – Flashing and Sheet Metal: Flashing associated with windows and doors
- J. Section 079200 – Joint Sealers

### 1.03 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date
- B. All reference amendments adopted prior to the effective date of this Specification shall be applicable to this Project
- C. All materials, installation, and workmanship shall comply with the applicable requirements and standards addressed within the following references:

**\*\*\*Note to Specifier: Delete any references below that are not required by the project, and add others as required.**

1. AAMA611 – Voluntary specifications for anodized architectural aluminum (revised).
2. AAMA1503 – Voluntary test method for thermal transmittance and condensation resistance of windows, doors, and glazed wall sections
3. ASTM A36/A36M – Standard specification for carbon structural steel
4. ASTM B221/B221M – Standard specification for aluminum and aluminum-alloy extruded bars, rods, wires, profiles, and tubes
5. ASTM B241/B241M – Standard specification for aluminum and aluminum-alloy seamless pipe and seamless tubes
6. ASTM C1115 – Standard specification for dense elastomeric silicone rubber gaskets and accessories
7. ASTM C864 – Standard specification for dense elastomeric compression seal gaskets, setting blocks, and spacers
8. ASTM E283 – Standard test method for structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.

9. ASTM E330 – Standard test method for structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference
10. ASTM E331 – Standard test method for water penetration of exterior windows, curtain walls, and doors by uniform static air pressure difference
11. ASTM E547 – Water penetration of exterior windows, curtain walls, and doors.
12. ASTM E1886 – Standard test method for performance of exterior windows, curtain walls, doors, and impact protective systems impacted by missiles and exposed to cyclic pressure differentials
13. ASTM E 1996 – Standard specification for performance of exterior windows, curtain walls, doors, and impact protective systems impacted by windborne debris in hurricanes
14. AWS D1 – Structural welding code
15. FGMA – Flat glass marketing association, glazing manual

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Air and Water Leakage – Design, fabricate, assemble, and erect the aluminum glazed system to be permanently free of significant air leakage. Significant leakage shall 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.
1. Significant Air Leakage – No more than 0.18 cfm per square foot (projected area of module), determine by ASTM 283
    - a. Supply certified testing report(s) adhering to the requirements set forth by ASTM-E283 at the required pressure of 1.57psf and 75Pa.
    - b. Supply certified testing report(s) adhering to the requirements set forth by ASTM-E283 at the required pressure of 6.24psf and 300Pa.
  2. Significant Water Leakage – Any uncontrolled penetration of water, determined by ASTM E 331; at test pressure equal to 10% of positive wind pressure design, but not less than 12psf.
- 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 should not exceed 1/175 of clear span for span lengths of 13'6" or less and 1/240 + 1/4" for all others. Restrict deflection to 3/4" maximum for individual glazing lites.

2. Parallel to wall deflection should not exceed 75% of glass edge clearance. Restrict deflection to L/360 or 1/8" maximum. Restrict deflection to 1/16" maximum above doors and/or windows. It shall be permitted to increase the deflection to 1/8" if the door operation is not affected.
3. Deflection of the entire assembly, including, but not limited to, glass, shall not exceed 1 1/2"

C. Thermal Performance – Tested values, certifications, and simulation protocols

1. U-Value – Unit to comply with the U-value NFRC rated, or simulated in accordance with NFRC 100 protocol, shown in manufacturers latest published data for the glazing and sill specified.
  - a. U-Value requirement – Based on glazing (consult manufacturer)
2. Solar Heat Gain Coefficient – Unit to comply with the Solar Heat Gain Coefficient NFRC rated, or simulated in accordance with NFRC 200 protocol, shown in manufacturers latest published data for the glazing and sill specified.
  - a. SHGC requirement – Based on glazing (consult manufacturer)
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– Based on glazing (consult manufacturer)

## 1.05 MANUFACTURER'S CERTIFICATES

**\*\*\*Note to Specifier: Select the appropriate set of test results for the project details. Delete all other paragraphs.**

### A. SI5600 Pyramid Skylight

1. Air Infiltration Test – ASTM E283
  - a. Force of 1.57psf = 0.18cfm/ft<sup>2</sup> infiltration
  - b. Force of 6.24psf = 0.09cfm/ft<sup>2</sup> infiltration
2. Water Penetration Test – ASTM E331
  - a. Water pressure of 30.0psf 5gph/ft<sup>2</sup> = no leakage

3. Uniform Structural Load Test – ASTM E330
  - a. Force of 130psf exterior = 0.065" permanent set (overload)
  - b. Force of 130psf interior = 0.001" permanent set (overload)
4. Florida Product Approval
  - a. Impact FL# 11259.1

#### 1.06 SUBMITTALS

- A. Submit under the provisions of Section 013000 for review and approval for fabrication.
- B. 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. Show opening dimensions, framed opening tolerances, profiles, product components, anchorages, and accessories.
  1. Indicate fastener locations, glazing, and hardware arrangements
  2. Include schedule identifying each unit, with marks or numbers referencing drawings
  3. Must show all surrounding substrates and relevant conditions
  4. Must be drawn in the domestic USA, by the manufacturer of the system.
- C. Product Data – Manufacturer's data sheets on each product to be used, including:
  1. Storage and handling requirements and recommendations
  2. Preparation instructions and recommendations
  3. Installation methods

**\*\*\*Note to Specifier: Delete color section samples if colors have been pre-selected.**

- D. Color Samples – Two complete color chip sets representing manufacturer's full range of stocked colors with a standard size of 2" x 3" (50mm x 75mm).
- E. Verification Samples – required samples for verification of system
  1. Aluminum Finish – Two samples, minimum size of 2" x 3" (50mm x 75mm), representing actual product and color.
  2. Glazing – Two samples, minimum size of 12" x 12" (300mm x 300mm), representing specified glass, including coatings and/or frit pattern(s).

**\*\*\*Note to Specifier: Assembly sample provided upon request only.**

3. Assembly Sample – One sample illustration connection details with a maximum size of 12" x 12" x 12". Glazing included as offered by glass supplier. Sample developed to best represent the specified product.

1.07 QUALITY ASSURANCE

A. Manufacturer qualifications – company shall be a company specializing in the manufacturing of products specified in this section. Manufacturer shall have at least nineteen (19) years of experience in fabrication and erection of projects of similar scope.

1. Manufacturer must use an extruded aluminum system comprised of domestically produced aluminum and is fabricated/assembled in the use.
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).
6. Manufacturing facility must have achieved Gold LEED certification

B. Installer Qualifications – Installer shall be experienced in performing the work of this section that has specialized in installation of work similar to that required for this project for a minimum of nineteen (19) years.

**\*\*\*Note to Specifier: Include a mock-up if the project size and/or scope warrant taking such a precaution. The following is one example of how a mock-up on a large project might be specified. When deciding on the extent of the mock-up, consider all the major different types of work on the project and consult with product manufacturer prior to selection.**

C. Mock-ups

1. Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - a. Approximate size: \_\_\_\_\_
  - b. Finish areas designated by Architect

- c. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
- d. Refinish mock-up area as required to produce acceptable work.
- e. Incorporate accepted mock-up as part of the Work.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the jobsite freight prepaid.
- B. Store products in manufacturer's original unopened packaging, covered to protect factory finishes from damage, precipitation, and construction dirt until ready for installation
- C. Store materials off construction grounds in a secure location that is a dry, covered area and protected from weather conditions
- D. Inspect and report any freight damages to the manufacturer immediately.

#### 1.09 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimal results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Perform structural silicone sealant work when air temperature is above 10° F (minus 12° C)

#### 1.10 WARRANTY

- A. Provide manufacturer's limited warranty that all components are warranted for one (1) year for cases of normal use. Many components are also warranted by the original manufacturers for greater lengths of time. Reference original warranty for complete warranty time frames.
- B. Warranty Addendum – Manufacturer offers extended warranties and service contracts on a per job basis.

**\*\*\*Note to Specifier: Delete warranties below that do not apply to the selected finish(es).**

#### C. Frame Finish

- 1. For anodized finishes provide a warranty of five (5) years.
- 2. For stock color AAMA 2605 finishes with 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 fifteen (15) years from date of application.

3. For custom color AAMA 2605 finishes with 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 fifteen (15) years from date of application.
4. For stock color AAMA 2604 finishes with 2 coats powder or liquid, provide warranty for color and film integrity for ten (10) years from date of application.
5. For custom color AAMA 2604 with 2 coats powder or liquid, provide paint manufacturer's warranty for cracking and pulling integrity for ten (10) years from date of application.
6. For stock AAMA 2603 finishes with 1 coat liquid only, thermosetting acrylic resin finishes, provide warranty for cracking and pulling integrity for five (5) years from date of application.
7. For custom color AAMA 2603 finishes with 1 coat liquid only, provide paint manufacturer's warranty for cracking and pulling integrity for at least five (5) years from date of application.
8. Custom warranty period, \_\_\_\_ years, to be approved and accepted in writing by Solar Innovations® based on project's scope and application

**\*\*\*Note to Specifier: Under extreme conditions, warranties for glazing may be less than 20 years. Verify conditions with manufacturers. Delete the following paragraph if not required; edit to suit conditions.**

D. For glazing, provide glazing manufacturer's standard warranty against defective materials, delamination, seal failure, and defects in manufacturing for up to twenty (20) years.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Product based on Solar Innovations® Greenhouse Systems, as provided by:  
Solar Innovations®  
31 Roberts Road  
Pine Grove, PA 17963  
Phone 800-618-0669 / Fax: 800-618-0743  
Email: [skylight@solarinnovations.com](mailto:skylight@solarinnovations.com)  
Website: [www.solarinnovations.com](http://www.solarinnovations.com)

**\*\*\*Note to Specifier: Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.**



B. Substitutions not permitted

## 2.02 GREENHOUSES

A. Greenhouse – SI5004

a. Dimensions

- (1) Width – \_\_\_\_\_
- (2) Length – \_\_\_\_\_
- (3) Projection – \_\_\_\_\_
- (4) Ridge Height – \_\_\_\_\_
- (5) As indicated on the Drawings

**\*\*\*Note to Specifier: Through use of custom curves composed of laminated glass, custom curved eave structures can be provided with roof pitches varying from a 2/12 to an 8/12 and can meet any specified length. Straight eave enclosures can be designed with any roof pitch from 2/12 to 12/12 or greater.**

- (6) Roof Pitch – \_\_\_\_\_
- (7) Eave Height – \_\_\_\_\_

b. Configuration

**\*\*\*Note to Specifier: Delete one of the following two paragraphs**

- (1) Straight Eave
- (2) Curved eave

**\*\*\*Note to Specifier: Delete one of the following two paragraphs**

- (3) Double Pitch/ Even Span
- (4) Lean-to

**\*\*\*Note to Specifier: Consult manufacturer prior to completing this section of the specifications to verify glass solution matches intended application and safety requirements (laminated layers) of product. The manufacturer will select the type of glazing for the project based on project location, site, use of structure, and input from the Architect. If glazing type has been determined, modify the following to indicate type, thickness, tint, and other specific requirements.**

## B. Glazing

1. Single pane glazing options (define variances between sloped and vertical glazing as needed.)
  - a. 3/16" (5mm) float glass
  - b. 1/4" (7mm) float glass
  - c. Polycarbonate
  - d. Other: \_\_\_\_\_
2. Double pane glazing options (verify variances between sloped and vertical glazing as needed.)
  - a. 1" insulated glass unit
    - (1) Outboard glazing lite – 3/16" tempered clear glass with LoE 272 low-emissivity coating on surface two
    - (2) Air spacer – Stainless Steel spacer with dual seals of polyisobutylene/silicone and filled with argon gas
    - (3) Vertical inboard glazing lite – 3/16" tempered clear glass
    - (4) Sloped inboard glazing lite – 5/16" annealed clear laminated glass with an .060PVB interlayer
3. Specialty glazing options (job specification sections can be provided for the following specialty glazing options.)

**\*\*\*Note to Specifier: Discuss all specialty glazing options with the manufacturer to determine viability, benefits, and recommended installation locations.**

- a. Electrochromic Glass – glazing system that can be controlled through a building automation system, greenhouse automation system, or manually; shading, glare, and HVAC can all be controlled.
  - b. Thermochromic Glass – glazing system that is 'tinted' via natural heat
4. Glazing Accessories
    - a. Decorative Mullions
    - b. Interior Grids – 3/16" x 5/8" (4.76mm x 15.87mm)
    - c. Simulated Divided Lites – 3/8" x 5/8" (9.52mm x 15.87mm)
    - d. Applied Grids
      - (1) 3/4" traditional grids
      - (2) 1 1/4" traditional grids

- (3) 7/8" colonial grids
- (4) 7/8" ogee grid
- (5) 3/4" low profile grid

e. Decorative Raised Panels

### C. Framing Members

#### 1. Framing Members – Aluminum

**\*\*\*Note to Specifier: Edit paragraphs appropriately.**

- a. SI5204 – LD System – 2" (50mm) by:
  - (1) 2" (50mm), not including glazing depth.
  - (2) 2 13/16" (71mm), not including glazing depth.
  - (3) 5 1/2" (139.7mm), not including glazing depth.
  - (4) 8" (203.2mm), not including glazing depth.
- b. SI5204I –I-Beam System – 2" (50mm) by:
  - (1) 2" (50mm), not including glazing depth.
  - (2) 2 13/16" (71mm), not including glazing depth.
- c. SI5204R – Restoration System – 2" (50mm) by:
  - (1) 2" (50mm), not including glazing depth.
- d. SI5254 – HD System – 2 1/2" (63.5mm) by
  - (1) 4" (101.6mm), not including glazing depth.
  - (2) 6" (152.4mm), not including glazing depth.
  - (3) 7" (177.8mm), not including glazing depth.
  - (4) 8" (203.2mm), not including glazing depth.
- e. Framing Member Cross Section – As required to accomplish performance criteria.
  - (1) Framing Member Cross Section - \_\_\_\_\_

**\*\*\*Note to Specifier: The following is applicable only on curved eave even-span structures. Standard bay width options are for 14.75° pitches. 30.5" bay centers are the only option available for 30° pitch.**

- a. Bay Centers

- (1) Bay Centers – 30.5" (774.7mm)
- (2) Bay Centers – 38" (965.2mm)
- (3) Bay Centers – 46.5" (1181.1mm)
- (4) Custom Bay Centers: \_\_\_\_

**\*\*\*Note to Specifier: Retain or add accessories desire for structure. All accessories must be included in submitted architectural drawings.**

D.Accessories – all operable accessories must include a thermal break

- a. Awning Windows (Must be thermally broken)
- b. Casement Windows (Must be thermally broken)
- c. Operable Skylights (Must be thermally broken)
- d. Terrace Door (Must be thermally broken)
- e. French Doors (Must be thermally broken)
- f. Pivot Windows (Must be thermally broken)
- g. Tilt Turn Windows (Must be thermally broken)
- h. Hopper Windows (Must be thermally broken)
- i. Appliques
- j. Corners
- k. Corner Posts
- l. Ridge Crests
- m. Moldings
- n. Decorative Crown
- o. Decorative Gutter
- p. Palladian
- q. Trims
- r. Grids
- s. Finials
- t. Transom Band

**\*\*\*Note to Specifier: Provide the design intent of the mullion(s) here or as indicated on the Drawings. For instance, the design may call for the use of mullion(s) to break up the glass to match the pattern on an existing structure. Any type of guideline for design the Architect can provide will assist the manufacturer in a workable design solution. Select one of the following options or modify to reflect actual design intents. Obtain the manufacturer's approval of design shown on Drawings.**

- u. Mullion and Purlin Design

- (1) Basic Mullion and Purlin Design – Uniform bay widths; dimension as recommended by manufacturer.
- (2) Basic Mullion and Purlin Design – As indicated on the Drawings.

**\*\*\*Note to Specifier: Many code jurisdictions have their own local code requirements. Provide local code requirements under which the project is being designed; i.e. Uniform Building Code, 1997 Edition with local amendments. If project location is only national code jurisdiction, indicate as such.**

E. Local Code Jurisdiction - \_\_\_\_\_

## 2.03 GREENHOUSE OPERATIONS EQUIPMENT

### A. Ventilation

1. Eave and ridge vent operators – Linear actuator motors designed specifically for the vent application. Motor must be moisture resistant.
2. Horizontal air flow fan(s) (HAF) – Supply and mount fans as shown on approved greenhouse shop drawings. Size and location is to be determined by the professional opinion of the greenhouse manufacturer and is to be shown on the approved greenhouse shop drawings.
3. Exhaust fan(s) – Supply and mount exhaust fans as shown on approved greenhouse shop drawings. Size and location is to be determined by the professional opinion of the greenhouse manufacturer and is to be shown on approved greenhouse shop drawings.
4. Air intake shutter(s) – Supply and mount intake shutters as shown on approved greenhouse shop drawings. Size is to be matched to required exhaust fan(s).

### B. Cooling

1. Evaporative cooler(s) – Supply and mount evaporative cooler(s) 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 trade(s).

C. Heating

1. Natural gas or LP heater(s) – 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.

D. Shading System(s)

1. Vertical or sloped shade system – Supply and mount vertical or sloped shade system as shown on approved greenhouse shop drawings. Greenhouse shading system to be manufactured with Phifer Shearweave Solar shades or greenhouse manufacturer approved equal. Wiring to be provided by other trade(s).
2. Horizontal shade system – Supply and mount horizontal shade system as shown on approved greenhouse shop drawings. Greenhouse shading system to be manufactured with Phifer Shearweave Solar shades or greenhouse manufacturer approved equal. Wiring to be provided by other trade(s).

E. Lighting

1. Grow light(s) – Grow light(s) shall be designed to provide adequate lighting for approved greenhouse bench layout. Grow light(s) to be switchable ballast for both metal halide and high pressure sodium bulb units. Grow lights shall be mounted and located by greenhouse manufacturer. Grow light(s) shall be shown on approved greenhouse shop drawings. Grow lights come outfitted with molded plugs. Wiring of lighting circuit is to be provided by other trade(s).
2. Task light(s) – To be provided by other trade(s).

F. Humidification

1. Fogger(s) – Supply and mount atomizing/fogging fan(s) as shown on approved greenhouse shop drawings. Fogger(s) to be sized and located by greenhouse manufacturer. Fogger(s) shall be manufactured by Jaybird Manufacturing or greenhouse manufacturer approved equal. Plumbing and electrical hookup by other trade(s).

G. Watering system(s)

1. Drip irrigation – Supply and mount bench mounted drip irrigation system. Drip irrigation system shall be manufactured by Damm, Phytotronics (based on final design), or greenhouse manufacturer approved equal. System shall provide adequate drippers and punch tool to install future drippers shall be supplied with system. Installed drippers shall be outfitted with a shut-off mechanism for the individual nozzles. Plumbing and wiring to be provided by other trade(s).
2. Misting irrigation – Supply and mount bench mounted misting irrigation. Misting irrigation system shall be manufactured by Damm, Phytotronics (based on final design), or greenhouse manufacturer approved equal. System shall provide adequate coverage for bench area. Plumbing and wiring to be provided by other trade(s).

#### H. Environmental control system

1. Environmental control system – Supply and mount a fully-functional control system with electrical control cabinets built specifically for the greenhouse based on the approved greenhouse shop drawings. Control system shall be capable of controlling each zone independently using interior zone data and/or exterior data that is supplied by a weather station included in the control system. Environmental control system shall include PC interface software package. System shall include complete electrical drawings and prints for final hook-up. Greenhouse control system shall be represented on the approved shop drawings for system mounting location. Mounting of sensors and weather station shall be the responsibility of greenhouse manufacturer. Wiring of control system, sensors, and weather station shall be provided by other trade(s).
  - a. One day of training and on site commissioning to be completed by the control system manufacturer
- I. Greenhouse Bench(es) - Manufacturer of greenhouse shall also be manufacturer of greenhouse bench system. Greenhouse benches to be shown on approved greenhouse shop drawings. If bench mounted irrigation is selected, irrigation system shall also be represented on the approved greenhouse shop drawings. Greenhouse bench layout shall be coordinated between greenhouse manufacturer and architect for final approval.

## 2.04 MATERIALS

- A. Aluminum – 6063-T52, 6063-T6, or 6061-T6 alloy and temper. Other alloys and tempers may be used for non-structural members provided they do not void the required warranties. Indicate alloys and tempers clearly on shop drawings and in structural calculations.
1. Framing Members – Thickness based on design loading, cross sectional configuration, and fabrication requirement.
  2. Aluminum Flashing and Closures – Minimum of 0.040" (1mm) thick.
  3. Snap-on Covers and Miscellaneous Non-structural trim – Minimum thickness recommended by the manufacturer.
- B. Insulated Panels – Expanded polystyrene; provide at all filler panels and sheet metal members.
- C. Glazing – See Product Section
- D. Glazing Gaskets – Compression type design, replaceable, EPDM, complying with ASTM C864, with solid strand cord to prevent shrinkage.
1. Completely compatible with glazing sealant to be used
  2. Profile and hardness as necessary to maintain uniform pressure for watertight seal
  3. Manufacturer's standard black color
- E. Flashings – Sheet aluminum, same finish as for system components; secured with concealed fastening method or fastener with head finished to match; thickness as required for conditions encountered.

**\*\*\*Note to Specifier: Verify with manufacturer if internal reinforcing is required based on framing material, size, and configuration.**

F. Internal Reinforcing

1. ASTM A36/A36M for carbon steel; or ASTM B308/B308M for structural aluminum
2. Shapes and sizes to suit installation
3. Shop coat steel components after fabrication with manufacturer recommended primer

G. Setting Blocks, Edge Blocks, and Spacers – As required by manufacturer and compatible with insulated glass where required

H. Structural Glazing Sealant – Manufacturer's Standard; black

I. Perimeter Sealant – Manufacturer's Standard color to match framing finish if available, otherwise color as selected from manufacturer's standard range

J. Anchors and Fasteners



1. Aluminum and Stainless Steel of type which will not cause electrolytic action or corrosion
  2. Zinc cadmium-plated fasteners may be used if acceptable to manufacturer.
  3. Finish exposed fasteners to match aluminum frame
- K. Accessories – Provide accessories as schedule to achieve design intent and environmental control.

## 2.05 FINISHES

**\*\*\*Note to Specifier: Delete all but one of the following frame finishes. If more than one finish is required, indicate the locations where each is to be used on the architectural drawings.**

### A. Aluminum Finishes

1. Unfinished Aluminum: Mill
2. Aluminum Finish: Anodized complying with AAMA 611
  - a. Color: Clear (Class I)
  - b. Color: Dark Bronze
3. Aluminum Finish: AAMA 2605 finish
  - a. Color: Manufacturer's standard bronze color
  - b. Color: Manufacturer's standard Hartford green color
  - c. Color: Manufacturer's standard white color
  - d. Color: Manufacturer's standard sandstone color
  - e. Color: Manufacturer's standard black color
  - f. Color: Manufacturer's standard natural clay color
4. Aluminum Finish: AAMA 2604 finish
  - a. Color: Manufacturer's standard bronze color
  - b. Color: Manufacturer's standard Hartford green color
  - c. Color: Manufacturer's standard white color
  - d. Color: Manufacturer's standard sandstone color
  - e. Color: Manufacturer's standard black color
  - f. Color: Manufacturer's standard natural clay color
5. Aluminum Finish: AAMA 2603 finish
  - a. Color: Manufacturer's standard bronze color

- b. Color: Manufacturer's standard Hartford green color
- c. Color: Manufacturer's standard white color
- d. Color: Manufacturer's standard sandstone color
- e. Color: Manufacturer's standard black color
- f. Color: Manufacturer's standard natural clay color

**\*\*\*Note to Specifier: If a custom color or a different type of finish is required, verify availability with manufacturer and enter a description below.**

- 6. Aluminum Liquid Finish: \_\_\_\_\_
- 7. Aluminum Powder Finish: \_\_\_\_\_
- 8. Aluminum Anodized Finish: \_\_\_\_\_
- 9. Metal Cladding: \_\_\_\_\_
- 10. Equipment Finishes – All related greenhouse equipment shall be per original manufacturer's original finish. Equipment shall not be painted to match greenhouse finish to preserve equipment form, fit, looks and original warranty.

## 2.06 FABRICATION

- A. Fabricate components in accordance with the shop drawings approved by the architect.
- B. All **major** fabrication shall be done at the manufacturing location and not onsite.
- C. Manufacturer shall remove all burrs and rough edges prior to finish application.
- D. Install all gaskets and tapes at factory, as reasonable.
- E. Disassemble only to the extent necessary for shipping and handling limitations.
- F. Manufacturer shall be notified of any field modification prior to the activity commencing.
- G. All welding shall comply with standards set forth by the American Welding Society.
- H. Grind exposed welds smooth and flush with adjacent surfaces before finishing; restore mechanical finish.
- I. Perform all work in a method that will meet or exceed industry standards.
- J. Isolation membrane materials shall be used to separate dissimilar metals to prevent galvanic corrosion/action between materials.
- K. 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 weather tight.

**\*\*\*Note to Specifier: Delete the following if internal reinforcing is not required for this project.**

L. Steel Components

1. Clean surfaces after fabrication and immediately prior to application of primer in accord with manufacturer's recommendations.
2. Apply specified shop coat primer in accord with manufacturer's instructions to provide 1.0 mil (0.05mm) minimum dry film thickness

M. Fabricate components true to detail and free from defects impairing appearance, strength or durability.

N. Provide contoured exterior horizontal or purlin glazing retainers to minimize water, ice, and snow buildup.

O. Reinforce components at anchorage and support points, joints, and attachment points for interfacing work.

P. Accurately size glazing to fit openings allowing for clearances as set forth by the "Glazing Manual" published by the Flat Glass Marketing Association (FGMA).

Q. Cut glass clean and carefully. Nicks and damaged edges will not be accepted. Replace all glass with damaged edges.

### **PART 3 EXECUTION**

**\*\*\*Note to Specifier:**  
**This section is only applicable if Solar Innovations® installation is accepted.**

#### 3.01 PREPARATION

- A. General contractor shall direct, supervise, and inspect all site work related to the greenhouse.
- B. Do not begin installation until substrates have been properly prepared and approved by manufacturer. Substrate preparation shall be done in strict accordance with the approved shop drawings.
- C. If substrate penetration is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Thoroughly clean all surfaces and substrates prior to installation.
- E. Prepare surfaces using the method recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### 3.02 INSTALLATION

- A. Installation of the greenhouse shall be done in accordance with approved shop drawings and manufacturer's instruction and installation manual(s).
- B. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.
- C. Provide attachments and shims to permanently fasten system to building structure.
- D. Maintain dimensional tolerances and alignment with adjacent work.
- E. Anchor securely in place, allowing for required movement, including expansion and contraction.
- F. Install glazing sealants in accordance with manufacturer's instructions without exception, including surface preparations.
- G. Set sill members in bed of sealant. Set other members with internal sealants to provide weather tight construction.
- H. Install flashings, bent metal closures, corners, gutters, and other accessories as required or detailed.
- I. Clean surfaces and install sealant in accordance with sealant manufacturer's instructions and guidelines.

### 3.03 ADJUSTING AND CLEANING

- A. Adjust hinge set, locksets, and other hardware for proper operation. Lubricate using a suitable lubricant compatible with door and frame coatings.
- B. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions before owner's acceptance.
- C. Any abraded surface of the finish shall be cleaned and touched up with air dry paint, as approved and furnished by the window manufacture, in a color to match factory applied finish.
- D. Remove from project site, and legally dispose of construction debris associated with this work.
- E. Removable sill and head stop provide for greater serviceability of hardware without the need to remove the other panels.

### 3.04 HOUSEKEEPING

- A. Manufacturer shall deliver all related operating instructions, maintenance manuals, and warranty registration cards to the general contractor during the completion of the project.
- B. Installer shall protect installed products until completion of the installation from all construction debris and natural elements.

- C. Manufacturer is responsible for all touch-up, repair, or replacement of damaged products during the installation.
- D. Installer shall keep area tidy and safe at all times.
- E. Clean and dress all sealant prior to installation completion.
- F. Clean all glass prior to installation completion.
- G. Installer shall clean the entire enclosure one time at the completion of the installation. Cleaning shall include surface cleaning of aluminum framing and glass and clean up of construction debris. All subsequent cleaning shall be the responsibility of the general contractor.

### 3.05 TESTING

- A. Greenhouse installer shall complete a water test to the AAMA 501.2 standard with AAMA standard equipment with architect or general contractor in presence.
- B. Define all other post installation testing requirements.

### 3.06 TRAINING

- A. Greenhouse installer shall provide one (1) onsite day of training on operations and maintenance of the greenhouse structure in the presence of all requested parties.
- B. Greenhouse installer shall coordinate onsite visit, commissioning, and training of greenhouse control system by greenhouse control system manufacturer.

### 3.07 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

## **END OF SECTION**