

PART ONE - GENERAL

SECTIONS INCLUDES

PERFORM ALL WORK required to complete the greenhouse work.

1. GREENHOUSE with motor operated venting roof panels.
2. GLASS AND GLAZING
3. AWNING WINDOWS
4. ENTRY DOOR
5. ENVIRONMENTAL ACCESSORIES
6. ACCESSORIES AND EQUIPMENT necessary to provide a functional environment.

RELATED SECTIONS

1. GENERAL CONDITIONS and DIVISION 1
2. JOINT SEALERS: Section 07 900
3. SHEET METAL FLASHING & TRIM: Section 07 620
4. ALTERNATES: Section 01 100

REFERENCES

AAMA 611- Voluntary Specification for Anodized Architectural Aluminum.

ASTM A 36/A 36M: Standard Specifications for Carbon Structural Steel.

ASTM B 308 / B308M: Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.

ASTM C 864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

AWS D1 – Structural Welding Code

PERFORMANCE REQUIREMENTS

PERFORMANCE CRITERIA:

1. SNOW LOAD: 50 psf, meet code for drifted snow loading criteria.
2. POSITIVE WIND LOAD: 40 psf
3. NEGATIVE WIND LOAD:
4. MAX DEFLECTION: L/175
5. CONCENTRATED LOAD:

PROVIDE FRAMING SYSTEM supporting glazing, complete with all components necessary to provide a weathertight system, including perimeter flashing and sealants within the structure.

1. PROVIDE STRUCTURAL DESIGN, engineering and fabrication by manufacturer.
2. DESIGN TO WITHSTAND uniform structural load of 40 psf, plus snow loading surcharge or as required by code.
3. DESIGN FRAMING SYSTEM and glazing material to support design loads as prescribed by the governing building code.
4. DESIGN TO WITHSTAND thermal variations of 60 degrees F from ambient temperature without causing bucking, stresses on glass, failure of seals, undue stress on structural elements, reduction of performance or to other detrimental effects.
5. MAXIMUM ALLOWABLE DEFLECTION of any framing member normal to plane of glazing: Not more than L/175.
6. NO UNCONTROLLED WATER LEAKAGE in system under normal circumstances.
7. PERMANENTLY FREE OF SIGNIFICANT AIR LEAKAGE (no more than 0.09 CFM per ASTM E283 at differential static pressure of 6.24 pounds per square foot).

SUBMITTALS

PRODUCT DATA: Manufacturer's data sheets on each product to be used, including:

1. PRODUCT DETAILS
2. PREPARATION INSTRUCTIONS and recommendations.
3. STORAGE AND HANDLING requirements.
4. INSTALLATION METHODS

SHOP DRAWINGS: Detailed layout, details and structural calculations prepared specifically for this project, provide stamp or seal of licensed professional structural engineer registered in State of Michigan.

SAMPLES: Two complete sets of finish samples representing manufacturer's full range of standard colors, plus any custom colors as specified.

VERIFICATION SAMPLES

1. ALUMINUM FINISH: Two samples, minimum size 2 by 3 inches (50 by 75 mm), representing actual product and color.
2. GLASS: Two samples, minimum size 12 inches (300 mm) square, of specified glass, including coatings or frit pattern.
3. ASSEMBLY SAMPLE: 12 by 12 inch (300 by 300 mm) assembly complete with glazing, gaskets, fasteners, anchors, and finish; do not proceed with fabrication until workmanship and color are approved by Architect.

MANUFACTURER'S CERTIFICATES: Certify products meet or exceed specified requirements.

1. 88 1/4"x 84 1/4" Double Pitch Skylight.
 - a. Air Infiltration: AAMA/NAFS 5.3.2. and ICC ES AC17
 - b. Water Resistance: AAMA/NAFS 5.3.2. and ICC ES AC 17
 - c. Uniform Structural Load: AAMA/NAFS

QUALITY ASSURANCE

MANUFACTURER QUALIFICATIONS: Company specializing in manufacturing products specified in this Section with minimum 12 years experience in fabrication and erection of glazed structures for projects of similar scope.

INSTALLER QUALIFICATIONS: Experienced in performing work of this section that has specialized in installation of work similar to that required for this project.

CONFORM TO Michigan Building Code. Current Edition.

DELIVERY, STORAGE, AND HANDLING

STORE products in manufacturer's unopened packaging, covered to protect factory finishes from damage, precipitation, and construction dirt until ready for installation.

PROTECT factory finishes from damage, precipitation, and construction materials until ready for installation.

PROJECT CONDITIONS

MAINTAIN ENVIRONMENTAL CONDITIONS (temperature, humidity, and ventilation) with limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PERFORM STRUCTURAL SILICONE SEALANT work when air temperature is above 10 degrees F (minus 12 degrees C).

WARRANTY

FIVE (5) YEAR WRITTEN manufacturer's warranty that installed structure will be free from significant defects in material, workmanship, and uncontrolled water leakage, from date of Substantial Completion.

FIFTEEN (15) YEAR WARRANTY: For glazing, provide glazing manufacturer's standard warranty against defective materials, delamination, seal failure, and defects in manufacturing, from date of Substantial Completion.

TEN (10) YEAR WARRANTY: For custom color fluoropolymer finishes, provide paint manufacturer's warranty for color and film integrity, from date of Substantial Completion.

PART TWO – PRODUCTS

GENERAL

PRE-ENGINEERED GREENHOUSE: Structure with accessories for a complete, water resistant, leak resistant installation.

INSTALL on masonry base wall and concrete footing.

GREENHOUSE

1. FRAMING MEMBERS: Aluminum.
2. GLAZING: Refer to subsequent sections and 08 800 for further information.

3. DESIGN: As indicated on the drawings.
4. FRAMING MEMBER CROSS SECTION: As required to accomplish performance criteria.
5. ACCESSORIES:
 - a. Ridge vents
 - b. Awning windows
 - c. Ridge vent controls and other accessories
 - d. Entry door
 - e. Environmental accessories
6. DIMENSIONS (not including masonry base wall)
 - a. Ridge Height: +/- 10'-11"
 - b. Eave Height: +/- 4'-2" (top of gutter)
 - c. Roof Pitch: To match existing
 - d. Width: +/- 18'-2"
 - e. Depth: +/- 13'-0"
 - f. Basic Mullion and Purlin Design: As indicated on the drawings.

ACCEPTABLE MANUFACTURERS

BASIS OF DESIGN and performance is

1. SOLAR INNOVATIONS: Subject to compliance with the Specifications.
 - a. Telephone: 800-618-0669
 - b. Web: www.solarinnovations.com

OTHER ACCEPTABLE MANUFACTURERS: Subject to compliance with the specifications and performance level of the above specified product – include:

1. ACURLITE STRUCTURAL SKYLIGHTS, INC.; Tele: 570.759.6882, or www.acurlite.com
2. Winandy Greenhouse Company, Inc.; Tele: 765.935.2111, or www.winandygreenhouse.com
3. APPROVED SUBSTITUTE

MANUFACTURER must manufacture structure system and all doors, windows, and vents required to complete the greenhouse structure.

GREENHOUSE MATERIALS

FRAMEWORK: Extruded aluminum 6063-T5/T6.

1. REINFORCE FRAMING as needed to meet loading criteria and building code.
2. FRAMING MEMBERS: Thickness based on the design loading, cross sectional configuration, and fabrication requirement.
3. ALUMINUM FLASHING and CLOSURES: Minimum of 0.040 inches thick.
4. SNAP ON COVERS and Miscellaneous Non-Structural Trim: Minimum thickness recommended by
the manufacturer.

THERMAL BREAK: Manufacturer's standard system to provide thermal separation between exterior and interior components.

INTERNAL REINFORCING:

1. ASTM A 36/A 36M for carbon steel: or ASTM B 308/B 308M for structural aluminum.
2. SHAPES and sizes to suit installation.
3. SHOP COAT STEEL COMPONENTS after fabrication with manufacturer recommended primer.

GLAZING: Refer to Section 08 800.

1. HI-PERFORMANCE Low E insulated glass panels, ASTM E773.
2. WALL GLASS
 - a. Exterior Lite: Minimum 3/16" thick, tempered float
 - b. Interior Lite: Minimum 3/16" thick, tempered float
3. ROOF GLASS
 - a. Exterior Lite: Minimum 1/4" thick, tempered float
 - b. Interior Lite: Minimum 7/16" thick, laminated float (mm. 3/16" glass panels with inter layer)
4. PERFORMANCE
 - a. Solar heat gain: Maximum .33
 - b. Visible light reflectance: Maximum 15%

- c. Visible light transmittance: Maximum %

GLAZING GASKETS: Compression type design, replaceable EPDM, complying with ASTM C 864, 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
4. FACTORY MOLDED corners required at interior.
5. ENGAGE all glass edges.

FINISH

ALUMINUM MEMBERS: PPG Duranar, Two coats, 70% fluoropolymer resin.

1. COLOR: As selected

COMPONENTS

HORIZONTAL DIVIDING BARS: Prefinished aluminum to match. Secure to framing with stainless steel fasteners and plates.

1. AT ROOF MUNTINS: Sloped leading edge to allow water to drain off by gravity. Without ponding at the muntin cap.

EXTERIOR GLAZING CAP: Prefinished aluminum, to match. Secure to framing with stainless steel fasteners.

1. GASKET: Continuous EPDM at vertical, double face tap on horizontals dividers.

GLAZING BARS: Aluminum prefinished extrusions with internal and external weep / condensation channels to direct moisture to the exterior of the greenhouse.

INSULATED PANELS: Insulated panels shall be expanded polystyrene and faced on both sides with aluminum. Insulated panels shall be provided where indicated on the drawings.

PRIMARY ACCESSORIES

ROOF RIDGE VENT: Continuous at ridge.

1. OPERATION: Motor operated mechanism arm to open vent to not more than parallel to ground.
2. CONTROL: Thermostatically controlled vent motor actuator 110VAC, with rain sensor and manual over-ride.
3. PERIMETER: Full weatherstripping, EPDM gasket system.
4. INSECT SCREEN: Provide
5. FINISH: Match framing

VENTILATION WINDOWS: Refer to drawings for size and location.

1. OPERATION: Awning
2. SASH LOCK: Lever handle with cam lock
 - a. Material: White Bronze
 - b. Spacing: Maximum 40" o.c. (not less than 2 per window)

ENTRY DOOR: Refer to drawings

1. OPERATION: Swing
2. STYLE: Grid and base panel
3. SIZE: 3'-0" x 7'-0"

FLASHINGS: Sheet aluminum, same finish as for system components; secure with concealed fastening method or fastener with head finished to match; thickness as required for conditions encountered.

SETTING BLOCKS, Edge Blocks and Spacers: As required by manufacturer and compatible with insulated glass where required.

STRUCTURAL GLAZING SEALANT: Dow Corning or GE Silpruf; black.

PERIMETER SEALANT: Refer to specification Section 07 900.

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.

ACCESSORIES: Provide accessories as scheduled to achieve design intent and environmental control.

GREENHOUSE OPERATIONS EQUIPMENT

COOLING

1. EVAPORATIVE COOLER(S) – Supply and mount evaporative cooler(s) as shown on approved greenhouse shop drawings. Coolers to be manufacturer 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 base upon approved greenhouse shop drawings.
2. HIGH PRESSURE FOGGING SYSTEM – High pressure fogging system to perform dual duty in humidity control and assist in cooling function. System to be installed with centrally located pump station and individual growth chamber zones as shown on approved greenhouse shop drawings. High pressure fogging is not a one source cooling solution, but provided assistance to the cooling system while providing its primary duty in humidification of greenhouse.

HEATING

1. NATURE 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.

HUMIDIFICATION

1. ATOMIZING FAN(S) – Supply and mount atomizing / fogging fan(s) as shown on approved greenhouse shop drawings. Atomizing fan(s) to be sized and located by greenhouse manufacturer. Atomizing fan(s) shall be manufactured by Jaybird Manufacturing or greenhouse manufacturer approved equal.
2. HIGH PRESSURE FOGGING SYSTEM – High pressure fogging system to perform dual duty in humidity control and assist in cooling function. System to be installed with centrally located pump station and individual growth chamber zones as shown on approved greenhouse shop drawings.

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 nozzles and tool to install future nozzles shall be supplied with system. Installed nozzles shall be outfitted with a shut-off mechanism for the individual nozzles.
2. MISSING 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 and individual nozzle shut-off mechanisms.

ENVIRONMENTAL CONTROL SYSTEM

1. ENVIRONMENTAL CONTROL SYSTEM - Supply and mount a full-functioned 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 exterior data that is supplied by a weather station included in the control system. Greenhouse system shall include computer hook up 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.

FABRICATION

FABRICATE COMPONENTS in accordance with approved shop drawings. Remove burrs and rough edges. Shop fabricate to greatest extent practicable to minimize field cutting, splicing, and assembly. Disassemble only to extend necessary for shipping and handling limitations. Install gaskets and tapes in factory.

WELDING

1. COMPLY with recommendations of American Welding Society.
2. GRIND exposed welds smooth and flush with adjacent surfaces before finishing; restore mechanical finish.

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 2.0 mil minimum dry film thickness.

FABRICATE COMPONENTS true to detail and free from defects impairing appearance, strength or durability. Contour outdoor horizontal or purlin glazing retainers to minimize water ponding and ice or snow buildup.

FABRICATE COMPONENTS to allow or 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 weathertight. Ensure slip joints make full, tight contact and are weathertight.

REINFORCE COMPONENTS at anchorage and support points, at joints, and at attachment points for interfacing work.

GLASS: Accurately size glass to fit openings allowing clearances following recommendations of "Glazing Manual" published by Flat Glass Marketing Association.

1. **MINIMUM THICKNESS:** See above Page 3 and Specification Section 08 800.

CUT GLASS CLEAN AND CAREFULLY. Nicks and damaged edges will not be accepted. Replace glass that has damaged edges.

PART 3 – EXECUTION

EXAMINATION

INSPECT SUBSTRATE CONDITIONS

1. **DO NOT BEGIN** installation until substrate conditions are satisfactory.
2. **COORDINATE SIZE,** and flashing with mason contractor.

PREPARATION

CLEAN SURFACES thoroughly prior to installation.

PREPARE SURFACES using the methods recommended by the manufacturer for achieving the best results for the substrate under the project conditions.

INSTALLATION

INSTALL GLAZED GREENHOUSE STRUCTURE system in accordance with approved shop drawings and manufacturer's instructions.

1. **SET LEVEL,** square, plumb at proper elevations, in alignment with other work.

SEPARATE DISSIMILAR MATERIALS using nonconductive tape, paint or other material not visible in finished work.

PROVIDE ATTACHMENTS and shims to permanently fasten system to building structure.

ANCHOR SECURELY IN PLACE, to the building structure allowing for required movement, including expansion and contraction.

1. **SET SILL MEMBERS** in bed of sealant. Set other members with internal sealants to provide weathertight construction.
2. **INSTALL FLASHINGS,** bent metal closures, corners, gutters, and other accessories as required or detailed.

INSTALL GLAZING AND SEALANTS in accordance with manufacturer's instructions without exception, including surface preparations.

CLEANING AND ADJUSTMENT

CLEAN SURFACES and install sealant in accordance with sealant manufacturer's instructions and structure manufacturer's guidelines.

ADJUST all operating components

TOUCH UP any scratches.

CLEAN glass. Interior and exterior.

PROTECTION

PROTECT INSTALLED PRODUCTS until completion of project.

TOUCH UP, repair or replace damaged products before Substantial Completion.

END OF SECTION