



UNIVERSITY OF MARYLAND

U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON 2017



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U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON 2017
SPECIFICATIONS
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01 - GENERAL REQUIREMENTS

013200 - CONSTRUCTION PROGRESS DOCUMENTATION

- A. Receipts for all materials, supplies and professional services shall be provided to the Construction Manager, whether or not reimbursement for expenses is required.
- B. Photographs depicting completed elements of the Work shall be provided in digital form to the Construction Manager. Photographs shall be of sufficient quality and scope to verify the correct completion of each element of the Work.
- C. Photographs showing the location of all services (plumbing, wiring, etc.) which shall be hidden by subsequent elements of the Work (drywall, etc.) shall be provided in digital form to the Construction Manager. Recognizable reference points shall be included in the photographs so as to allow unambiguous identification and location of hidden elements.
- D. All elements requiring inspection by responsible authorities (University, Local, State, Competition Organizers) shall be left open until said inspections are complete, and shall not be hidden by other elements of the Work.

END SECTION 013200

013300 - SUBMITTAL PROCEDURES

- A. All Submittals required by other sections of this document shall be provided in both digital and printed (hardcopy) form to the Construction Manager.
- B. All warranties, performance specifications, installation and operating instructions which normally accompany products incorporated into the Work shall be provided to the Construction Manager, whether or not said materials are specifically mentioned in other sections of this document.
- C. Upon request from the Construction Manager, Project Manager, Project Architect or Project Engineer, the manufacturer or their authorized reseller shall provide test data to verify the performance of any given product, whether or not this requirement is specifically cited in other sections of this document.

END SECTION 013300

017300 - EXECUTION

- A. All products shall be installed according to instructions from the product manufacturer. Installation guides for each product shall be provided to the Construction Manager, whether or not said documentation is specifically requested in other sections of this document. Any discrepancies or differences between manufacturer instructions and those found in other sections of this document or in the Drawings shall be called to the attention of the Construction Manager and the Project Architect for resolution before that element of the Work is started.

- B. Execution of all elements of the Work shall be performed in compliance with all applicable laws, building codes and Competition rules. If discrepancies or conflict are noted between said regulations and other sections of this document or in the Drawings, they shall be called to the attention of the Construction Manager and the Project Architect for resolution before that element of the Work is started.

END SECTION 017300

017400 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

- A. A Construction Waste Management Plan shall be developed and submitted to and approved by the Construction Manager and the Project Manager prior to commencement of the Work. This Plan shall include measures for diverting at least 99 % of materials from the landfill for composting, recycling or reuse. This Plan shall identify collection locations for various waste streams at the Construction Site.
- B. A Construction Waste Management Plan shall be submitted by each supplier of materials that constitute more than 5% of the Work by weight or value. These Plans shall identify measures taken by the supplier to divert materials from the landfill.

END SECTION 017400

017500 - HEALTH & SAFETY PLANS

- A. A Health and Safety Plan shall be developed and submitted to and approved by the Health and Safety Officer(s), the Project Manager and the Construction Manager prior to commencement of the Work. This Plan shall clearly identify all equipment and procedures for assuring the health and safety of workers and visitors to the Construction Site, and the Competition Site. The H&S Plan shall also specify training requirements for responsible safety officers and for all workers on site.
- B. Personnel found to regularly or willfully violate provisions of the H&S Plan shall be barred from the Construction Site and/or the Competition Site.

END SECTION 017500

018100 - SUSTAINABLE CERTIFICATION DOCUMENTATION

- A. The Project Manager, Construction Manager and Project Architect shall review the documentation requirements for the LEED for Homes certification system and shall identify measures to meet all prerequisites and sufficient credits to achieve a Platinum level of certification. All documentation requirements normally associated with LEED certification at

this level shall be provided during the Construction, assembly, operation and disassembly of the Work and Competition.

- B. The Project Manager, Construction Manager and Project Architect shall review the documentation and compliance requirements for Full Certification under the International Living Future Institute's (ILFI's) Living Building Challenge and Living Product Challenge systems. All documentation requirements normally associated with LBC and LPC Certification shall be provided during the Construction, assembly, operation and disassembly of the Work and Competition.
- C. For each product and material used in the Work, the manufacturers shall provide either : a) a comprehensive list of constituent chemicals sufficiently detailed to verify Compliance with the ILFI Red List OR b) an ILFI Declare label for the product or material.

END SECTION 018100

019100 - SUSTAINABLE MATERIAL REQUIREMENTS

- A. All materials and products used in the Work shall be ILFI RedList Compliant unless otherwise approved in writing by the Project Architect.

END SECTION 019100

06 - WOOD, PLASTICS & COMPOSITES

061000 – ROUGH CARPENTRY

PART 1 – GENERAL

1.1 SCOPE

Rough carpentry includes splines added to reinforce Structural Insulated Panels (SIPs), framing for floors, interior partitions, sheer walls, and structural reinforcement.

1.2 PERFORMANCE REQUIREMENTS

- A.
- B. Wood framing used for sill plates or contacting concrete or earth shall be pressure treated to prevent rotting and insect infestation.
- C. Framing sizes shall be as indicated in the Drawings.
- D. Framing members shall be free of excessive warping, knots, splitting, and other structural defects.

PART 3 – EXECUTION

3.1 STORAGE

- A. Rough carpentry shall be stored under cover, and shall be acclimated prior to use in the Work.

3.2 DISPOSAL

- A. Remainders shall be stored on site for reuse.

END SECTION 061000

061500 – DECKING

PART 1 – GENERAL

1.1 SCOPE

Decking refers to elevated walking surfaces surrounding and attached to the house including porches, walkways, and ramps, but not the courtyard floor.

PART 3 – EXECUTION

- A. Decking boards shall be separated by a gap of no more than 3/16 of an inch.
- B. Decking shall be securely attached to structural members using fasteners approved for use with the decking material.
- C. Decking must be installed flat and level, except at ramps.

END SECTION 061500

061600 – WOOD SHEATHING

PART 1 – GENERAL

1.1 SCOPE

Wood sheathing is used to provide lateral strength on walls other than Structural Insulated Panels (SIPs). This includes walls of the bathroom and kitchen modules, and attic shear walls.

1.2 PERFORMANCE REQUIREMENTS

- A. Sheathing shall be plywood or composite material approved in writing by the Project Architect.
- B. Minimum thickness ½ inch unless noted otherwise on the Drawings.
- C. Sheathing shall have minimum 1-hour fire rating.

PART 2 –

2.1 PROUDUCT

- A. Acceptable Products : Advan Tech Flooring and Sheathing by Huber Engineered Woods.

PART 3 – EXECUTION

- A. Sheathing shall be secured to framing as specified in the structural drawings.
- B. Sheathing shall be stored flat, and under cover.

065000 – STRUCTURAL INSULATED PANELS

PART 1 – GENERAL

1.1 SCOPE

Structural Insulated Panels (SIPs) constitute the primary structural system and thermal envelope of the house. SIPs provide lateral stability for the walls (wind and seismic), and support floor and roof spans under gravity loads (dead and live).

SIPs are comprised of an insulated core with attached stress skin panels on both interior and exterior surfaces.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide at least R-35 insulation with an 8 inch thick panel.
- B. Provide at least R-60 insulation with a 12 inch thick panel.
- C. Shall support a clear span of at least 12'-0" with an 10 inch thick panel.
- D. Shall support a cantilever of at least 4'-0" with a 12 inch thick panel.
- E. Sheathing on each side of the panel (stress skin) shall have a 1-hour fire rating.
- F. Core of panels shall not be exposed on the interior or exterior but shall be fully protected by sheathing.
- G. Panel splines shall be double 2x wood, width matching the thickness of the EPS core.

1.3 SUBMITTALS

- A. Manufacturer shall provide qualified test data supporting advertised thermal performance.
- B. Manufacturer shall provide qualified test data supporting advertised structural performance.
- C. Manufacturer shall provide qualified test data supporting advertised fire-rating performance.

PART 2 - PRODUCTS

2.1 EXPANDED POLYSTYRENE CORE SIPs

- A. Acceptable Products:
 - 1. Insulspan
 - 2. Renegade SIPs
- B. Approved Distributor : MM&I Construction and Design Inc.
- C. For more information, see <http://www.insulspan.com/>

PART 3 – EXECUTION

1. All connections between SIPs and with other elements of the Work shall be as indicated on the Drawings, on Structural Drawings or on Shop Drawings from the manufacturer. Contractor shall resolve any discrepancies in different Drawings prior to commencement of the Work.
2. Where Drawings do not specify connection schedules, nailing and screwing shall be as recommended by the SIPs manufacturer for the anticipated design load for the panels.

END SECTION 065000

07 - THERMAL & MOISTURE PROTECTION

072100 – THERMAL INSULATION (general purpose site installed)

PART 1 - GENERAL

1.1 SCOPE

Rock wool insulation, both batts and boards, used as cavity insulation.

1.2 PERFORMANCE REQUIREMENTS

- A. Insulation shall have a minimum thermal resistance (R-value) of 3.8 BTU/ft²/deg.F/hr per inch of thickness.
- B. The vapor permeability of the insulation, when installed, shall have be greater than 55 perms per inch of thickness (such that the total perm rating for the installed cavity insulation is greater than 10).

1.3 SUBMITTALS

- A. The Contractor shall provide the Architect with technical details of materials data sheets and installation instructions sufficient to verify the performance requirements cited above.
- B. The Contractor shall provide the Owner with a warranty certificate covering materials AND installation of the Insulation.

PART 2 - PRODUCTS

2.1 Stone Wool

A. Acceptable Products

- 1. R24 ComfortBatt™
 - a. Manufacturer: Roxul
 - b. Thickness: 5 ½"
 - c. Width: 15 ¼"
 - d. Recycled Content: Up to 93%
 - e. Fire and Water Resistant
 - f. Greenguard gold certified for indoors
 - g. Non-combustible
 - h. Friction fit between studs
- 2. R15 ComfortBatt™
 - a. Manufacturer: Roxul
 - b. Thickness: 3 ½"
 - c. Width: 15 ¼"
 - d. Recycled Content: Up to 93%
 - e. Fire and Water Resistant
 - f. Greenguard gold certified for indoors
 - g. Non-combustible (melting point is 2150 degree Fahrenheit)
 - h. Friction fit between studs
- 3. Safe 'n' Sound
 - a. Manufacturer: Roxul
 - b. Thickness: 3"
 - c. Width: 15 ¼"

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- d. Greenguard gold certified for indoors
 - e. Resistant to water, mold, rot, mildew and bacterial growth
 - f. Non-combustible
 - g. Made from basalt rock and recycled content
4. ComfortBoard™ 80 Rigid Insulation
- a. Manufacturer: Roxul
 - b. Thickness: 3"
 - c. Width: 24"
 - d. Fire and Water Resistant
 - e. Greenguard gold certified for indoors
 - f. Non-combustible (melting point is 2150 degree Fahrenheit)

PART 3 - EXECUTION

- A. Insulation shall be friction fit between studs and joists.
- B. Insulation shall fill the framing cavity (or space between sheathing in SIPs panels) unless otherwise indicated on the Drawings, but shall not significantly overfill the cavities.

END SECTION 072100

SECTION 072500 – WEATHER RESISTIVE BARRIERS

PART 1 - GENERAL

1.1 SCOPE

Weather Resistive Barriers (WRBs) are applied to the exterior face of wall and roof sheathing, behind the exterior cladding. WRBs serve as an air barrier and drainage plane for exterior moisture.

1.2 PERFORMANCE REQUIREMENTS

- A. Impermeable to air infiltration.
- B. Wall WRB shall be water vapor permeable – 10 perms or greater
- C. Impermeable to liquid water.
- D. Self-adhesive roll sheeting or liquid applied
- E. UV stable for at least 90 days.
- F. Self-healing around small penetrations like screws or nails.

1.3 SUBMITTALS

- A. Cut sheets documenting performance as noted above.

PART 2 - PRODUCTS

2.1 Liquid Applied Membranes

- A. For use on walls only.
- B. Acceptable Products
 - 1. R-Guard Cat 5
 - a. Manufacturer: Prosoco
 - b. Qualities:
 - i. Highly durable
 - ii. Seamless
 - iii. Elastomeric
 - iv. Prevents water and air penetration up to category 5 hurricane conditions
 - v. Can be applied to damp or dry substrates
 - vi. Solvent, isocyanate, and phthalate free
 - vii. No shrinkage, staining, or yellowing
 - viii. Breathable
 - c. Uses:
 - i. Waterproofing
 - ii. Air and water barrier
 - iii. Roller applied
 - d. Certifications:
 - i. Indoor Advantage™ Gold
 - ii. SCS Indoor Air Quality
 - iii. Air Barrier Association of America (ABAA) approved
 - 2. R-Guard Joint and Seam Filler
 - a. Manufacturer: Prosoco
 - b. Qualities:
 - i. Applicable to damp or dry surfaces
 - ii. Cures under variety of weather conditions
 - iii. Fills open joints and seams up to 1" in width

- iv. Solvent, isocyanate, and phthalate free
 - v. No shrinkage, staining, or yellowing
 - vi. Breathable
 - c. Uses:
 - i. Crack and joint filler
 - ii. Create transitions where flexible reinforcement is required
 - iii. Provide continuous support of fluid-applied flashing membranes, waterproofing, or air barrier components
 - iv. Easy to gun, spread and tool
 - d. Certifications:
 - i. Passes ASTM E84
 - ii. Indoor Advantage™ Gold
 - iii. SCS Indoor Air Quality
3. R-Guard FastFlash
- a. Manufacturer: Prosoco
 - b. Qualities:
 - i. Available in gun-grade or roller-grade
 - ii. Bonds and cures in wet weather, on damp substrates, and tolerates rain immediately after application
 - iii. Highly durable
 - iv. Seamless
 - v. Elastomeric
 - vi. Solvent, isocyanate, and phthalate free
 - vii. No shrinkage, staining, or yellowing
 - viii. Breathable
 - c. Uses:
 - i. Flashing
 - ii. Long term adhesion
 - iii. Same day installation of windows, doors, and other wall assembly, waterproofing or air barrier components
 - d. Certifications:
 - i. Indoor Advantage™ Gold
 - ii. SCS Indoor Air Quality
4. R-Guard AirDam
- a. Manufacturer: Prosoco
 - b. Qualities:
 - i. Solvent, isocyanate, and phthalate free
 - ii. No shrinkage, staining, or yellowing
 - iii. Highly durable
 - iv. Stops penetration of air and water under normal and extreme weather conditions
 - v. Easy to gun and tool in all climates
 - vi. Breathable
 - vii. Elastomeric

- c. Uses:
 - i. Prevents moist outside air from entering and conditioned indoor air from escaping around window and door assemblies
- d. Certifications:
 - i. Indoor Advantage™ Gold
 - ii. SCS Indoor Air Quality

2.2 Self-Adhering Roof Underlayment

- A. For use under metal roofing
- B. Acceptable Products
 - 1. Grace Ice & Water Shield
 - a. Manufacturer: GCP Applied Technologies
 - b. Product Description: Aggressive rubberized asphalt adhesive backed by a layer of slip resistant coated high density cross laminated polyethylene film
 - c. Qualities:
 - i. Seals around fasteners, resisting leakage
 - ii. Protects under all standard sloped roof coverings
 - iii. Self-adhesive
 - iv. Forms watertight overlaps
 - v. Slip resistant surface
 - vi. Membrane will not crack, dry out or rot
 - d. Uses:
 - i. Underlayment for sloped roofs to resist water penetration due to water back-up behind ice dams or wind-driven rain
 - ii. Leak protection in trouble prone spots like valleys, skylights, protrusions and other flashing areas
 - 2. EcoWhite EPDM
 - a. Manufacturer: RubberGard
 - b. Thickness: 60 mil
 - c. Bi-laminate
 - d. Exceeds ASTM D 4637 standards
 - e. Eligible for 20 and 30 year Firestone Red Shield Warranty
 - f. Qualifies for ENERGY STAR Program

2.4 ACCESSORIES – Sealing Tape

- A. For use sealing joints between WRB sheets, sealing top edges of metal flashing, sealing seams in wood panels, etc.
- B. Acceptable Products
 - 1. First Choice – ProClima TESCON VANA Sealing Tape
 - 2. Subject to investigation of material incompatibilities, alternate sealing tape selection will be according to WRB manufacturer recommendations.

2.5 ACCESSORIES – Termination Mastic

- A. Used to terminate the top edges of flashing and/or sealing tape.

- B. Select termination mastic per manufacturer recommendations.

END SECTION 072500

SECTION 072600 – VAPOR RETARDERS

Part 1 – GENERAL

1.1 SCOPE

Prevents the migration of air and water vapor. Used in this project only under the floor framing to prevent rising damp from ground.

1.2 PERFORMANCE REQUIREMENTS

- A. Maximum perm rating of 0.1
- B. Preferred per rating < 0.01.
- C. Minimum thickness: 6 mil (0.006")
- D. Shall be tear resistant

Part 2 – PRODUCTS

2.1 ELASTOMERIC VAPOR RETARDER

- A. Acceptable Products
 - 1. Stego Wrap Vapor Barrier or Retarder
 - a. Minimum Thickness: 10 mil (0.01 in).
 - b. Perm Rating (English): 0.0016 perms
- B. Alternative products with similar performance may be substituted with written approval of the Project Architect.

2.2 SEALING TAPE

- A. Acceptable Products
 - 1. Stego Tape

Part 3 EXECUTION

Limit perforation of the membrane for plumbing and attachment. Seal around all penetrations with approved liquid-applied sealant, mastic or tape (approved by membrane manufacturer).

END SECTION 072600

SECTION 073100 – WOOD SIDING

Part 1 – GENERAL

1.1 SCOPE

Wood siding is used as exterior cladding for walls. For specific information regarding the use of wood siding on this project, refer to the Drawings.

1.2 APPLICABLE STANDARDS

- A. International Living Future Institute (ILFI) Living Building Challenge (LBC)
- B. ILFI Declare Products
- C. ILFI RedList Compliance

1.2 REQUIREMENTS

- A. Shall be ILFI RedList Compliant – including any special insect resistance treatments, stains, sealants or paints that are factory applied.
- B. No exotic hardwoods or old growth materials shall be used in the Work.
- C. Wood shall resist infestation by insects.
- D. Wood shall be treated (including stains, coatings and sealants) to resist fading and discoloration (from time, sunlight, UV light, rain, etc.).

1.4 SUBMITTALS

- A. Comprehensive list of chemicals, include factory-applied insect-resistance, stains, sealers and paints shall be provided to the Construction Manager sufficient to verify RedList Compliance
- B. A copy of the ILFI Declare label (if applicable) shall be provided to the Construction Manager.

Part 2 – PRODUCTS

- A. Acceptable Products
 - 1. Lamboo Rainscreen Architectural Wall/Ceiling Siding
 - a. Thickness: ½ in., ¾ in., 1 in., 1.5 in.
 - b. Stock Lengths: 8' and 16'. Custom lengths are available with a minimum purchase of 3,000 ln.ft (1250 sq.ft.)
 - c. <http://www.lamboo-rainscreen.com>
- B. Alternative Products may be substituted with prior written approval of the Project Architect.
- C. Stains and other coatings and sealants shall be selected and approved in writing by the Project Architect.

Part 3 – EXECUTION

- A. Wood siding shall be applied over a suitable drainage plane to prevent moisture build-up and rot.
- B. Wood siding shall be fastened to the substrate using approved fasteners to prevent warping, popping and corrosion.
- C. Wood siding shall be stored under cover, preferably in conditioned space prior to installation. Follow manufacturer recommendations for stacking and acclimatization.

END SECTION 073100

SECTION 074100 – STANDING SEAM METAL PANELS

Part 1 – GENERAL

1.1 SCOPE

Standing seam metal panels include a cleat that is securely fastened to the substrate, and overlapping seams that can be securely snapped, crimped or clamped to the cleats. Panels may have additional ribs intended to reduce oil-canning or for aesthetic effect. Standing seal metal panels may be made of steel or aluminum and are typically protected by a Kynar finish. Standing seam metal panels are used primarily as roofing panels on this project, but may be considered for vertical (wall) applications as well.

1.2 REQUIREMENTS

- A. Minimum warranty service life of 50 years.
- B. Low-emissivity coatings and materials shall be used to create a "cool roof" application.
- C. Standing seams must be capable of supporting the attachment of clamps for mounting of solar panels.
- D. Panel sizes (seam spacing) shall as indicated on the Drawings.

1.3 SUBMITTALS

- A. A copy of the warranty shall be provided to the Construction Manager.
- B. A letter or other official document shall be provided by the manufacturer or their authorized reseller or installer to verify the attachment of solar panels without voiding the warranty (using hardware proposed by the Project Architect). This documentation shall be provided to the Construction Manager and to the Project Architect.
- C. Samples of all colors noted under Products below shall be provided to the Project Architect for final selection and approval (in writing).

Part 2 – PRODUCTS

2.1 STANDING SEAM METAL PANELS

- A. Acceptable Products
 - 1. Peterson PAC-CLAD
 - a. SnapClad Panels
 - b. Colors: Cityscape, Anodic Clear, Silversmith.
 - 2. FABRAL Metal Wall and Roof Systems
 - a. Model: 1-½" SSR 150
 - b. Color: Galvalume Acrylic Coated
- B. Alternate products may be proposed, subject to written approval by the Project Architect. Technical specifications and color samples shall be provided for all suggested alternate products.

Part 3 – EXECUTION

- A. Standing seam metal panels shall be installed without damaging the protective finishes.
- B. Panels shall be installed so as to prevent oil-canning or warping, including from thermal expansion or contraction
- C. Installer shall demonstrate methods for removing and reinstalling panels without damage.

END SECTION 074100

SECTION 074600 – CORRUGATED METAL PANELS

Part 1 – GENERAL

1.1 SCOPE

Corrugated metal panels exhibit a regular pattern of ridges and valleys, which may be rounded or flattened depending on specific products selected. The panels are generally installed by overlapping panel edges (one or two corrugation widths) and attaching to the substrate through a valley, using exposed fasteners. Corrugated metal panels are typically protected by a Kynar finish.

Corrugated metal panels are used primarily on walls in this project with the corrugations running either vertically or horizontally as indicated on the Drawings, but applications to roofs is also permitted.

1.2 REQUIREMENTS

- A. Minimum warranty service life of 50 years.
- B. Low-emissivity coatings and materials shall be used to create a "cool wall" or "cool roof" application.
- C. Panel sizes (corrugation widths) shall as indicated on the Drawings.

1.3 SUBMITTALS

- A. A copy of the warranty shall be provided to the Construction Manager.
- B. Samples of all colors noted under Products below shall be provided to the Project Architect for final selection and approval (in writing).

Part 2 – PRODUCTS

- A. Acceptable Products
 - 1. Petersen PAC-CLAD
 - a. ½ in. or 7/8 in. Corrugated Metal Panels
 - 2. Petersen PAC-CLAD
 - a. 7.2 Corrugated Metal Panels (Thickness: 1.5 in.)
 - 3. FABRAL Metal Wall and Roof Systems
 - a. ½ in. Or 7/8 in. Corrugated
 - b. Materials: Aluminum or Gauge Steel
- B. Alternate products may be proposed, subject to written approval by the Project Architect. Technical specifications, corrugation shape and color samples shall be provided for all suggested alternate products.

Part 3 – EXECUTION

- A. Matching color exposed fasteners shall be used for attachment of the panels unless otherwise approved in writing by the Project Architect
- B. Exposed fasteners shall be of materials that are compatible with the panels (without causing corrosion of either panel or fastener).

END SECTION 074600

SECTION 074800 – RAINSCREENS

Part 1 – GENERAL

1.1 SCOPE

Climate shield clips will be used to support wood siding and to create a cavity behind the wood siding to allow for necessary airflow.

Part 2 – PRODUCTS

2.1 ACCESSORIES – RAINSCREEN CLIPS

A. Acceptable Products

1. Climate-Shield

- a. Rain Screen Clip CSRSC2
- b. Available Lamboo panel Thickness ½" and ¾". Other thicknesses per request
- c. Maximum spacing from horizontal edge of rain screen panel to clipping system, when using "Z" clip, 4".
- d. Maximum spacing between "Z" clip/rail fastening system 44".
- e. All Lamboo exterior rain screen panels using the "Z" clipping system must use heavy-duty stainless steel "Z" clips and rail.

END SECTION 074800

SECTION 075300 – EPDM MEMBRANE

Part 1 – GENERAL

1.1 SCOPE

Ethylene Propylene Diene Monomer (EPDM) rubber membranes are in common usage as waterproof protective coverings for roofs and terraces.

EPDM is used in this project primarily as a protective waterproof layer on the floor of the mechanical room.

Part 2 – PRODUCTS

2.1 EPDM Membranes

A. Acceptable Products

1. Firestone RubberGard EPDM

- a. Website: <http://firestonebpco.com/roofing/epdm-roofing-systems/rubbergard-epdm-roofing-systems/>

2.2 ACCESSORIES – BONDING AGENTS

A. Acceptable Products

1. For Firestone RubberGard

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2. Firestone QuickSeam
 3. Firestone RubberGard EPDM Solvent-Free Bonding Adhesive
- B. Bonding agents must be approved by the EPDM membrane manufacturer. Alternative bonding agents to those indicated above may be substituted with written permission of the Project Architect.

Part 3 – EXECUTION

- A. Use only accessories and adhesives approved for use with the EPDM membrane manufacturer.
- B. Use only details (such as for floor drains) approved by the membrane manufacturer.
- C. Seal all seams with an approved sealing "tape" or flashing membrane.
- D. Terminate the top edge of the membrane (where used on floors or roof rakes) to the wall using an approved mechanical termination strip (bar).
- E. Seal the top edge of the termination bar using an approved caulk or mastic.

END SECTION 075300

SECTION 076200 - METAL FLASHING AND TRIM

Part 1 – GENERAL

1.1 SCOPE

Metal flashing is used to cover edges and seams in order to exclude moisture from entering the structure.

Metal trim is generally used for decorative purposes, but may simultaneously serve a role similar to flashing.

1.2 APPLICABLE STANDARDS

- A. SMACNA – Architectural Sheet Metal Manual

1.3 REQUIREMENTS

- A. All metal flashing used in the Work shall be stainless steel.
- B. All fasteners used to attach flashing shall be stainless steel.
- C. All flashings and fascia shall have clear, straight (or smoothly curving) edges, without wrinkles, waviness or oil-canning.
- D. Metal flashing shall be attached and sealed to other elements of the Work as indicated in the Drawings.
- E. All metal flashings and fascia shall be of an appropriate gage as determined by the Construction Manager and installer to achieve acceptable results as defined above.

Part 2 – PRODUCTS

No specific products are required or preferred by this Specification. Contractor or Installer may select sources and manufacturers, provided that a high level of quality in materials and workmanship is maintained.

END SECTION 076200

SECTION 077200 – ROOF ACCESSORIES

Part 1 – GENERAL

1.1 SCOPE

This section specifies roof hatches, equipment supports, gravity ventilation, and metal grating roof walkway system.

Part 2 – PRODUCTS

2.1 Gravity Ventilation

B. Acceptable Products

1. ATAS Internation, Inc- Above Sheathing Ventilation

- a. Website: <https://www.atas.com/sustainable/above-sheathing-ventilation#Gallery>

END SECTION 077200

END SECTION 07

08 – OPENINGS

810000 - WINDOWS

PART 1 - GENERAL

1.1 Scope

There are interior and exterior windows used in the awning, casement, and skylight. They are used to increase the day lighting within the interior of the house to reduce the need for artificial lighting.

1.2 Performance Requirements

- A. Structural Performance: Provide wood windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window and door assemblies representing types, grades, and sizes required for this Project according to test methods indicated.
- B. Design wind velocity at Project site is 60 mph.
- C. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in NWWDA I.S. 2 for water penetration, and structural performance for the type and performance grade of window units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of NWWDA I.S. 2, Article 6, "Optional Performance Classifications," for higher than minimum performance grades.
- D. Standards: Performance requirements for operating force, air infiltration, water penetration, structural performance, and forced-entry resistance for wood windows are those specified in NWWDA I.S. 2, "Industry Standard for Wood Window Units."
- E. Test Criteria: Testing shall be performed by a qualified independent testing agency based on the following criteria:
- F. Test Procedures: Test window units according to ASTM E 283 for air infiltration, ASTM E 547 for water penetration, and ASTM E 330 for structural performance.
- G. Air-Infiltration Rate for Windows: Not more than 0.05 cfm/sq. ft. for an inward test pressure of 6.24 lbf/sq. ft. (295 Pa).
- H. Water Penetration for Windows: No water penetration as defined in the test method at a static pressure of 12 p.s.f. after 15 minutes with water applied at a rate of five gallons per hour per square foot.
- I. Structural Performance: No failure or permanent deflection in excess of 0.4 percent of any member's span after removing the imposed load, for a positive (inward) and negative (outward) test pressure of 22.5 lbf/sq. ft. (1077 Pa).

1.3 Submittals

- A. Product Data sheets
- B. Shop Drawings
- C. Manufacturer approval for installation

1.4 References

- A. General: Standards listed by reference form a part of this specification section. Standards listed are identified by issuing authority, abbreviation, designation number, title or other designation. Standards subsequently referenced in this Section are referred to by issuing authority abbreviation and standard designation.
- B. American Architectural Manufacturers Association (AAMA):
1. AAMA 450 - Voluntary Performance Rating Method for Muller Fenestration Assemblies.
 2. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
 3. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 4. AAMA 902 - Voluntary Specification for Sash Balances.
 5. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 6. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 7. NAFS - North American Fenestration Standard/Specification for windows, doors and skylights.
- C. ASTM International (ASTM):
1. ASTM C1036 - Standard Specification for Flat Glass.
 2. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 3. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 4. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
 5. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
 6. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
 7. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
 8. ASTM F2090 - Standard Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms.

PART 2 – PRODUCTS

2.1 Acceptable products

- A. Acceptable products
1. Product: Push Out Awning E-series Window
 - a. Manufacturer: Anderson Windows
 - b. Dimensions: per Drawings
 - c. Frame : 4-9/16"

- d. Interior Materials: Wood, primed
- e. Exterior Cladding : Aluminum – Dark Ash Kynar finish
- f. Glazing: SmartSun™/Low-E4®
- g. Dual-Pane
- 2. Product: Casement E-Series Casement Window
 - a. Manufacturer: Anderson Windows
 - b. Dimensions: per Drawings
 - c. Frame : 4-9/16"
 - d. Interior Materials: Wood , primed
 - e. Exterior Cladding: Aluminum - Dark Ash Kynar finish
 - f. Glazing Options: SmartSun™/Low-E4®
 - g. Dual-Pane
- 3. Product: Direct Set (fixed) E-Series Casement Window
 - a. Manufacturer: Anderson Windows
 - b. Dimensions: per Drawings
 - c. Frame : 4-9/16"
 - d. Interior Materials: Wood , primed
 - e. Exterior Cladding: Aluminum - Dark Ash Kynar finish
 - f. Glazing Options: SmartSun™/Low-E4®
 - g. Dual-Pane
- 4. Product: Fresh Air Electric Deck Mount Skylight
 - a. Manufacturer: VELUX
 - b. Glass: Laminated low-e3 glass
 - c. Dimensions: per Drawings
 - d. Control: touch screen control
- 5. Product: Sun tunnel skylight
 - a. Manufacturer: VELUX
 - b. Model: TCR
 - c. Daylight area: 138 in²
 - d. Curb metal flashing

PART 3 - EXECUTION

3.1 FABRICATION

- A. General: Fabricate wood window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window and door units.
 - 1. Comply with requirements of NWWDA I.S. 2 , I.S. 610, and I.S. 620 for moisture content of lumber at time of fabrication.
 - 2. Fabricate.
- B. Provide weather stripping at perimeter of each operating sash.
- C. Factory-Glazed Window and Door Units: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze window and door units in the shop before delivery, unless factory glazing is not available from manufacturer. Comply with requirements of NWWDA I.S.
- D. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullion and cover plates capable of withstanding design loads of window units.

3.02 INSTALLATION

- A. Check with manufacturer on installation guidelines for all products and provide installation requirements to the Contractor and Architect for approval.
- B. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in manufacturer's written instructions.
- C. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.
- D. Fasten door and window frames securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.
- E. Separate dissimilar metals and metal products from contact with wood or cementations materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.
- F. Correct deficiencies in or remove and reinstall windows, doors, glazing, or hardware that does not comply with requirements.
- G. Repair, refinish, or replace windows and doors damaged during installation, as directed by Architect.
- H. Adjust operating parts and hardware for smooth, quiet operation and weather tight closure. Lubricate hardware and moving parts.

END SECTION 810000

083000 – EXTERIOR DOORS

PART 1 – GENERAL

1.1 SCOPE

Steel entry doors are located along the exterior of the house. Two glass doors that are located in the courtyard area.

1.2 Performance Requirements

- A. Provide doors engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard door assemblies representing types, grades, and sizes required for this Project according to test methods indicated.
- B. No failure or permanent deflection in excess of 0.4 percent of any member's span after removing the imposed load, for a positive (inward) and negative (outward) test pressure of 22.5 lbf/sq. ft. (1077 Pa).

1.3 Submittals:

- A. Product Data.
- B. Shop Drawings.
- C. Testing verification.

1.4 Test Criteria:

- A. Testing shall be performed by a qualified independent testing agency based on the following criteria:
 - 1. Design wind velocity at Project site is 60 mph.
 - 2. Test Procedures: Test door units according to ASTM E 283 for air infiltration, ASTM E 547 for water penetration, and ASTM E 330 for structural performance.
- C. Testing shall demonstrate compliance with requirements indicated in NWWDA I.S. 2 for water penetration and structural performance for the type and performance grade of window and door units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of NWWDA I.S. 2, Article 6, "Optional Performance Classifications," for higher than minimum performance grades.

1.5 Air-Infiltration Rate for Doors:

- A. Not more than 0.15 cfm/sq. ft. for an inward test pressure of 1.57 lbf/sq. ft. (75 Pa).

1.6 Water Penetration for Doors:

- A. No water penetration as defined in the test method at a static pressure of 4.16 p.s.f. after 15 minutes with water applied at a rate of five gallons per hour per square foot.

PART 2 – PRODUCTS

A. Acceptable products

1. Exterior Doors

- a. Product: 82 – Traditional Panel Exterior Door
 - i. Manufacturer: Simpson Door Company
 - ii. Dimensions: 80" X 36"
 - iii. Panels: 3/8" VG Flat Panel
 - iv. Door size: 1 3/4" double sticking
 - v. Profile: Ovolo Sticking
- b. Product: 7502 – Thermal Sash(TDL)
 - i. Manufacturer: Simpson Door Company
 - ii. Type: Exterior French & Sash
 - iii. Dimensions: 80" X 36"
 - iv. Panels: 1-7/16" Innerbond® Double Hip-Raised Panel Glass:
 - v. Glass: 3/4" Insulated Glazing
 - vi. Privacy Ration: 1

2. Interior Doors

- a. Product: 20 – Interior Panel Door
 - i. Manufacturer: Simpson Door Company
 - ii. Dimension: 80" X 36"
 - iii. Type: Interior panel
 - iv. Panels: 3/8" VG Flat Panel
 - v. Profile: Ovolo Sticking

PART 3 – EXECUTION

3.1 Fabrication

- A. General: Fabricate wood door units to comply with indicated standards. Include a complete system for assembly of components and anchorage of door units.
- B. Comply with requirements of NWWDA I.S. 2 , I.S. 610, and I.S. 620 for moisture content of lumber at time of fabrication.

3.02 INSTALLATION

- A. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in manufacturer's written instructions.
- B. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.
- C. Correct deficiencies in or remove and reinstall doors, glazing, or hardware that does not comply with requirements.
- D. Repair, refinish, or replace doors damaged during installation, as directed by Architect.

END SECTION 083000

083100 – FOLDING GLASS DOOR SYSTEM

PART 1 – GENERAL

1.1 SCOPE

Floor track supported, sliding-folding, thermally broken, aluminum-framed glass panel system to be installed between courtyard and indoor living area

1.2 SUBMITTALS

- A. Detail Drawings: Indicate dimensioning, direction of swing, configuration, swing panels, typical head jamb, side jambs and sill details, type of glazing material, and handle height.
- B. Product Data: Manufacturer's literature including independently tested data listing performance criteria and Owner's Manual with installation instructions.
- C. Contract Closeout Submittal: Submit Owner's Manual from manufacturer. Identify with project name, location and completion date, type and size of unit installed.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Provide complete, precision built, engineered, pre-fitted unit by a single source manufacturer with at least 20 years experience in providing folding/sliding door systems for large openings in the North American market.
 - 1. The manufacturer must have a quality management system registration to the ISO 9001: 2008 standard.
- B. Performance Requirements: Provide from manufacturer that has independently tested typical units. Testing results to include air infiltration in accordance with ASTM E 283 and NFRC 400, water penetration in accordance with ASTM E 547 and E 331, structural loading in accordance with ASTM E 330, and forced entry in accordance with AAMA 1304.
- C. Thermal Performance U factor: Unit to be rated, certified and labeled in accordance with NFRC 100, shown in manufacturer's latest published data for the glazing, sill, and direction of opening specified.
- D. Solar Heat Gain Coefficient: Unit to be rated, certified and labeled in accordance with NFRC 200, shown in manufacturer's latest published data for the glazing, sill, and direction of opening specified.
 - 1. If desired, Energy Star ratings can be achieved by the use of proper glass with the unit. See NanaWall's Performance data for details.
- E. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar products for large openings. Installer to provide reference list

of at least 3 projects of similar scale and complexity successfully completed in the last 3 years.

1.4 WARRANTY

- A. Provide manufacturer's standard warranty against defects in materials and workmanship.
- B. Warranty Period: Ten years for rollers and for seal failure of insulated glass supplied. For all other components, one year (two years if unit is installed by manufacturer's certified trained installer) from date of delivery by manufacturer.

1.5 SITE CONDITIONS, DELIVERY, STORAGE AND HANDLING

- A. In addition to general delivery, storage and handling requirements specified in Section 01600, comply with the following:
 - 1. Deliver materials to job site in sealed, unopened cartons or crates. Protect units from damage. Store material under cover, protected from weather and construction activities.

PART 2 - PRODUCTS

2.1 Acceptable manufacturer

- A. NanaWall Systems, Inc., which is located at 100 Meadowcreek Drive #250 Corte Madera, CA 94925; Toll Free Tel: 800-873-5673; Tel: 415-383-3148; Fax: 415-383-0132; Website: www.nanawall.com; Email: info@nanawall.com
- B. Frame and Panels: From manufacturer's standard profiles, provide head track, side jambs, and panels with dimensions shown on drawings.
 - 1. Provide panels with: Standard one lite
 - 2. Provide standard bottom rail.
 - 3. Aluminum Extrusion: Extrusions with nominal thickness of .078" (2.0 mm). Alloy specified as AlMgSi0.5 with strength rated as 6063-T5 or F-22 (European standard). Anodized conforming to AAMA 611 or powder coated conforming to AAMA 2604.
 - 4. Thermally broken with a wide Polyamide plastic reinforced with glass fibers. Polyamide plastic less than 7/8 (22 mm) wide or pour and de-bridge thermal break will not be accepted.
- C. Product will be selected by the Contractor in accordance to the Work, and approved by the Architect

PART 3 - EXECUTION

3.1 FABRICATION

- A. Use extruded aluminum frame and panel profiles with male-female interlocking, corner connectors and hinges, sliding and folding hardware, locking hardware and handles, glass and glazing and weather stripping as specified herein to make a folding glass wall. Factory pre-assemble as is standard for manufacturer and ship with all components and installation instructions.
- B. Sizes and Configurations: See drawings for selected custom dimensions within maximum frame sizes possible as indicated in manufacturer's literature. See drawings for selected number of panels and configuration. Inward [OR outward] opening unit. On configurations with a pair of swing panels, looking from inside, primary swing panel on the left [OR right].

3.2 ERECTION

- A. Because of the large dimensions involved and the weight and movement of the panels, verify the structural integrity of the header such that the deflection with live

load and dead loads is limited to the lesser of $L/720$ of the span and $1/4$ (6 mm). Structural support for lateral loads (both wind load and eccentric load when the panels are stacked open) must be provided. It is recommended that all building dead loads be applied to the header prior to installing the NanaWall. If so and if a reasonable amount of time has been allowed for the effect of this dead load on the header, then only the building's live load can be used to meet the above requirements of $L/720$ or $1/4$ (6 mm). If not, both the dead and live loads need to be considered.

- B. It is recommended that all building dead loads be applied to the header prior to installing the NanaWall. If so and if a reasonable amount of time has been allowed for the effect of this dead load on the header, then only the building's live load can be used to meet the above requirements of $L/720$ or $1/4$ (6 mm). If not, both the dead and live loads need to be considered.

3.2 INSTALLATION

- A. Install frame in accordance with manufacturer's recommendations and installation instructions.
- B. Properly flash and waterproof around the perimeter of the opening.
- C. Installer to provide appropriate anchorage devices and to securely and rigidly fit frame in place, absolutely level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work.

END OF SECTION 083100

083200 - RESIDENTIAL HANGER DOOR

PART 1 – GENERAL

1.1 SCOPE

Automated hanger door to be installed in courtyard

1.2 PERFORMANCE REQUIREMENTS

- A. The door must be constructed to fit within the dimensions of the courtyard
- B. A sufficient seal must be provided to prevent moisture from entering the interior of the house
- C. The door must be equipped with a locking mechanism
- D. The door width must not exceed 30 ft.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on all products to be used, including:
 - 1. Preparation instructions and recommendations
 - 2. Storage and handling requirements and recommendations
 - 3. Installation instructions
 - 4. Cleaning and maintenance instructions
- B. Structural Analysis: Provide confirmation of the capability and adequacy of the structure to carry the dead and live load weights required

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

- A. PRODUCT: WILSON CLEAR-VUE DOOR
 - 1. Acceptable Manufacturer: Wilson Industrial Doors, which is located at PO Box 246 Franksville, WI 53126; Tel: 262-732-5042; Fax: 262-835-2660; Email: request info (info@wilsondoors.com); Web: www.wilsondoors.com
 - 2. Frame: ¼" thick 6061-T6 Aluminum Alloy Tubing
 - 3. Seals: rubber top seal, neoprene side seals, hinge seal, rubber floor seal conforms to contour of the ground
 - 4. Covering: any specified material, to be provided by other manufacturer
 - 5. Lift Cables: galvanized steel, custom-sized to provide a 5:1 safety factor
 - 6. Drive Shaft and Cable Drums: heavy-duty galvanized tubing; 6"x4" mounting angle; mounted above the door and runs the width of the door
 - 7. Locking Mechanism: dual handle manual locking mechanism; lock switch shuts off power to motor until door is unlocked (optional auto lock)

8. Power Operator: electrical controls designed to meet National Electrical Code Section 513
9. Control Box: programmable drive; momentary contact, 3-button controls (Up/Down/Stop standard)
10. Over Travel Switch: back-up switch to prevent the door from reaching its upper limit

END OF SECTION 083200

084000 – VENTS

PART 1 – GENERAL

1.1 SCOPE

Vent openings to be indicated in the drawings. The openings include bathroom ventilation, kitchen, and living areas.

1.2 Submittals:

- A. Product Data

1.3 Standards

- A. ASTM B26 – Aluminum-Alloy Sand Castings.
- B. ASTM B85 – Aluminum-Alloy Die Castings.

PART 2 - PRODUCTS

2.1 No product specified, and needs to be supplied to the Architect for approval

2.2 FINISHES

- A. Wall vent finish: anodized aluminum.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate supply of vents with construction of walls to ensure proper sizing and placement of vent openings.

3.2 INSTALLATION

- A. Install vents and dampers in accordance with manufacturer's installation instructions and approved shop drawings
- B. Do not install bent, scratched, or otherwise damaged vents. Remove damaged components from site and replace
- C. Install vents secure, level, plumb, and flush with wall surface.

3.3 CLEANING

- A. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
- B. Wash exposed surfaces with solution of mild detergent applied with soft cloth. Take care to remove dirt from corners. Wipe surfaces clean.

END OF SECTION 084000

END OF SECTION 08

09 – FINISHES

093100 - COUNTERTOPS

Part 1 – GENERAL

1.1 SCOPE

To be used in the kitchen for atop the cabinets as counters and bathroom vanity.

1.2 PERFORMANCE REQUIREMENTS

- A. Shall contain recycled content
- B. Shall be GREENGUARD certified
- C. Shall receive LEED certification for sustainable design

1.3 RECEIVING, INSPECTION, STORAGE

- A. Sheet Inspection to be completed upon arrival at conditioned storage facility
 - 1. Do not cut the materials before visible inspection and matching process is completed in shop.
- B. Check to ensure the lot numbers are in sequence or within allowable tolerance (+/- 50).
- C. Check for visual defects on the surface or edges once peel coat is removed. Please note that color may vary slightly from run to run and from the sample itself. Lists of inspection items that should be checked:
 - 1. Color difference within same lot
 - 2. Scratches
 - 3. Bending
 - 4. Pin hole
 - 5. Crack
 - 6. Thickness difference

Part 2 - PRODUCTS

2.1 RECYCLED COUNTERTOP

- A. Acceptable Products
 - 1. 3Form 100 percent
 - a. Manufacturer: 3form
 - b. Recycled content: 100%
 - c. Thickness: 1"
 - d. Sheet width: 44"
 - e. Sheet length: 112"
 - f. Color: Night Sky or Snowmelt

2.2 ADHESIVE

- A. Bulk adhesive cartridges typically provide 1000mm of seaming.
- B. Normal cure time is about 40 minutes in 21° C. If hotter, your working time is greatly reduced and, if cooler, your working time is extended. Consider this as you begin assembly. You do not want to get too far ahead of yourself if it is warm.
- C. Remember to consider scuff-sanding joints for better bonding using 60 grit sandpaper.

- D. Before applying the adhesive, clean all areas being bonded with denatured alcohol and a clean white rag. Inspect for dirt, pencil marks, and oily fingerprints on all bonding surfaces and remove them.
- E. Assemble the cartridge in the seaming gun with a fresh disposable mixing tip. After each use, remove and replace the tip. The adhesive in the tip will set up just as the seams do on your materials. If you are finished gluing for the day, you can leave the tip on and place it in the storage refrigerator. The next time you use it you only need to change the tip.
- F. As you get ready to apply adhesive and begin assembly of your HI-MACS top, remember to purge the tip. This is done by squeezing out a bead of approximately the length of the tip. This ensures trapped air has worked itself from the mixing tip and that the catalyst and adhesive have properly mixed and are ready.

Part 3 - EXECUTION

- A. Product needs to be cut according to drawings and installed according to manufacturers specifications.

END SECTION 093100

093013 – CERAMIC TILING

PART 1 – GENERAL

1.1 SCOPE

Wall tiling will be used on the bathroom shower stall walls and the kitchen back splash. The ceramic flooring tile will be used in the kitchen, bathroom and courtyard as indicated on the drawings.

1.2 STANDARDS

A. Applicable ASTM

1. ASTM C-373
2. ASTM C-99
3. ASTM C-501
4. ASTM E-228
5. ASTM C-484
6. ASTM C-1028

PART 2 – PRODUCTS

2.1 FLOOR TILING

A. ACCEPTABLE PRODUCTS

1. Mosa Tile

- a. Manufacturer: Mosa
- b. Size: 24" x 24"
- c. Thickness: 12 mm
- d. Color code: 203 (cool black)
- e. Type: V (smooth)
- f. Cradle to Cradle: Silver certified

END SECTION 093013

096400 – WOOD FLOORING

Part 1 – GENERAL

1.1 SCOPE

The hardwood is to be used in the main wings of the house as indicated on the drawing.

1.2 PERFORMANCE REQUIREMENTS

- A. Shall be GREENGUARD certified
- B. Shall be FSC certified

1.3 SUBMITTALS

Sample colors for final color approval by the Architect

PART 2 – PRODUCTS

2.1 HARDWOOD FLOORING

- A. Acceptable Products
 - 1. Lamboo Flooring System (bamboo flooring)
 - a. Manufacturer: Lamboo Technologies
 - b. Width: 3"
 - c. Length: 16'
 - d. Thickness: 3/4"
 - e. Color code: VCP-C (Cherry)

END SECTION 096400

END SECTION 09

10 - SPECIALTIES

108100 – COMPOSTING TOILET

PART 1 – GENERAL

1.1 SCOPE

Composting toilet that allows waste to be recycled into compost. This is a self-contained system used in the bathroom.

1.2 REQUIREMENTS

- A. System will be self-contained.
- B. System will have the capacity for a household of 3 residents and up to 12 guests.
- C. System will use AC power

1.3 SUBMITTALS

- A. Product owner manual and maintenance
- B. Instructions on setup and instillation

PART 2 – PRODUCT SELECTION

2.1 COMPOSTING TOILET

- A. Model: Dry Self-Contained Composting Toilet
- B. Manufacturer: Nature's Head
- C. Power Requirement
 - 1. Fan Current: 1.7 Amps
 - 2. 110 Volts AC
- D. Water Consumption: no water consumption
- E. Color: White or Bone
- F. Temperature Requirement: Above 55 degrees Fahrenheit
- G. Accessories: Compost Quick, Microbe Mix, Compost Sure, Vent Kit,
- H.

PART 3 – EXECUTION

- A. Venting pipe must be installed and connected to the system.
- B. Regular maintenance of the system is required as directed by the instructions.
- C. System uses 12V DC Power and must be installed with an AC Adaptor.
- D. AC Adaptor shall be installed on the wall adjacent to toilet and hardwired to the homes electrical system. Alternatively, AC Adaptor may be installed inside the wall with a removeable service door for access.

END SECTION 108100

108200 – WATER FILTRATION SYSTEM

SECTION 108210 – SAND FILTER

PART 1. GENERAL

- I. The biosand filter provides both aerobic and anaerobic decomposition of contaminants.

PART 2. PRODUCTS

- J. Hydrad biosand filter - plastic (0.77m height by 0.42 m diameter)
 1. Weight: 3.6 kg (empty), 63.5 kg (full)
 2. Flow rate: 0.2 m/hr (average). 0.4 m/hr (maximum).
- K. Sand and Gravel from a quarry or gravel pit
 1. Filtering layer - 55 cm fine sand (< or = to 3.15 mm diameter)
 2. Support layer - 5 cm coarse sand (3.125 to 6.125 mm diameter)
 3. Underdrain layer - 5 cm fine gravel (6.25 to 12.25 mm diameter)

PART 3. EXECUTION^[1]

3.01 INSTALLATION

- L. Filter Sand and gravel through sieves of sizes ½ inch, ¼ inch, and 1/16 inch. Material that does not go through the ¼ inch sieve becomes the gravel layer. Material left in the 1/16 inch sieves becomes the coarse layer and material that passes through all three sieves becomes the fine sand layer.
- M. Wash Underdrain sand by placing 12 mm in a bucket, then doubling the water in the bucket. Fill the bucket twice as much water as sand, rinsed, and repeated until the water leaving the bucket is clear. This is repeated for the rest of the sand.
- N. Supporting sand is washed using the procedure as for underdrain sand, but half as much sand.
- O. The fine upper layer of sand is washed using a small amount of sand and double the amount of water. This water is then removed.
- P. Media is placed in the sun to dry
- Q. Install container and standpipe, filling the container halfway with water. Add gravel up to 5 cm. Supporting sand is filled to 10 cm. Place a bucket under the standpipe and add fine gravel is filled to 100 cm. Remove the bucket once water stops coming out. Add or remove sand until water height is 5 cm.

3.02 FLUSHING THE FILTER

- R. Place the diffuser plate above the surface of the water. Place a bucket under the standpipe and then pour water into the filter until the water that comes out into the bucket is clear.

3.03 DISINFECTING THE STANDPIPE (only during initial installation)

- S. Attach a garden hose to the spout. Attach a funnel to this garden hose and hold it above the spout for 2 minutes. Then, drain the bleach into a bucket. Wipe the spout with bleach. Then, put 5 gallons of water into the top of the filter and allow it to drain into a bucket.

3.04 DISINFECTING THE FILTER CONTAINER

- T. Clean the spout and exterior of the container daily with soap and water or chlorine based cleaning product.

3.05 CLEANING THE FILTER

- U. Remove lid, and pour water so that area above diffuser plate is half full. Then, remove the diffuser plate.
- V. Gently move sand in the uppermost 1 cm with fingers.
- W. Remove water above sand layer.
- X. Replace diffuser plate and lid. Pour in 5 gallons.
- Y.

^[1] All procedures modified from: *An introduction to Slow Sand Filtration*. (2005). Retrieved from <http://www.solutionsforwater.org/wp-content/uploads/2011/12/Slow-Sand-Filtration-Introduction-7-MB-16-Dec-2011.pdf>

END SECTION 108210

SECTION 108220 – GRANULAR ACTIVATED CHARCOAL SYSTEM

PART 1. GENERAL

1.01 DESCRIPTION

Z. Carbon Filter. See schedule on water filtration system components.

1.02 REQUIREMENTS

PART 2. PRODUCT

2.01 FUSION CATALYTIC CARBON BACKWASHING SYSTEM

AA. Carbon filter

BB. Model:

- a. FSF-150: Service flow rates (Normal-6GPM, Peak-8GPM); Backwash flow rate- 5GPM; Filter media volume- 1.5 ft³; Filter tank size- 10" X 54"; Tank Jacket- included.
- b. FSF-200: Service flow rates (Normal-8GPM, Peak-10GPM); Backwash flow rate- 7GPM; Filter media volume- 2 ft³; Filter tank size- 12" X 52"; Tank Jacket- included.
- c. FSF-250: Service flow rates (Normal-10GPM, Peak-13GPM); Backwash flow rate- 11GPM; Filter media volume- 2.5 ft³; Filter tank size- 10"X54"; Tank Jacket- included.
- d. FSF-300: Service flow rates (Normal-12GPM, Peak-15GPM); Backwash flow rate- No button; Filter media volume- 3 ft³; Filter tank size- 14"X 65"; Tank Jacket- not included.
- e. FSF-400: Service flow rates (Normal-15GPM, Peak-20GPM); Backwash flow rate- No button; Filter media volume- 4 ft³; Filter tank size- 16"X 65"; Tank Jacket-not included.

CC. Dimension: 60.25" x 10"

2.02 Plumbing Connections ¾" or 1"

2.03 Electrical Requirements should have input of 120V 60Hz and should output 12V 650mA

2.04 Water Temperature Min 39 max 100 degree Fahrenheit

2.05 Water Pressure 20-125 psi

END SECTION 108220

SECTION 108230 – ULTRAVIOLET WATER STERILIZATION SYSTEM

PART 1. GENERAL

1.1 SCOPE

- A. The UV water purifier will eliminate both viruses and bacteria provided the water is free of physical contaminants. UV dosage is sufficient for >99% removal of microorganisms.

1.2 SUBMITTALS

- A. Product Warranty
- B. Product Installation and Maintenance Manual(s)

PART 2. PRODUCTS

- A. Manufacturer: Atlantic Ultraviolet Corporation
- B. Model: BIO-1.5
 - 1.5 gal/min
 - $\frac{3}{8}$ " NPT female inlet and outlet
 - Power Consumption: 16.5 W
 - (measurements in inches) Length = $14\frac{1}{4}$, Width = $3\frac{11}{16}$, Height = $3\frac{3}{8}$
 - 8 lbs
 - Lamp ID Number: 05-1366-R
 - 10,000 hours rated bulb lifetime

PART 3. EXECUTION

3.01 INSTALLATION

- A. Horizontal installation close to final use
- B. Mounting Kit is standard for resting on ground
- C. Connection to 3-wire grounded outlet
- D. Connection to inlet and outlet

3.02 SCHEDULE

- A. Monthly cleaning of quartz sleeve
- B. Bulb replacement approximately every 14 months

END SECTION 108230

END SECTION 108200

SECTION 108300 - HYDROPONIC SYSTEM

PART 1 – GENERAL

1.1 SCOPE

A wall-mounted system for growing plants without soil using nutrient rich water. Used along south wall of the core.

1.2 PERFORMANCE REQUIREMENTS

- A. Use a sustainable non-soil or soil alternative.
- B. Must be partially automatic, leaving room for occupants to interact and care for the system.
- C. Will fit within the dimensions of 4' w X 6"d X 7' h, aligned with the immovable portion of the glazing.
- D. Will not interfere with hallway accessibility.
- E. System must be anchored or stabilized.
- F. System will be safe, and produce food that is also safe to consume.

1.3 SUBMITTALS

- A. Components: Shelving System Design, Shelf Support, Reservoir Design, Pump, Tubing, Net pots/Growing Medium, Wall/Floor Fasteners
 - 1. Specifications
 - 2. Who will install and maintain them
 - 3. Directions on how to maintain the system.
- B. Accessories: pH tester kit, pH adjusters, hydroponic nutrients
 - 1. Specifications
 - 2. Directions on how to maintain the system.
- C. List of indicators to be aware of to monitor plant health, and system functionality.

PART 2 – PRODUCTS

2.1 SHELVING SYSTEM

- A. Acceptable manufacturers and products
 - 1. Product: Fiberglass Molded Custom Shelves
 - a. Manufacturer: Precision Plastics Inc.
 - b. Dimensions: Fits within 4' w X 6"d
 - c. Requirements: Each shelf hold five net pots. Must limit the waters exposure to light.

2.2 SHELF SUPPORT

- A. Acceptable manufacturers and products
 - 1. Product: Steel Rods with threaded sections
 - a. Manufacturer:
 - b. Model Number:
 - c. Dimensions: 5/8" diameter
 - d. Requirements: Cut or ordered in size needed
 - e. Additional: will need hexagon nuts to hold the shelf in place at the correct angle

2.3 SHELF SUPPORT COVER

A. Acceptable manufacturers and products

1. Product: Aluminum Sheet
 - a. Manufacturer: MSC Industrial Supply Co.
 - b. Thickness: 0.125"
 - c. Dimensions when folded: fits within 2"w x 6"d x 7'h when folded as cover
 - d. Requirements: Will cover the shelf support and the system tubing
 - e. Additional: will need hexagon nuts to hold the shelf in place at the correct angle

2.4 RESERVOIR DESIGN

A. Acceptable manufacturers and products

1. Product: Fiberglass molded custom reservoir
 - a. Manufacturer: Precision Plastics Inc.
 - b. Dimensions: fits within 4' w X 6"d, matching the shelf width and depth
 - d. Requirements: Hold enough water to keep pump submersed and have capacity to hold all the water moving through the system at any given time. Must not allow light into it. Mad of same material as the shelf system.

2.5 SUBMERSABLE PUMP

A. Acceptable manufacturers and products

1. Product: EcoPlus Eco 396 Submersible Pump 396 GPH
 - a. Manufacturer: EcoPlus
 - b. Model Number: 728310
 - c. Dimensions: 6.4" x 3.1" x 4.5"
 - d. Warranty: 1 year
 - e. Power: 120v, 60Hz, .30 Amps
 - f. Requirements: Must be able to reach the max height of the system, and supply adequate water flow to system.

2.6 TUBING

A. Acceptable manufacturers and products

1. Product: Hydro Flow Premium Vinyl Tubing – Black
 - a. Manufacturer: Hydro Flow
 - b. Dimensions: ½ in. outside diameter, at least 20 ft long
 - c. Requirements: Must not allow light to penetrate the water in the tubing.

2.7 NET POTS/GROWING MEDIA

A. Acceptable manufacturers and products

1. Product: Go Pro Net Pot 3.75"
 - a. Manufacturer: Go Pro
 - b. Dimensions: 3.75" diameter
2. Product: Gold Label Hydrocorn
 - a. Manufacturer: Gold Label
 - b. Model Number: 713750

2.8 ACCESSORIES

A. Acceptable manufacturers and products

1. Product: Milwaukee Instruments Martini H55 pH/Temp Tester and Probe
 - a. Manufacturer: Milwaukee
 - b. Model Number: 716798
2. Product: GH pH Up Liquid
 - a. Manufacturer: General Hydroponics
 - b. Model Number: 722090
2. Product: GH pH Down Liquid
 - a. Manufacturer: General Hydroponics
 - b. Model Number: 722120
3. Product: GH Flora Series Performance Pack
 - a. Manufacturer: General Hydroponics
 - b. Model Number: 718145

Part 3 – EXECUTION

3.1 INSTALLATION

- A. Shelving structure will be built first.
- B. Shelving Units and the Shelf Support will be assembled.
 1. Shelves will be slid into place on the support pipes with the hexagonal support washers holding the shelves in place at a 1% to 2% slope.
 2. Tubing will be run through the system, connecting the shelves to each other and the reservoir.
- C. Reservoir will hold the pump and the water for the system.
 1. Pump will be connected to the tubing leading to the top of the system.
 2. The power cord must have a drip loop to make sure water has a location to drip off the cord, avoiding contact with the electrical outlet.
- D. Place the shelf support covering over the tubing and shelf support.
- E. Add water to the reservoir, test flow of system, check everything if functioning correctly.
- F. Apply additional support as needed with wall or floor fasteners.
- G. Desired plants should be grown or placed in non-soil medium in the net pots, place into the shelf system.
- H. The pH tester kit, pH adjusters, hydroponic nutrients will be used as needed, determined by the instructions.

END SECTION 108300

SECTION 108500 – BARREL COMPOST SYSTEM

PART 1 – GENERAL

1.1 SCOPE

This tumbler, barrel shaped, composting system will be placed on the back porch in an area which is easily accessible to the residents.

1.2 REQUIREMENTS

- A. System will be self-contained.
- A. System will have the capacity for the household.
- B. System will be easy to access.

1.3 SUBMITTALS

- A. Product owner manual and maintenance
- B. Instructions on setup and installation

PART 2 – PRODUCTS

1.1 BARREL COMPOST SYSTEM

- A. ACCEPTABLE PRODUCTS
- B. Model #: IM4000
- C. Manufacturer: YIMBY
- D. Dimensions (H x W x D): 36" x 28" x 26"
- E. Product Weight: 60 lbs
- F. Capacity: 37 gallons

PART 3 – EXECUTION

3.01 BARREL COMPOST SYSTEM

- A. The system will produce compost for the resident's gardens and landscaping.
- B. Add material to one side of the barrel and rotate regularly.
- C. When one side becomes full, begin filling the other side
- D. Switch back and forth between the sides until compost is made.
- E. Remove completed compost batch, keep a small amount of the batch left over to help start the next batch.

END SECTION 108500

END SECTION 10

11 - EQUIPMENT

113100 – RESIDENTIAL APPLIANCES

1.1 SCOPE

Kitchen and bathroom appliances including cooking and cleaning are included in the Drawings.

1.2 PERFORMANCE REQUIREMENTS

- A. When applicable, appliances must have Energy Star Rating or equivalent.
- B. Appliances must have a written warranty with a warranty period of 5 years.
- C. All appliances to be installed per installation instructions included in cut sheets.
- D. Maximum power draw limited to (?? Need this info from the power team).

1.3 SUBMITTALS

- A. Contractor shall provide Owner and Architect with brochures showing the full range of color, finish and sizes available for each proposed product.
- B. Contractor shall provide Owner and Architect with sample finishes of each product proposed in up to two (2) different colors, as selected by the Architect from the full range of options available.
- C. Contractor shall provide Owner with a valid warranty certificate covering all materials used in the completion of the Work.

2. PRODUCTS

2.1 REFRIGERATORS

A. Acceptable Manufacturers and Products

- 1. Beko– Model BFTF2715SSIM

(http://www.beko.us/urun_detay.aspx?urn=22914&kat=6446&lang=en-US)

B. Width: 27 1/2"

C. Height: 67 3/4"

D. Depth: 25 1/4"

E. Color: as selected by the Architect for each unit, from the full range of colors available from the manufacturer. Up to five different colors may be selected for the project, and each unit in a Triplex or Duplex building may be assigned a different color.

2.2 COOKTOP & OVEN

A. Acceptable Manufacturers and Products

1. Electrolux – Model EW30IS65JS (<http://www.electroluxappliances.com/Kitchen-Appliances/Ranges/Induction-Range/EW30IS65JS/>)

2. Alternative products may be proposed by the Contractor as options for pricing. If an alternative product is proposed, Contractor shall provide performance, cost, installation and other product information as requested by the Architect. All material substitutions shall be subject to approval by the Owner and Architect.

B. Width: 30 in

C. Height: 36 5/8 in

D. Depth: 28 5/16 in

E. Color: as selected by the Architect for each unit, from the full range of colors available from the manufacturer. Up to five different colors may be selected for the project, and each unit in a Triplex or Duplex building may be assigned a different color.

2.3 DISHWASHERS

A. Acceptable Manufacturers and Products

1. Beko– DIN25400 (http://www.beko.us/urun_detay.aspx?urn=22942&kat=6461&lang=en-US)

B. Width: 23.5 in

C. Height: 32.25 in

D. Depth: 21.625 in

E. Color: as selected by the Architect for each unit, from the full range of colors available from the manufacturer. Up to five different colors may be selected for the project, and each unit in a Triplex or Duplex building may be assigned a different color.

2.4 CLOTHES WASHERS

A. Acceptable Manufacturers and Products

1. Beko – Model WMY10148CO
(http://www.beko.us/urun_detay.aspx?urn=22948&kat=6450&lang=en-US)

B. Width: 23 5/8in

C. Height: 33 1/8in

D. Depth: 24 5/8 in

E. Color: as selected by the Architect for each unit, from the full range of colors available from the manufacturer. Up to five different colors may be selected for the project, and each unit in a Triplex or Duplex building may be assigned a different color.

2.5 CLOTHES DRYERS

A. Acceptable Manufacturers and Products

1. Beko – Model HPD24412W

(http://www.beko.us/urun_detay.aspx?urn=22956&kat=6451&lang=en-US)

B. Width: 23 3/8 in

C. Height: 33.25 in

D. Depth: 24 in

E. Color: as selected by the Architect for each unit, from the full range of colors available from the manufacturer. Up to five different colors may be selected for the project, and each unit in a Triplex or Duplex building may be assigned a different color.

3. EXECUTION

A. Workers shall wear protective equipment as recommended by the materials manufacturer when installing equipment.

B. All wiring and plumbing hook ups to be per manufacturer instructions.

C. All exposed screw heads shall be countersunk, the hole filled as recommended by the material manufacturer and painted to match the adjacent surface.

END OF SECTION 113100

END OF SECTION 11

21 – FIRE SUPPRESSION

210000 – WET PIPE SPRINKLER SYSTEM

PART 1 – GENERAL

1.1 SCOPE

To be installed in the house ceiling area and requires water used from the water filtration system potable water supply.

1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data for valves, sprinklers, specialties, and alarms.
 - 1. Submit sprinkler system drawings identified as "working plans" and calculations according to NFPA 13. Submit required number of sets to authorities having jurisdiction for review, comment, and approval. Include system hydraulic calculations.
 - 2. Submit test reports and certificates as described in NFPA 13.
- B. Design and Installation Approval: Acceptable to authorities having jurisdiction.
- C. Hydraulically design sprinkler systems according to NFPA 13.
- D. Comply with NFPA 13D and NFPA 70, and IRC 2009 Section P2904.
- E. UL-listed and -labeled and FM-approved pipe and fittings.
- F. Verify dimensions in field measurements before fabrication & indicate on shop drawings.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. CPVC Plastic Pipe: ASTM F 442/F 442M, UL 1821, 175-psig rating, made in NPS for sprinkler service. Include "Listed" and "CPVC Sprinkler Pipe" marks on pipe.
- B. CPVC Plastic Pipe Fittings: ASTM F 438 for NPS 3/4 to NPS 1-1/2 and ASTM F 439 for NPS 2, UL listed, 175-psig rating, for sprinkler service. Include "Listed" and "CPVC
- C. Sprinkler Fitting" marks on fittings.
- D. Black steel piping shall be provided in all exposed areas.
- E. Provide hangers, supports, and seismic restraints with UL listing and FM approval for fire-protection systems.

2.2 VALVES

- A. Fire-Protection Service Valves: UL listed and FM approved, with 175-psig nonshock minimum working-pressure rating. Indicating valves shall be butterfly or ball type, bronze body, and integral indicating device with 115-V ac, electric, single-circuit supervisory switch indicator.

2.3 SPRINKLERS

- A. Automatic Sprinklers: With heat-responsive element complying with the following:
 - a. UL 1626, for residential applications.
- B. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- C. Sprinkler types include the following:
 - a. Pendent Sprinkler: Tyco Rapid Response LFII Flush Residential Sprinkler Head
 - b. Pendent Sprinkler: Viking VK457 Concealed Sprinkler Head
 - c. Pendant Sprinkler: Viking VK468 Semi-Recessed Sprinkler Head
- D. Sprinkler Escutcheons: steel, one piece, with finish to match sprinklers.

- E. Sprinklers shall be low flow residential hidden pendent sprinklers engineered to provide a minimum design density of 0.05 gpm/ft² over the listed coverage area.
- F. Sprinkler frame and deflector shall be of bronze frame construction having a ½" NPT thread.
- G. Water seal assembly shall consist of a Teflon-coated Belleville spring washer with top-loaded extruded or cold head cup with 3 mm glass bulb containing no plastic parts, and having a temperature rating of 155°F, 165°F or 175°F.
- H. Sprinklers shall have a nominal K-factor of as designed in the hydraulic sprinkler design.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.
- B. Correct deficiencies in or remove and reinstall sprinkler that does not comply with requirements.
- C. Repair, refinish, or replace sprinklers damaged during installation, as directed by Architect.
- D. Adjust operating parts and hardware for smooth, quiet operation and weather tight closure. Lubricate hardware and moving parts.

3.2 PIPE AND FITTING APPLICATION

- A. Use steel pipe with threaded, press-seal, roll-grooved, or cut-grooved joints; copper tube with wrought-copper fittings and brazed joints; or CPVC plastic pipe and fittings and metal-to-plastic transition fittings with solvent-cemented joints.

3.3 PIPING INSTALLATION

- A. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve.

3.4 TESTING

- A. Flush, test, and inspect sprinkler-piping systems according to NFPA 13.

END SECTION 210000

END SECTION 21

22 – PLUMBING

221000 – PLUMBING PIPING

PART 1 - GENERAL

1.1 SCOPE

Included in this section are the piping for the house. There is a difference between feed piping and drain piping, and that will be specified in this section. Depending on the systems and appliances in the house, there will be different sizing to the pipes.

1.2 REQUIREMENTS

- a. Solar Decathlon Building Code
- b. International Residential Code 2015
 - i. Table P2605.1 Piping Support
- c. NSF 14
 - i. Plastic piping, fittings and components from third party vendors
- d. NSF 61

1.3 SUBMITTALS

- e. Product
 - i. Specifications
 - ii. Warranty
 - iii. Installation Requirements

PART 2 - PRODUCTS

2.1 PEX TUBING (COLD WATER)

- 1. 1" PEX TUBING
 - i. Color: Blue
 - ii. Location: Wet Wall
 - iii. Website: <http://www.homedepot.com/p/SharkBite-1-in-x-500-ft-Blue-PEX-Pipe-U880B500/202688018>
 - iv. Manufacturer: SharkBite
 - v. Certifications: IAMPO Certified
 - vi. Pipe Size: 1"
 - vii. Dimensions (L x W x H x Depth): 500' x 34.24" x 13" x 34.25"
 - viii. Max. Working Temperature: 200 F
 - ix. Min. Working Temperature: 32 F
 - x. Max. Working Pressure: 160 PSI
- 2. 3/4" PEX TUBING
 - i. Color: Blue
 - ii. Location: Wet Wall and Mechanical Room
 - iii. Website: <http://www.homedepot.com/p/SharkBite-3-4-in-x-300-ft-Blue-PEX-Pipe-U870B300/202687981>
 - iv. Manufacturer: SharkBite
 - v. Certifications: IAMPO Certified

- vi. Pipe Size: $\frac{3}{4}$ "
- vii. Dimensions (L x W x H x Depth): 300' x 30" x 12" x 30"
- viii. Max. Working Temperature: 200 F
- ix. Min. Working Temperature: 32 F
- x. Max. Working Pressure: 160 PSI

2.2 PEX PIPING (HOT WATER)

3. 1" PEX TUBING

- i. Color: Red
- ii. Location: Wet wall
- iii. Website: <http://www.homedepot.com/p/SharkBite-1-in-x-100-ft-Red-PEX-Pipe-U880R100/202033016>
- iv. Manufacturer: SharkBite
- v. Certifications: ANSI Certified, CSA Listed, IAMPO Certified
- vi. Pipe Size: 1"
- vii. Dimensions (L x W x H x Depth): 100' x 12" x 29" x 29"
- viii. Max. Working Temperature: 200 F
- ix. Min. Working Temperature: 32 F
- x. Max. Working Pressure: 160 PSI

4. $\frac{3}{4}$ " PEX TUBING

- i. Color: Red
- ii. Location: Wet Wall and Mechanical Room
- iii. Website: <http://www.homedepot.com/p/SharkBite-3-4-in-x-500-ft-Red-PEX-Pipe-U870R500/202033040>
- iv. Manufacturer: SharkBite
- v. Certifications: ANSI Certified, CSA Listed, IAMPO Certified
- vi. Pipe Size: $\frac{3}{4}$ "
- vii. Dimensions (L x W x H x Depth): 500' x 12" x 29" x 29"
- viii. Max. Working Temperature: 200 F
- ix. Min. Working Temperature: 32 F
- x. Max. Working Pressure: 160 PSI

2.3 ABS (ACRYLONITRILE BUTADIENE STYRENE) PIPING

- A. Website: <http://www.homedepot.com/p/2-in-ABS-DWV-90-Degree-Hub-x-Hub-Long-Turn-Elbow-C5807LTHD2/100346300>
- B. Manufacturer: Nibco Inc.
- C. Fitting size: 2"
- D. Dimensions (L x W x H x Depth): 5.38" x 2.73" x 5.38" x 5.38"
- E. Maximum Working Pressure: 5 PSI

PART 3. EXECUTION

1. INSTALLATION

a. PEX TUBING

- i. Website: https://www.huduser.gov/portal/publications/pex_design_guide.pdf
- ii. Requirements:
 - 1. Minimum bending radius for 1" tubing = 7" and $\frac{3}{4}$ " tubing = 9"

2. Do not pull the tubing too much
- b. ABS PIPING
 - i. Website: <https://www.ppfahome.org/abs/absgeneral.aspx#install>

END SECTION 221000

221100 – PEX PIPING MANIFOLD

PART 1. GENERAL

1. SCOPE

Included in this section is the Pex Manifold System that will be the control system where the hot and cold water will be distributed to individual fixtures. This will help with water and energy consumption throughout the house.

2. REQUIREMENTS

- a. IAMPO
- b. NSF International Performance and Health Effects
- c. Intertek Testing Services

3. SUBMITTALS

- a. Specifications
- b. Warranty
- c. Installation Requirements

PART 2. PRODUCTS

1. PEX PIPING MANIFOLD

- a. Website:
https://www.cpesupply.com/2319552/Product/50243?gclid=CjwKEAiApLDBBRC8oICb9NvKsg0SJAD9yOHsMiISQpNWf7PLW2rulMvDjZIA2JLwZ-TjupWSlwnhCxoC9GXw_wcB
- b. Manufacturer: Viega
- c. Material: Brass
- d. Nominal Size: 1" (need another ¾" one for those pipes)
- e. Dimensions (L x W x D): 24-3/8" x 8" x 3"
- f. Number of Outlets: 24 (9 hot, 15 cold)
- g. Includes: 1/4 Turn Valves and T-Handle Valve Key, Port Crimp Connections, Drill Templates, Instruction Guide, Faceplate and Port Labels

PART 3. EXECUTION

1. INSTALLATION

- a. Must be protected from UV exposure and petroleum
- b. Reference to Viega cutsheet

222100 - Potable Water Tanks

PART 1. GENERAL

1. SCOPE

Included in this section is the tank where the potable, drinking water will be stored. For the competition, this tank will only be filled once. However, after the competition, the grey water

filtration system will contribute to the supply in the potable water tank to feed into the water appliances and for drinking.

2. REQUIREMENTS

- a. Solar Decathlon Rules
 - i. Rule 9. Liquids
- b. NSF
- c. ANSI61

3. SUBMITTALS

- a. Product
 - i. Specifications
 - ii. Warranty
 - iii. Installation Requirements

PART 2. PRODUCTS

1. POTABLE WATER STORAGE TANK

- a. Type: Pillow Tank
- b. Website: <http://www.aireindustrial.net/products/750-gallon-potable-water-pillow-tank.asp>
- c. Manufacturer: AIRE
- d. Dimensions (L x W x Loft): 120" x 100" x 16"
- e. Capacity: 750 gallons
- f. Warranty: 1 year limited warranty

PART 3. EXECUTION

1. INSTALLATION

- a. Website: http://www.aireindustrial.net/images/Bladder_Instructions_web.pdf
- b. Precautions upon installation
 - i. Make sure the area is free of sharp objects
 - ii. Make sure that the tank is leveled
 - iii. Do not drag bladder
 - iv. Use Teflon tape for tight connection

END SECTION 221100

222200 – WATER STORAGE TANKS

PART 1. GENERAL

1. SCOPE

Included in this section are the tanks that will be used to store the grey water that is coming from the light grey water appliances (i.e. washing machine, bathroom sink, and shower) and the tank that will store the water after the biosand filtration and rainwater. In total, it should be two tanks.

2. REQUIREMENTS

- a. Solar Decathlon Rules
- b. Solar Decathlon Building Code
- c. NSF
- d. ANSI61

3. SUBMITTALS

- a. Product
 - i. Specifications
 - ii. Warranty
 - iii. Installation Requirements

PART 2. PRODUCTS

1. GRAY 1, WASTE WATER, TANK

- a. Type: Pillow Tank
- b. Website: <http://www.aireindustrial.net/products/150-gallon-waste-water-pillow-tank.asp>
- c. Manufacturer: AIRE
- d. Dimensions (L x W x Loft): 66" x 48" x 12"
- e. Capacity: 150 Gallons
- f. Warranty: 1 year limited

2. TREATED COMBINED LIGHT GRAY AND RAIN TANK

- a. Type: Pillow Tank
- b. Website: <http://www.aireindustrial.net/products/750-gallon-waste-water-pillow-tank.asp>
- c. Manufacturer: AIRE
- d. Dimensions (L x W x Loft): 120" x 100" x 16"
- e. Capacity: 750 Gallons
- f. Warranty: 1 year limited

END SECTION 222200

222400 – WATER PUMPS

PART 1 - GENERAL

1.1 SCOPE

Included in this section is the pressure boosting pump for our water filtration system. This pump will be in between the first grey water storage tank and the biosand filter. There is going to be a significant vertical head that the water will need to travel in order to reach the biosand filter, and this pump will accomplish that.

1.2 SUBMITTALS

- A. Specifications
- B. Installation Requirements

PART 2 - PRODUCTS

2.1 SCALA PUMP

- C. Purpose: Pump water from GREY 1 tank to biosand filter which cannot be gravity fed.
- D. Website: <http://us.grundfos.com/products/find-product/SCALA2.html#brochures>
- E. Manufacturer: Grundfos
- F. Dimensions (L x W x H): 15.9" x 7.6" x 11.9"
- G. Power Requirement: Max. 600 W
- H. Flow Rate: Max. 16 GPM

2.2 BMQE PUMP

- A. Purpose: Provides constant pressure and works with low pressure feed. Able to set the desirable pressure.
- B. Website: http://us.grundfos.com/products/find-product/grundfos-bmqe-system/_jcr_content/tabbedpanel/brochures/download_list/downloads/download_0/file/file.res/L-DWS-PG-01.pdf
- C. Manufacturer: Grundfos
- D. Dimensions (L x W x H): 22.44" x 8.58" x 12.74"
- E. Power Requirement: 200 W
- F. Flow Rate: 22 GPM

PART 3 - EXECUTION

3.1 INSTALLATION

PUMP #1

- A. Website :<http://us.grundfos.com/content/dam/GPU/Literature/SCALA2/SCALA2-IO.pdf>
- B. Location
 - a. Must not be exposed to frost
 - b. Near drain or in a drip tray connected to a drain
 - c. Space Requirement: 17" x 8.5" x 12.8"

END SECTION 222400

223000 – HOT WATER HEATER

PART 1 - GENERAL

1.1 SCOPE

Will be used for the hot water in the house and both components will be located in the mechanical closet.

1.2 SPECIFICATION REQUIREMENTS

1. Energy efficiency
2. Corrosion resistant tank
3. 149 degree F hot water temperature
4. Support four person family
5. CO2 refrigerant
6. Heat pump warranty 10 years
7. Heat storage tank warranty 15 years

1.3 SUBMITTALS

1. Product specifications
2. Drawing with installation location

PART 2 - PRODUCTS

2.1 HEAT PUMP WATER HEATER

1. Volume: 43 gallons
2. Energy factor: 3.5
3. Water temperature: 149
4. Pipe size: ½"

2.2 STAINLESS STEEL STORAGE TANK

END SECTION 223000

224100 – RESIDENTIAL PLUMBING FIXTURES

PART 1 – GENERAL

1.1 SCOPE

Fixtures that are used in the kitchen and bathroom plumbing fixtures.

1.2 STANDARDS

- A. ASME A112.18.1/CSA B125.1 NSF 61 NSF 372 All applicable US Federal and State material regulations DOE - Energy Policy Act 1992 ADA ICC/ANSI A117.1 CSA B651 OBC

PART 2 – PRODUCTS

2.1 BATHROOM SINK

A. Acceptable Product

1. Product: Purist Wading Pool Bathroom Sink
2. Model: K-2314-1
3. Manufacturer: Kohler
4. Website:
5. Size: 24" (610 mm) x 23-1/2" (597 mm)
6. Overflow: None
7. Faucet hole: 1-3/8"
8. Warranty: 1 year limited
9. Colors: White, Biscuit, and Almond

2.2 BATHROOM SINK FIXTURE

A. Acceptable Product

1. Product: Elliston single-handle bathroom sink faucet
2. Model: K-R72782-AD
3. Manufacturer: Kohler
4. Website:
5. Spout reach: 5"
6. Max flow rate: 1.5 gal/min
7. Pressure: 60 psi
8. Warranty: 1 year limited
9. Color: Polish chrome, or vibrant brushed nickel

2.3 KITCHEN SINK

A. Acceptable Product

1. Product: Undermount Stainless Steel Kitchen Sink
2. Manufacturer: Elkay
3. Single bowl
4. Length: 24"
5. Width: 18-1/4"
6. Depth: 9"
7. Faucet holes: 0
8. Size: 24"x 18.25" x 9"
9. Undermounted
10. Colors: Stainless Steel

11. <http://www.homedepot.com/p/Elkay-Undermount-Stainless-Steel-24-in-0-Hole-Single-Bowl-Kitchen-Sink-HDU24189F/206889274>

2.4 KITCHEN SINK FIXTURE

A. Acceptable Product

1. Product: Coralasis Kitchen Sink Faucet
2. Model: K-15175-P
3. Manufacturer: Kohler
4. Spout reach: 8-1/2"
5. Flow rate: 1.8 gal/min
6. Pressure: 60 psi
7. Color: Polished chrome

2.4 SHOWER FIXTURE

A. Acceptable Product

1. Product: Contemporary Round Rain Showerhead
2. Model: K-45201
3. Manufacturer: Kohler
4. Flow rate: 2.0 gpm (gallons per minute)
5. Connection: 1/2-inch NPT

END SECTION 224100

END SECTION 22

SECTION 23 – HEATING VENTILATION & AIR CONDITIONING

231000 – INSTRUMENTS

Part 1 – GENERAL

1.1 SCOPE

Used to measure various physical parameters for recording by digital systems and feedback for control systems.

1.2 REQUIREMENTS

- A. Requirements for measurement range and sensitivity vary from sensor to sensor and from location to location.
- B. Provide hardwired data and power connections to all instrumentation that requires it. Connections shall be shown on the appropriate (telecommunications) sheets of the Drawings.

Part 2 – PRODUCTS

2.1 THERMOSTAT

- A. Acceptable thermostat products
 - 1. NEST
 - 2. Website:
<https://store.nest.com/product/thermostat?selectedVariantId=T3007ES>
 - 3. Assembled mass: 8.6 oz (243.7 g)
 - 4. Assembled diameter: 3.3 in (8.4 cm)
 - 5. Assembled height: 1.21 in (3.08 cm)
 - 6. Wireless: Wi-Fi 802.11b/g/n @ 2.4GHz, 5GHz
 - 7. Battery: Built-in rechargeable lithium-ion battery
 - i. Power consumption: Less than 1 kWh/month
 - 8. Connectivity: Nest app on phone or tablet with iOS 8 or later, or Android 4.1 or later
 - 9. Warranty: 2-year limited

~~2.2 TEMPERATURE SENSORS~~

~~2.3 HUMIDITY SENSORS~~

~~2.4 MOTION DETECTORS – NEAR FIELD~~

~~2.5 MOTION DETECTORS – FAR FIELD~~

~~2.6 AMBIENT LIGHT~~

~~2.7 ELECTRICAL CURRENT SENSORS~~

~~2.8 POWER CONSUMPTION SENSORS~~

END SECTION 231000

SECTION 232000 - DAMPERS

Part 1 – GENERAL

1.1 SCOPE

Custom fabricated lag-stick dampers are used to distribute heat evenly among the heat pump system's outdoor units inside the attic space or to operate the outdoor units inline with each other. The HPHW OU precools the air for the space conditioning OU depending on the season.

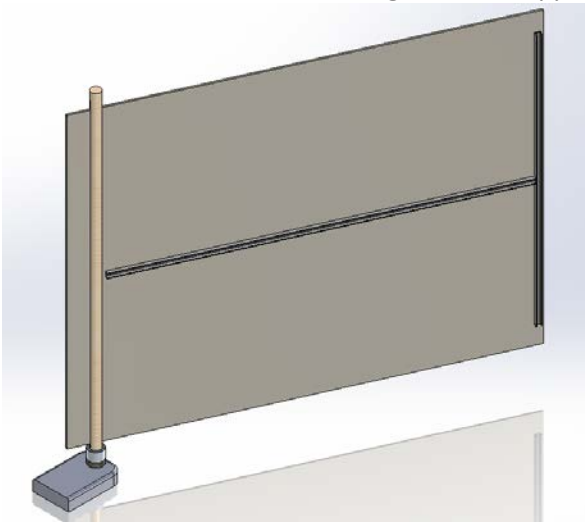
Part 2 – PRODUCTS

2.1 Attic Configured Heat Pump Dampers

- A. Acceptable damper products
 - 1. Product: Custom Design
 - a. Elmer's Foam Board
 - b. Owen's Corning Raft-R-mate Foam Insulation
 - c. Gorilla Glue
 - d. 1" Dowel Rod
 - e. 2" Diam. 6062 Al round stock (Approx 3" length)
 - f. Damper Motor 45° Displacement
 - g. Aluminum U-channel 1/8"

Part 3 – EXECUTION

- 1. Construct, glue, fasten boards and shaft coupler to rod.
- 2. Insulate Dividing wall for improved energy efficiency and temperature control
- 3. Consult local building codes for approved installation practices



END SECTION 232000

SECTION 233000 – ENERGY RECOVERY VENTILATOR

Part 1 - GENERAL

1.1 SCOPE

Energy Recovery Ventilator is used to provide a continuous flow of fresh outdoor air to the house interior in a pressure balanced system (neither pressurizing nor depressurizing the house). This is required by ASHRAE 62.2 because most high-efficiency modern homes are tightly sealed against air infiltration. ERVs provide transfer of sensible and latent heat (humidity) between incoming fresh and outgoing stale air streams, enhancing the energy efficiency of the system overall.

1.2 REQUIREMENTS

- A. Applicable Standards
 - 1. ASHRAE 62.2
 - 2. ASHRAE 90.1
 - 3. Interior CO₂ levels shall not exceed 1000 PPM.
- B. Provide minimum of 0.5 ACH fresh outside air (based on 4 occupants and 1000 square foot home size for).
- C. Provide booster mode (additional capacity) to handle maximum anticipated CO₂ load (based on 12 people).

Part 2 – PRODUCTS

- 1. Acceptable products for Energy Recovery Ventilator (ERV)
 - 1. Product: ComfoAir 200
 - a. Manufacturer: Zehnder
 - b. Filters: class G4 for general and F7 for pollen
 - c. CO₂ Sensor for Operation Control
 - d. DC Motors
 - e. Dimensions: (H x W x D) 47.25" x 21.4" x 12.5"
 - f. Thermal output: up to 95%

Part 3 – EXECUTION

- A. Maintenance
 - 1. Regular replacement and cleaning of the filter in front of the unit
 - 2. The heat exchanger should be cleaned every 3-4 years depending on how dirty the outside air is
 - 3. Please see the unit manual for additional servicing tasks.

END SECTION 233000

SECTION 234000 – COMPRESSOR / CONDENSER UNIT

Part 1 – GENERAL

1.1 SCOPE

The compressor / condenser unit is located outside the thermal envelope of the house. Its function is to reject heat from the interior (cooling mode) or absorb heat from the exterior (heating mode).

1.2 REQUIREMENTS

- A. Applicable Standards
 - 1. ASHRAE 90.1
- B. Installed unit shall be UL Listed. Any modifications to the unit for increased efficiency shall be thoroughly tested and the results provided to the Solar Decathlon Competition Organizers prior to acceptance of the design.
- C. Capacity of the unit shall be determined according to the total system heat and cooling loads as determined by energy modeling.

Part 2 – PRODUCTS

2.1 VRF CONDENSER

- A. Acceptable Products
 - 1. VRF Mini-Split Condenser
 - a. Manufacturer: LG
 - b. Model: LMU30CHV
 - c. Website: <http://www.totalhomesupply.com/30000-btu-22-seer-quad-zone-multi-f-mini-split-air-conditioner/p/LG-LMU30CHV>
 - d. Dimensions (HxWxD): 32.8" x 37.4" x 15.7"

Part 3 - EXECUTION

- A. If the outdoor unit is installed on a roof structure be sure to level the unit. Ensure the roof structure and anchoring method are adequate for the unit location.
- B. Consult local codes regarding rooftop mounting.
- C. Unit shall be kept free of snow.
- D. Unit shall not be installed in areas where corrosive gases, such as acid or alkaline gas, are produced.
- E. Unit shall not be installed where it could be exposed directly to sea winds.

END SECTION 234000

SECTION 236000 – INTERIOR HEAT PUMP UNITS

Part 1 – GENERAL

1.1 SCOPE

Interior heat pump units provide heated or cooled air (heating and cooling modes respectively). In cooling mode, these units also dehumidify the air. Air is drawn from the space in which the unit is located, heated or cooled / dehumidified and recirculated into the space.

Interior units are generally installed high on the wall or in the ceiling (different products for each application). A separate unit is generally installed in each living space (living room, bedroom, etc.) and are controlled separately by proprietary remote control systems.

1.2 REQUIREMENTS

- A. Applicable Standards
 - 1. ASHRAE 90.1
- B. Capacity of each unit is selected from range of products commercially available, and based on energy analysis of the house and space served
- C. Minimum Seasonal Energy Efficiency Rating (SEER) : 22
- D. Minimum Coefficient of Performance (COP) : 4.0

Part 2 – PRODUCTS

2.1 WALL-MOUNTED UNIT

- A. Acceptable Products:
 - 1. Mini-split Wall-mounted Unit
 - a. Manufacturer: LG
 - b. Model:
 - c. Web Link <http://www.totalhomesupply.com/7000-btu-standard-indoor-wall-unit-heat-pump/p/LG>
 - d. Height 8.2" Width 35.6" Depth 11.4"

2.2 CEILING MOUNTED UNIT

- A. Acceptable Products
 - 1. Mini-Split Ceiling Mounted Unit
 - a. Manufacturer LG
 - b. Model LMN096HVT
 - c. Web Link <http://www.totalhomesupply.com/7000-btu-standard-indoor-wall-unit-heat-pump/p/LG>
 - d. Dimensions L
 - i. Height 8.2"
 - ii. Width 35.6"
 - iii. Depth 11.4"

Part 3 - EXECUTION

- A. Indoor units with product-specific mounting kits. Route the indoor refrigerant lines to the required piping hole position and connect to exterior condensing unit. Route the condensate drain line to a convenient exterior location and discharge to ground. No air ducts are required for this unit.

END SECTION 236000

SECTION 237000 — ELECTRIC RADIANT HEATING

Part 1 — GENERAL

1.1 SCOPE

Electric radiant heat is commonly installed in floors and / or walls of kitchen and / or bathroom spaces. Electric resistance wires with a suitable protective coating (UL listed commercially available product) are commonly embedded in the layer of thin-set mortar used to adhere tile to the surface.

In this application, electric radiant heating is reserved for the bathroom floor only. Refer to Drawings.

1.2 REQUIREMENTS

- A. Products and materials must be UL Listed
- B. Products and materials shall be rated for use under floor tiles, including in wet-service areas such as showers.

Part 2 PRODUCTS

- A. Acceptable Products
 - 1. Schluter Ditra Heat
 - a. Website: <http://www.schluter.com/schluter-us/en-US/Floor-Warming/Schluter®-DITRA-HEAT-E-KIT/p/DITRA-HEAT-E-KIT>.

Part 3 — EXECUTION

- A. Install over wood, concrete or composite substrate, in thin-set mortar under ceramic tiles.
- B. Install in conjunction with suitable waterproof membranes and crack prevention membranes.
- C. Requires electrical hook-up (hardwired)
- D. Requires a thermostat (programmable — included in the kit)

END SECTION 237000

END SECTION 23

26 - ELECTRICAL

260500 – WIRING

PART 1 – GENERAL

1.1 SCOPE

Insulated electrical conductors for distributing power throughout the dwelling.

PART 2 – PRODUCTS

2.1 Acceptable manufacturers and products

A. Romex 14/3 NM-B Copper Wire

1. Website: https://hdsupplysolutions.com/shop/p/14-3-romex-nm-b-copper-wire-50-length-p301398?gclid=CjwKEAiA6YDBBRDwtpTQnYzx5IASJAC57ObMT2woaN3w8dcOmLCr c59SM7MrzqMJEs0muc5CbtzG5xoC6qjw_wcB
2. Manufacturer: Southwire
3. Dimensions (in): 8.9x9.1x2.1
4. Length of pack (ft): 50
5. Amps (A): 15
6. Price: \$36.00

- B. Alternative products may be proposed by the Contractor to the Owner to provide options based on pricing. If an alternative product is proposed, Contractor shall provide performance, cost, installation and other product information as requested by the Architect. All material substitutions shall be subject to approval by the Owner and Architect.

PART 3 – EXECUTION

- A. All electrical wires shall be run through a central location (preferably near a fuse box)
- B. Red and black wires denote live wires, white wires serve as the ground, and blue yellow or other colors are used for switches.
- C. Avoid laying conduit around sharp corners.
- D. Each major appliance shall have a dedicated circuit and circuit breaker in the panel.
- E. Each hard-wired appliance or piece of equipment shall have a dedicated circuit and circuit breaker in the panel.

261100 – LIGHTING CONTROLS

PART 1 – GENERAL

1.1 SCOPE

The lighting control system will allow for automatic control of the lighting. This will allow for advanced energy saving capabilities and the ability of the occupants to control the lighting in each portion of the house by smartphone or tablet “apps”.

1.2 PERFORMANCE REQUIREMENTS

Main Controller

- a. cULus Listed
- b. FCC approved
- c. Operates on standard 120V, 50/60 Hz
- d. Operational between 32 and 104 degrees F
- e. Operates between 0% and 90% humidity
- f. Controls on frequency signals between 431 and 437 MHz
- g. Remains unharmed when exposed to static discharge-conforms to IEC 61000-4-2
- h. Remains unharmed when exposed to surge voltages-conforms to IEEE C62.41-1991
- i. Retains memory after power failure
- j. Able to connect to the internet
- k. Can relay signals between occupant and room controllers
- l. Programmable
- m. Can control the settings of lighting in each room based on different “set modes” produced by the user
- n. Can schedule lighting turning on and off based on schedules provided by the user
- o. Connects to Lutron Cloud, enabling remote control

Room Controller

- a. Controllable by frequency signals between 431 and 437 MHz
- b. Can control LED lamps and fixtures
- c. Retains set mode of lighting level prior to power failure
- d. cULus Listed
- e. FCC approved
- f. Operates on standard 120V, 50/60 Hz
- g. Remains unharmed when exposed to static discharge-conforms to IEC 61000-4-2
- h. Remains unharmed when exposed to surge voltages-conforms to IEEE C62.41-1991
- i. Can be mounted in standard 1-gang electrical receptacles
- j. Operational between 32 and 104 degrees F
- k. Operates between 0% and 90% humidity
- l. Can connect to 10 devices
- m. Can connect to devices visible within 60 feet.
- n. Can connect to devices through walls within 30 feet

1.3 SUBMITTALS

- A. Main Controller
 - a. Specs
 - b. Warranty
 - c. Who will install and maintain
 - d. Installation instructions
- B. Room Controller
 - a. Specs
 - b. Warranty
 - c. Who will install and maintain
 - d. Installation instructions

PART 2 – PRODUCTS

2.1 Main Controller

2.1.1 Lutron

- A. Connect Bridge
 - a. Size: W: 2.75", L: 2.75", H: 2.75"
 - a. Power Supply: 5V, 300 mA
 - b. Typical Power Usage: 1.3W
 - c. Used in conjunction with Lutron Main Repeater to connect to devices
 - d. 1 year warranty
 - e. Price: \$209
- B. Main Repeater
 - a. Operates on frequency of 434 MHz
 - b. Antenna length of 6.25 in
 - c. Signal operates up to 30 ft
 - d. Electrical input: 9V @ 300 milliAmps
 - e. Consumes 3.1W
 - f. Connects with devices operating on frequencies between 431 and 437 MHz
 - g. Can connect to internet
 - h. Remains unharmed when exposed to static discharge-conforms to IEC 61000-4-2
 - i. Remains unharmed when exposed to surge voltages-conforms to IEEE C62.41-1991
 - j. Retains memory after power failure
 - k. Size: W: 4.25", L: 5.25" (disregarding antenna attachment), H: 1 1/16"
 - l. Size: W: 2.75", L: 2.75", H: 2.75"
 - f. Power Supply: 5V, 300 mA
 - g. Typical Power Usage: 1.3W
 - h. Must be used with Lutron Main Repeater to connect to devices
 - i. 1 year warranty
 - j. Price: \$341.01
- C. Smart Bridge
 - a. Size: W: 2.75", L: 2.75", H: 2.75"
 - b. Power Supply: 5V, 300 mA
 - c. Typical Power Usage: 1.3W

- d. 1 year warranty
 - e. Price: \$110.00
 - 2.1.2 Developed System
 - A. See performance requirements above that need to be met for a developed system to be considered.
- 2.2 Room Controller
 - 2.2.2 Lutron
 - A. Caseta Wireless In-Wall Dimmer
 - a. Size: W:2 15/16", L: 4 11/16", D: 1 7/16"
 - b. Needs to be wired to ground
 - c. Price: \$72.00
 - 2.2.3 Developed System
 - A. See performance requirements above that need to be met for a developed system to be considered.
- 2.3 Accessories
 - 2.5.1 Wire
 - A. See Power specification
 - 2.5.2 Junction Boxes
 - A. See Power specification
 - 2.5.3 Switch Covers
 - A. Lutron
 - a. Size: W: 2.75", L: 4.75", D: 0.25"
 - b. Style of Switch: Rocker
 - c. Number of Gangs: 1-6
 - d. Shape: Rectangular
 - e. Color: Multiple options
 - f. Material: Plastic
 - g. Price: \$4.90
 - B. Generic Model
 - a. Size: W: 2.75", L: 4.75", D: 0.25"
 - b. Style of Switch: Rocker
 - c. Number of Gangs: 1-6
 - d. Shape: Rectangular
 - e. Color: Multiple options
 - f. Material: Plastic
 - g. Price: \$0.79 and up

PART 3- EXECUTION

Installation of the system shall be in compliance with local, and national codes. The trained technicians installing the system shall follow the instructions provided by the manufacturer in the "Installation Instructions". Controller will be integrated with the relevant lighting sensors provided in integrated automation.

- 3.1 Installer
 - A. Electrical Contractor
 - a. Shall have applicable licensure
 - b. Shall have qualified technicians installing product

- c. Shall troubleshoot issues at the site for best installation
- d. Shall follow applicable building codes
- e. Shall follow installation instructions
- f. Shall ensure all components are operating correctly at the site

END SECTION 261100

261200 – LIGHTING FIXTURES

PART 1 – GENERAL

1.1 SCOPE

This section addresses the lighting needs through asking for spaces with ambient lighting, tasked lighting and accent lighting highlighting the structure at the same time.

1.2 REQUIREMENTS

Good quality day lighting

Use of LED lights which integrates with the integrated automation system

1.3 SUBMITTALS

Product data sheets

PART 2 – PRODUCTS

1. Products have been selected for all rooms within the house according to the lighting schedule
2. Product data sheets are included
3. Any alternatives need to be approved by Owner

PART 3 - EXECUTION

Installation of the system shall be in compliance with local, and national codes. The trained technicians installing the system shall follow the instructions provided by the manufacturer in the "Installation Instructions". Controller will be integrated with the relevant lighting sensors provided in integrated automation.

Installer

Electrical Contractor

- Shall have applicable licensure
- Shall have qualified technicians installing product
- Shall troubleshoot issues at the site for best installation
- Shall follow applicable building codes
- Shall follow installation instructions
- Shall ensure all components are operating correctly at the site

END SECTION 261200

SECTION 263100 – PHOTOVOLTAIC SOLAR COLLECTORS

PART 1 – GENERAL

1.1 SCOPE

Photovoltaic panels used to convert sunlight into DC electricity, and when accompanied by built-in microinverters, into AC electricity.

1.2 PERFORMANCE REQUIREMENTS

- A. Panels shall have a useful service life of at least 25 years.
- B. A typical 60" x 42" panel shall have a peak power output of at least 300 W.
- C. Panels shall be UL Listed.

1.3 SUBMITTALS

- A. Documentation of UL Listing.

PART 2 - PRODUCTS

2.1 Acceptable manufacturers and products

- A. Sunpower SPR-X21-335-BLK
 - 1. Website: <https://us.sunpower.com/sites/sunpower/files/media-library/data-sheets/ds-x21-series-335-345-residential-solar-panels-datasheet.pdf>
 - 2. Manufacturer: Sunpower
 - 3. Dimensions (in): 61.24x41.18 x1.81
 - 4. Area (ft2): 17.54
 - 5. Max Power (W): 335
 - 6. Warranty: 25 years
- B. Alternative products may be proposed by the Contractor to the Owner to provide options based on pricing. If an alternative product is proposed, Contractor shall provide performance, cost, installation and other product information as requested by the Architect. All material substitutions shall be subject to approval by the Owner and Architect.

PART 3 – EXECUTION

- A. Solar panels add 5-6 lbs per square foot of roof loading.
- B. Most companies want to install the panels themselves.

- C. There must be adequate insulation between the solar panel and roof to ensure that the solar panels do not heat up. Need some space for convective heat transfer to cool down solar.

END SECTION 263100

SECTION 263120 – INVERTER

PART 1 – GENERAL

1.1 SCOPE

Microinverters convert the DC power from each photovoltaic panel into AC power.

PART 2 – PRODUCTS

2.1 Acceptable Manufacturers and Products

A. Solar Edge SE7600-US

1. Website:

https://www.solaredge.com/sites/default/files/se_storedge_inverter_datasheet_na.pdf

2. Manufacturer: Solar Edge

3. Dimensions: 940 mm x 315 mm x 184 mm (without mounting bracket)

4. Max DC Volt Rating (V): 500

5. Max Power (VA): 8350VA at STC

6. Nominal AC Voltage (V): 240

7. Max AC Current (A): 25

B. Alternative products may be proposed by the Contractor to the Owner to provide options based on pricing. If an alternative product is proposed, Contractor shall provide performance, cost, installation and other product information as requested by the Architect. All material substitutions shall be subject to approval by the Owner and Architect.

PART 3 – EXECUTION

- A.** The autotransformer is used for backup power only, and is not mandatory if using Smart Energy Management applications only.
- B.** A secondary AC panel is used for backed up loads. The backed-up loads are rewired through this panel. A two pole 25A main circuit breaker is installed on this panel, to ensure the 25A phase imbalance limit is maintained at all times

END SECTION 263120

SECTION 263130 – DC-DC OPTIMIZER

PART 1 – GENERAL

1.1 SCOPE

PART 2 – PRODUCTS

1.2 Acceptable Manufacturers and Products

A. Solar Edge P400

1. Website: <http://www.solaredge.com/sites/default/files/se-P5-series-add-on-power-optimizer-datasheet-na.pdf>
2. Manufacturer: Solar Edge
3. Dimensions: 128 mm x 152 mm x 35 mm
4. Max DC Input Voltage (V): 80
5. Max DC Input Current (A): 10
6. Max Input Power at 40C (W): 400
7. Max Output Voltage (V): 60
8. Max Output Current (A): 15
9. Max OCPD Rating (A): 20

- B. Alternative products may be proposed by the Contractor to the Owner to provide options based on pricing. If an alternative product is proposed, Contractor shall provide performance, cost, installation and other product information as requested by the Architect. All material substitutions shall be subject to approval by the Owner and Architect.

PART 3 – EXECUTION

- A. Each power optimizer is attached to the rack using the 5/16" or 1/4" screws and washers.
- B. For grounding, the provided 5/16" stainless steel star washer is used between the railing and the flat side of the mounting bracket. The grounding washer should break through the anodize coating of the railing to ensure low-resistive connection (Torque of 9.5 N*m / 7 lb*ft.).
- C. The Minus (-) output connector of the string's first power optimizer is connected to the Plus (+) output connector of the string's second power optimizer. The rest of the power optimizers in the string in the same way.

END SECTION 263130

SECTION 263300 – BATTERY SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

Battery systems used to store energy from the photovoltaic array and from the utility grid for when the demand from the house exceeds power available from the panels or the grid. Battery systems may also be used when the grid is down if the system includes protective measures as required by local authority.

PART 2 – PRODUCTS

2.1 Acceptable Products

A. LG Chem RESU10H

1. Website: <http://www.lgchem.com/global/ess/ess/product-detail-PDEC0001>

1. Manufacturer: LG Chem

2. Dimensions (in): 29.3x35.7x8.1

3. Capacity (kWh): 9.8kWh @25C

4. Cost: \$6,275

5. Price per capacity (\$/kWh): \$640.3

6. Location: Indoor or outdoor

7. Warranty: 10 years

8. Operating Conditions : IP55 rated

9. Power (kW): 5kW, Peak: 7kW for 10sec

10. Installation: wall mounted

11. Color: white

B. Alternative products may be proposed by the Contractor to the Owner to provide options based on pricing. If an alternative product is proposed, Contractor shall provide performance, cost, installation and other product information as requested by the Architect. All material substitutions shall be subject to approval by the Owner and Architect.

PART 3 – EXECUTION

A. Caution is required with respect to where these batteries are installed. The LG RESU10H can go inside or outside, but the perimeter needs to be checked for clearance boundaries, ambient weather conditions and operating temperature.

END SECTION 263300

END SECTION 26

27 – TELECOMMUNICATIONS

271000 – ROUTER AND MODEM

1.1 SCOPE

In order to ensure connectivity of sensors, smart appliances, and wifi, the following products have been specified. Connectivity is tantamount to the communications between users, our "smartHouse" control system, and appliance accessibility.

1.2 PERFORMANCE SPECIFICATIONS

- A. Wireless functionality throughout the house
- B. These products will work with any appropriate internet provider for the area

1.3 SUBMITTALS

WIRELESS ROUTER

- a. Acceptable manufacturers and products
 - i. NETGEAR AC1750 Dual Band Router
 - i. Website: https://www.amazon.com/NETGEAR-Router-AC1750-Gigabit-R6300v2/dp/B00EM5UFP4/ref=cm_cr_ar_p_d_pdt_img_sims?ie=UTF8
 - ii. Manufacturer: Netgear
 - iii. Wireless: 802.11 A/C, 5.8 GHz Radio Frequency, 802.11 a/b/g/n
 - iv. Total WiFi speed: 1750Mbps
 - v. Processor Speed: Dual Core 800Mhz
 - vi. Dimensions (in): 10.12 x 12.01 x 2.83 in
 - vii. LAN Ports: 4
 - viii. Location: Core or Office space/Bedroom

B. Cable Modem

- b. Acceptable manufacturers and products:
 - i. ARRIS SURFboard SB6141 DOCSIS 3.0 Cable Modem
 - i. Description: 3 products in 1: a DOCSIS 3.0 Cable Modem, Dual-Band Concurrent 802.11ac Wi-Fi Access Point and 2-Port Gigabit Ethernet Router.
 - ii. Website: https://www.amazon.com/gp/product/B00AJHDZSI/ref=pd_cp_147_1?ie=UTF8&psc=1&refRID=QFD15A0SW6GNW4MZ5A8M
 - iii. Manufacturer: ARRIS
 - iv. Wireless: 802.11ac
 - v. Download speed: 343 Mbps wireless, 1600 Mbps wired
 - vi. Dimensions (in): 2 x 6.4 x 8.7 in
 - vii. Weight: 1.3 lbs
 - viii. Location: Core or Office space/Bedroom

END SECTION 271000

END SECTION 27

29 - INTEGRATED AUTOMATION

PART 1 - GENERAL

1.1 SCOPE

The “smartHouse” control system for the house is included in this section. The role that the control system takes is that of a supervisory mode. The effective range of control from the controller of a feature of the house will be limited to that which can be conducted manually by occupants. To define this role, the use of sensors as well as predictive data in terms of forecasts will influence the way in which the control system interacts with power, HVAC, and water. The goal of the “smartHouse” will be to autonomously enable the occupants to generate more effective cost-saving as well as resource-saving techniques and actions.

1.2 PERFORMANCE SPECIFICATIONS

- A. Predictive simulation through a physically based model of the house design (virtual house)
- B. Real-time data through a personal weather station & a wide range of sensors to assist and confirm the projected performance of the house.
Note: many of the other system’s products do already come with integrated sensors and accessibility to data.
- C. Intuitive user Interface and accessibility for occupants. Main control would be featured in the core in the form of a tablet while performing necessary calculations.
- D. Minimal invasiveness to actual imbedded system controllers. This is to disentangle and prove the modularity of the control system to be able to be implemented in many cases.
- E. Case designs made by the “smartHouse” will focus on event scheduling, such as the charging of the electric vehicle for maximizing profits.

1.3 SUBMITTALS

- A. Products: Sensors, actuators, controllers, user Interface & accessibility
 - 1. Specs and performance
 - 2. Warranty
 - 3. Installation

Part 2- Products

2.1 SENSORS

- A. Comfortability
 - 1. Acceptable manufacturers and products
 - a. SMAKN® DHT22 AM2302 Digital Temperature And Humidity Measurement Sensor
 - i. Description: Temperature Humidity Sensor
 - ii. Website: <https://www.amazon.com/SMAKN%C2%AE-Digital-Temperature-Humidity-Measurement/dp/B00MIBRFTI>
 - iii. Manufacturer: SMAKN®
 - iv. Temperature Sensor Range: -40~80°C.
 - v. RH Sensor Range: 0-100%RH.
 - vi. Accuracy resolution: 0.1
 - vii. Size: 6.9 x 3.9 x 0.9 inches
 - viii. Weight: 0.3 ounces

- ix. Location: 3 in attic, 3 in each room, 1 in greencourt, connected to Arduinos

B. Energy Management

- 1. Acceptable manufacturer and products
 - a. Neurio W1-HEM Home Energy Monitor (North American Version)
 - i. Description: Monitor & manage power consumption with smartphone accessibility
 - ii. Website: <http://www.homedepot.com/p/Neurio-Home-Electricity-Monitor-W1-HEM/206639413>
 - iii. Manufacturer: Neur.io
 - iv. Model Number: W1-HEM
 - v. Power Consumption: less than 2W
 - vi. Dimensions (in): 8.3 x 6.5 x 1.8
 - vii. Weight: 1.4 lb
 - viii. Accuracy: $\pm 1\%$
 - ix. Max load capacity: EU: 16A/230VAC; UK: 13A/240VAC
AU: 10A/240VAC; US: 15A/120VAC
 - x. Wireless: IEEE 802.11n
 - xi. Operating Frequency: 2.4 GHz
 - xii. Certification: UL/CSA/IEC 61010-1
 - xiii. Location: Installed in electrical box
 - xiv. Warranty: 1 yr

C. Light Management

- 1. Acceptable manufacturer and products
 - a. Universal Dimming Room Controller 2 channel, 16 amperes
 - i. Description: Dimming Controller for lighting
 - ii. Manufacturer: Wattstopper
 - iii. Model: LMRC-222
 - iv. Input Voltage: 120/277VAC, 50/60Hz
 - v. Operating Temperature: 32-131 F
 - vi. Max Branch Circuit Overcurrent Protection: 25A
 - b. Digital Dimming Wall Switch, 1 paddle, w/ I.R., white
 - i. Description: Digital Light Management – Low Voltage Switch
 - ii. Manufacturer: Wattstopper
 - iii. Model: LMDC-101-W
 - iv. Type: Digital Dimming Wall Switch
 - v. Special Features: 7-LED dimming level indicator, Low voltage switch
 - vi. Amps: 5mA
 - vii. Volts: 24VDC
 - c. Digital Dual Tech Ceiling Mount Sensor
 - i. Description: Occupancy Sensor
 - ii. Manufacturer: Wattstopper
 - iii. Model: LMDC-100
 - iv. IR Range On Axis: 1000 Sq. Ft.
 - v. LightOutput 1FCD: Automatic On/Off

- vi. RoHS: Yes
- d. Closed Loop Single Zone DLMphotosensor
 - i. Description: Daylight harvester sensor
 - ii. Manufacturer: Wattstopper
 - iii. Model: LMLS-400
 - iv. LightOutput 1FCD: On/Off, Bi-level, Tri-level or Dimming Control
 - v. Volts: 24VDC
 - vi. RoHS: Yes
- e. Digital Wireless ConfigurationTool
 - i. Description: Wireless handheld tool for remote configuration of Wattstopper system
 - ii. Manufacturer: Wattstopper
 - iii. Model: LMCT-100
 - iv. Type: Digital wireless configuration tool
 - v. Special Features: Digital Infrared

D. Arduino and related

1. Acceptable manufacturer and products

- a. Arduino Uno
 - i. Description: Microcontroller board based on the ATmega328 (datasheet)
 - ii. Website: <https://www.amazon.com/Arduino-Uno-R3-Microcontroller-A000066/dp/B008GRTSV6>
 - iii. Manufacturer: Arduino Rev 3
 - iv. Voltage: 5V
 - v. Auxillary: 4 USB ports, 40 GPIO pins, Full HDMI port, Combined 3.5mm audio jack and composite video
 - vi. Dimensions: 3.15 x 2.17 x 0.98 inches
 - vii. Location: Each room, attic, greencourt, mech room
- b. Power Supply
 - i. Description: Cord for Arduino
 - ii. Website: https://www.amazon.com/ZJchao-Power-Adapter-Arduino-2-Flat-Pin/dp/B00CP1QLSC/ref=pd_sim_147_1?encoding=UTF8&pd_rd_i=B00CP1QLSC&pd_rd_r=TGG7F6PHAH9R0G6NXH5Z&pd_rd_w=GGdOt&pd_rd_wg=Khy7T&psc=1&refRID=TGG7F6PHAH9R0G6NXH5Z
 - iii. Manufacturer: ZJChao
 - iv. Input: 100~240V, 50/60Hz
 - v. Output: 9V, 1A
 - vi. Dimensions (in): 3.75 x 2.75 x 1.25 inches
 - vii. Cord length: 100cm
 - viii. Location: Attached to Arduino to outlets
- c. Breadboard and Jumper Cambles
 - i. Description: 9pcs breadboard & Dupont wire

- ii. Website: <https://www.amazon.com/dp/B0745J8D2S?psc=1>
- iii. Manufacturer: Dupont
- iv. Dimensions (in): 1.2 x 4.2 x 3 inches
- v. Location: As needed in connection with sensors
- d. WiFi Shield
 - i. Description: WiFi / 802.11 Development Tools WiFi Shield ESP8266 Shield ESP8266 for Arduino
 - ii. Website: http://www.mouser.com/ProductDetail/SparkFun-Electronics/WRL-13287/?qs=WyAARYrbSnal3jeHYsjBkQ%3D%3D&gclid=Cj0KCQjwwqXMBRCDARIsAD-AQ2gIg87ATDnsEr8UdGisdPgXtiZGV_vF2fMMBbCf1t1FZJk_3Eda06QaAk6zEALw_wcB
 - iii. Manufacturer: Sparkfun Electronics
 - iv. Weight: .4512 oz

2.5 User Interface & Accessibility:

A. Touchscreen Display (Tablet)

- 1. Acceptable manufacturers and Products:
 - a. Planar PXL2430MW 24" Widescreen Multi-Touch LED Monitor
 - i. Website: https://www.amazon.com/Planar-PXL2430MW-Widescreen-Multi-Touch-Monitor/dp/B0053YJZ4U/ref=sr_1_2?s=electronics&ie=UTF8&qid=1498863502&sr=1-2&keywords=24+inch+planar+touchscreen
 - ii. Manufacturer: Planar
 - iii. Dimensions (in): 4.25 x 21.85 x 15.47 inches
 - iv. Weight: 11.4 pounds
 - v. USB Ports: 1
 - vi. Location: Hallway

B. Computer

- 1. Acceptable manufacturers and Products:
 - a. Intel BOXNUC7I7BNHX1 NUC Kit with 16GB Optane memory preinstalled
 - i. Website: <https://www.newegg.com/Product/Product.aspx?item=N82E16856102178>
 - ii. Manufacturer: Intel
 - iii. Processor: Intel i7-7567U
 - iv. Hard drive: M.2 SSD/2.5" HDD
 - v. USB: Thunderbolt 3.0
 - vi. Memory: DDR4 2133 (260Pin)
 - vii. Optane Memory: 16GB Optane Pre-installed
 - viii. Graphics: Intel Iris Plus Graphics 650
 - ix. Location: Hallway

C. Hard drive

- 1. Acceptable manufacturers and Products:
 - a. HGST Travelstar 7K1000 2.5-Inch 1TB 7200 RPM SATA III 32MB Cache Internal Hard Drive 0J22423

- i. Website: https://www.amazon.com/HGST-Travelstar-2-5-Inch-Internal-0J22423/dp/B00B4QESVQ/ref=sr_1_5?ie=UTF8&qid=1498868611&sr=8-5&keywords=1tb+hdd+2.5
- ii. Manufacturer: HGST
- iii. Capacity: 1 TB
- iv. Location: in NUC

D. RAM

- 1. Acceptable manufacturers and Products:
 - a. G.SKILL Ripjaws Series 8GB (2 x 4GB) 260-Pin DDR4 SO-DIMM DDR4 2133 (PC4 17000) Laptop Memory Model F4-2133C15D-8GRS
 - i. Website: https://www.newegg.com/Product/Product.aspx?Item=N82E16820232146&cm_re=ddr4_2133_260_pin_-_20-232-146_-_Product
 - ii. Manufacturer: G.Skill
 - iii. Size: 4 GB
 - iv. Slot: DDR4 2133 (260 Pin)
 - v. Location: in NUC

E. Wall Mount

- 1. Acceptable manufacturers and Products:
 - a. Dual VESA & Wall Mount Bracket for M350 Digital Signage Enclosure
 - i. Website: https://www.amazon.com/Mount-Bracket-Digital-Signage-Enclosure/dp/B006505B2W/ref=pd_sim_147_3?encoding=UTF8&pd_rd_i=B006505B2W&pd_rd_r=KH03B3GCXPC10CBVYJKG&pd_rd_w=iXdgn&pd_rd_wg=vQfl3&psc=1&refRID=KH03B3GCXC10CBVYJKG
 - ii. Manufacturer: MITXPC
 - iii. Size: 218mm x 196mm x 67mm (H x W x D) / 8.58" x 7.72" x 2.64". Main Bracket Including Tabs (extreme dimensions): 218mm x 232mm x 67mm (H x W x D) / 8.58" x 9.13" x 2.64"
 - iv. VESA Monitor Mounting Sizes: Small to Medium Monitors (12" - 22.9" diagonal): 75mm x 75mm, 100mm x 100mm. Larger Monitors (23" - 30.9" diagonal): 200mm x 100mm
 - v. Weight: 3 pounds
 - vi. Location: Hallway

Part 3- Installation

- a. Sensors will be installed in appropriate locations (either plugged in or powered by battery)
- b. Arduinos will be installed in appropriate places with appropriate accessories
- c. Touchscreen and NUC will be installed in hallway
- d. Calibration of sensors and smartHouse software will be ran

END SECTION 29

32 – EXTERIOR IMPROVEMENTS & LANDSCAPING

329300 – PLANTS

SECTION - GREEN WALL

PART 1 – GENERAL

1.1 SCOPE

Two wall-mounted system for growing plants without soil. Used along south wall of the exterior.

1.2 PERFORMANCE REQUIREMENTS

- A. Use a sustainable non-soil or soil alternative.
- B. Must be partially automatic, leaving room for occupants to interact and care for the system.
- C. Will fit within the dimensions of 4' w X 2' d X 7' h
- D. Will not interfere with patio accessibility.
- E. System must be anchored or stabilized to the wall.
- F. System needs to be able to function outside.

1.3 SUBMITTALS

- A. Components: Green Wall System
 - 1. Specifications
 - 2. Who will install and maintain them
 - 3. Directions on how to maintain the system.
- B. Accessories:
 - 1. Specifications
 - 2. Directions on how to maintain the system.
- C. List of indicators to be aware of to monitor plant health, and system functionality.

PART 2 – PRODUCTS

2.1 WALL PANEL SYSTEM

- A. Acceptable manufacturers and products
 - 1. Product: VGP Panel (VGP-1636)
 - a. Manufacturer: Tournesol Siteworks
 - b. Dimensions: 16-1/2" x 36-3/8" mounting panel
 - c. Empty Weight: 2 lbs per panel
 - d. Mounting system: minimum recommendation at least six mounting points per panel

2.2 WALL TRAY SYSTEM

- A. Acceptable manufacturers and products
 - 1. Product: VGP Tray (VGP-01)
 - a. Manufacturer: Tournesol Siteworks
 - b. Dimensions: 7-7/8" x 6" x 7-5/8" planting tray
 - c. Requirements: 8 (Extended-Spacing) to 12 (Close-Spacing) pieces per panel
 - 1. Approximate Planting Weight Extended Spacing (1.5 trays per sq. ft.): 12.7 to 20 lbs./sq.ft.
 - 2. Approximate Planting Weight Close Spacing (2 trays per sq. ft.): 19 to 30 lbs./sq.ft.

3. Empty Tray Weight: 1 lbs per tray
4. Tray planting volume: 110 cu. in. or .47 gal

2.3 IRRIGATION

A. Acceptable manufacturers and products

1. Product: ½" irrigation Black Polyethylene Tubing
 - a. Manufacturer: DIG Corp
 - b. Dimensions: 0.600 ID x 0.700 OD
 - c. Pressure: maximum 60 PSI
 - b. Requirements: Connection to the main water system placed at top of wall panels and down the panels. Controlled by a timer. Irrigate to top of wall, allow water to flow down the system wall. Water plants between 4-7am or 6-9pm to minimize evaporation losses
2. Product: 1/4" distribution Black Polyethylene Tubing
 - a. Manufacturer: DIG Corp
 - b. Dimensions: 0.170 ID x 0.250 OD
 - c. Pressure: maximum 60 PSI
 - d. Requirements: Used for distribution from irrigation laterals to trays
3. 1/2 in. Universal Nut Lock Elbow (15-056)
 - a. Manufacturer: DIG Corp
 - b. Requirements: To connect the third irrigation lateral
4. 1/2 in. Universal Nut Lock Tee (15-057)
 - c. Manufacturer: DIG Corp
 - d. Requirements: Used for distribution from main line to irrigation laterals
5. 1/4 in. Drip Line Barb Tee (25-002)
 - a. Manufacturer: DIG Corp
 - b. Requirements: Used for connection of irrigation laterals to the trays
6. FC 0-10 GPH Adjustable 8 Stream Drip Emitter 1/4 in. Barb (06-011)
 - a. Manufacturer: DIG Corp
 - b. Requirements: Used for controlling the flow out of the distribution tubing
7. 1/2 in. Hose End (16-021)
 - a. Manufacturer: DIG Corp
 - b. Requirements: Use for closing off the end of the irrigation line

2.4 ACCESSORIES

A. Acceptable manufacturers and products

1. Product: 3/4 in. FHT Hose Bib Drip Connection Kit (SW9000)
 - a. Manufacturer: DIG Corp
 - b. Components:
 1. Hose End Backflow Preventer D45
 - a. Prevents dirty water from backwashing into your potable water system
 - b. Inlet x Outlet: 3/4 in. FHT x 3/4 in. MHT
 2. "Y" Filter with 155 mesh screen (P16-155)
 - a. Screen can be extracted from filter for easy cleaning
 - b. Interchangeable screen and disc elements with a wide range of filtration degrees
 3. 3/4" x MNPT Swivel Adapter (P09-155)
 - a. 3/4" FHT x MNPT with washer
 4. 30PSI Preset Pressure Regulator (18-030)

- a. Regulator set to 30 PSI.
 - b. Reliable control regardless of fluctuation in upstream pressure or flow
- 5. 3/4" FHT Compression FNPT Swivel (15-024)
- c. Specifications:
 - 1. Maximum Flow Rate
 - a. Single Drip Line: 220 GPH
 - b. Two Drip Lines: 440 GPH
 - 2. Operating Pressure: 10 to 60 PSI
- 2. Product: 3/4 in. Hose End Timer w/ LCD Display (B09D)
 - a. Manufacturer: DIG Corp
 - b. Requirements: allow irrigation to flow at a set rate for a specific amount of time.

Part 3 – EXECUTION

3.1 INSTALLATION

A. Plant tray preparation.

- 1. Insert bottom mesh, snap into place
- 2. Slide irrigation baffle into top
- 3. Slide anti lift arm into both sides
- 4. Complete tray
- 5. Plant plants in trays

B. Installed panels onto home and connected to the manifold.

- 1. Install VGP mounting panel on to exterior wall three panels per wall to create a planted surface on each south facing wall.
- 2. Minimum of six connections to are required per panel.
- 3. Begin panel installation at bottom of panel and work from left to right.
- 4. Adjacent panels may interlock to share a mounting point.
- 5. Spacers should be used to cinch panels to the mounting surface to secure and prevent bending of panel corners.

C. Irrigation

- 1. Size the 1/2" irrigation line to the top of the system, connect the two 1/2 in. Universal Nut Lock Tee and the one 1/2 in. Universal Nut Lock Elbow to connect main line to the irrigation laterals.

- a. The 1/2" nut lock elbow should be on the end of the irrigation line.

- 2. Cut the irrigation line to the length of tubing required, connect the irrigation laterals to the nut lock connections in three different laterals, one lateral in the middle of each panel.

- 3. On the top most level and then every other level connect the 1/4 in. Drip Line Barb Tee.

- 4. Connect the 1/4 inch irrigation line to the barb tee on each end.

- 5. Repeat steps for the other irrigation laterals.

D. Test flow of system, check everything is functioning correctly.

E. Seal off the ends of the 1/2" irrigation line.

E. Install planters in desired arrangement and place the 1/4" irrigation tubes in the designated planters.

END SECTION

SECTION - TRELLIS WALL

PART 1 – GENERAL

1.1 SCOPE

Trellis system will be located next to the main door. Will support plants along the wall.

1.2 PERFORMANCE REQUIREMENTS

- A. Support a vining plant to grow up the wall.
- B. Connected to the timed irrigation system.
- C. Will fit within the dimensions of 4' w X 1' d X 7' h
- D. Will not interfere with door accessibility.
- E. System must be anchored or stabilized to the wall.

1.3 SUBMITTALS

- A. Components: Trellis Wall System
 - 1. Specifications
 - 2. Who will install and maintain them
 - 3. Directions on how to maintain the system.
- B. Accessories:
 - 1. Specifications
 - 2. Directions on how to maintain the system.
- C. List of indicators to be aware of to monitor plant health, and system functionality.

PART 2 – PRODUCTS

2.1 WIRE ROPE PLANT TRELLIS SYSTEM

- A. Acceptable manufacturers and products
 - 1. Product: Wire Rope Trellis System
 - a. Manufacturer: Jakob
 - b. Model Number: 30790-0000
 - c. Dimensions:
 - i. Depth: 2"
 - ii. Maximum Height: 96"
 - iii. Maximum length: 3'
 - iv. Rope Diameter: 5/32"

Part 3 – EXECUTION

3.1 INSTALLATION

- A. Secure and size the system to the specified dimensions.
- B. Install system with suggested manufacturer procedures.
- C. Set vining plants at the bottom to grow and cover the area.

LANDSCAPE IRRIGATION

PART 1 – GENERAL

1.1 SCOPE

The landscaping will cover the exterior of the home.

1.2 REQUIREMENTS

- A. The landscaping planting will be watered with timed irrigation system.
- B. The plants will be chosen to suit the environment.
- C. The irrigation system will cover the 300 square feet of expected planting area immediately surrounding the house.

1.3 SUBMITTALS

- A. Instructions on setup and installation for planting plan.
- B. Information on irrigation maintenance.

PART 2 – PRODUCT

2.1 LANDSCAPE IRRIGATION TUBING

- A. Acceptable manufacturers and products
 - 1. Product: ½" irrigation Black Polyethylene Tubing.
 - a. Manufacturer: DIG Corp
 - b. Requirements: Connection to the main water system.
 - 2. Product: 1/4" distribution Black Polyethylene Tubing.
 - a. Manufacturer: DIG Corp
 - b. Requirements: Used for distribution from main irrigation line to plant containers.

2.2 IRRIGATION FITTINGS

- A. Acceptable manufacturers and products
 - 1. 1/2 in. Universal Nut Lock Tee (15-057)
 - a. Manufacturer: DIG Corp
 - b. Requirements: Used for distribution from main line to other sections of landscape.
 - 2. 1/4 in. Drip Line Barb Tee (25-002)
 - a. Manufacturer: DIG Corp
 - b. Requirements: use for distribution of water from main line to ¼" distribution tubing.
 - 3. 1/2 in. Hose End (16-021)
 - c. Manufacturer: DIG Corp
 - d. Requirements: Use for closing off the end of the irrigation line.

2.3 DRIP EMITTERS

- A. Acceptable manufacturers and products
 - 1. FC 0-10 GPH Adjustable 8 Stream Drip Emitter 1/4 in. Barb (06-011)
 - a. Manufacturer: DIG Corp
 - b. Requirements: Used for controlling the flow of irrigation out of the distribution tubing.
 - 2. Flag 1 GPH Drip Emitter 1/4 in. Barb (06-009)
 - a. Manufacturer: DIG Corp
 - b. Requirements: Used for controlling the flow of irrigation out of the distribution tubing.
 - 3. 12-Outlet Self-Cleaning Drip Emitter (TOP-005)

- a. Manufacturer: DIG Corp
- b. Requirements: Used for splitting the flow of irrigation out of the distribution tubing.

2.4 ACCESSORIES

A. Acceptable manufacturers and products

1. Product: 3/4 in. FHT Hose Bib Drip Connection Kit (SW9000)

- a. Manufacturer: DIG Corp
- b. Components:
 - 6. Hose End Backflow Preventer D45
 - a. Prevents dirty water from backwashing into your potable water system
 - b. Inlet x Outlet: 3/4 in. FHT x 3/4 in. MHT
 - 7. "Y" Filter with 155 mesh screen (P16-155)
 - a. Screen can be extracted from filter for easy cleaning
 - b. Interchangeable screen and disc elements with a wide range of filtration degrees
 - 8. 3/4" x MNPT Swivel Adapter (P09-155)
 - a. 3/4" FHT x MNPT with washer
 - 9. 30PSI Preset Pressure Regulator (18-030)
 - a. Regulator set to 30 PSI.
 - b. Reliable control regardless of fluctuation in upstream pressure or flow
 - 10. 3/4" FHT Compression FNPT Swivel (15-024)

c. Specifications:

- 3. Maximum Flow Rate
 - c. Single Drip Line: 220 GPH
 - d. Two Drip Lines: 440 GPH
 - 4. Operating Pressure: 10 to 60 PSI
- #### 2. Product: 3/4 in. Hose End Timer w/ LCD Display (B09D)
- a. Manufacturer: DIG Corp
 - b. Requirements: allow irrigation to flow at a set rate for a specific amount of time.
- #### 3. Product: Rain Bird 1/4 in. Universal Tubing Stake (TS-025)
- a. Manufacturer: DIG Corp
 - b. Requirements: Use to secure the irrigation emitter line.
 - c. Component: Complementary Emitter for TOP 12-Outlet

Part 3 – EXECUTION

3.1 INSTALLATION

- A. Layout the irrigation line from water connection to reach the plants.
- B. Using a punch tool, make a hole in the 1/2" hose wherever you want to place a 1/4" barbed fitting for connection to distribution tubing.
- C. Cut distribution tubing to size, attach desired tees and length of distribution tubing.
- D. Assemble the Hose Bib Drip Connection Kit and attach the irrigation tubing.
- E. Run the water through the system to flush
- F. After flush seal off the end and attach the emitters.

END SECTION 329300

END SECTION 32