Seed[POD]

University of Arizona Solar Decathlon Team

for the

U.S. Department of Energy
2009 Solar Decathlon

Project Manual

Prepared by the UA Solar Decathlon Team
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Rule #	Rule Description	Content Requirement(s)	Drawing Sheet(s)
4-2	Construction Equipment	Drawing(s) showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site	O-101 O-102 O-301
4-2	Construction Equipment	Specs for heavy machinery	Specifications 412200
4-3	Ground Penetration	Drawing(s) showing the locations and depths of all ground penetrations on the competitionsite	S-101 E-101
4-4	Impact on the Turf	Drawing(s) showing the location, contact area, and soil bearing pressure of every component resting directly on the turf	S-101
4-5	Generators	Specifications for generators	Specifications 416516
4-6	Spill Containment	Drawing(s) showing the locations of all equipment, tanks, and pipes that will contain fluids at any point during the event	P-101
4-6	Spill Containment	Specifications for all equipment, tanks, and pipes that will contain fluids at any point during the event	Project Manual Section 22 of Construction Specifications
4-7	Lot Conditions	Calculations showing that structural design remains compliant even if 18 in. (45.7 cm) of vertical elevation change exists	Project Manual Structural Calculations
4-7	Lot Conditions	Drawing(s) showing shimming methods and materials to be used if 18 in. (45.7 cm) of vertical elevation change exists on the lot	S-501
5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	C-104 C-201 C-202
5-2	Solar Envelope Dimensions	List of solar envelope exemption requests accompanied by justifications and drawing references	NA
6-1	Structural Design Approval	List of, or marking on, all sheets in the complete electronic Construction Documents that have been or will be stamped by the structural engineer in the hard-copy, stamped structural submission; the stamped submission shall consist entirely of sheets or pages that also appear in the complete electronic construction document set	S-101 S-102 S-103 S-201 S-202 S-401 S-501 S-701
6-2	Maximum Architectural Footprint	Drawing(s) showing all information needed by the Rules Officials to measure the architectural footprint electronically	A-104
6-2	Maximum Architectural Footprint	Drawing(s) showing all movable components that may increase the footprint if operated during contest week	A-105

Rule #	Rule Description	Content Requirement(s)	Drawing Sheet(s)
6-2	Maximum Architectural Footprint	Shading calculations and/or diagrams for components that DO NOT shade the building above its finished floor height between 9 a.m. and 5 p.m. EDT on October 1 (shading calculations and/or diagrams are not necessary for components that are either shorter than finished floor height or obviously do not shade the building)	G-901
6-3	Minimum Conditioned Space	Drawing(s) showing space conditioning means in primary living spaces	A-105
6-4	Entrance and Exit Routes	Drawing(s) showing the accessible public tour route and the ground surface area that will be covered by organizer-provided walkway material	C-103 X-101
7-1	Placement	Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation designed as part of an integrated mobile system	L-101
7-2	Watering Restrictions	Drawings showing the layout and operation of greywater irrigation systems	L-102
8-1	PV Technology Limitations	Specifications for photovoltaic components	Project Manual Section 48 of Construction Specifications
8-1	PV Technology Limitations	Retail price quote for photovoltaic components	Project Manual Retail Price Quote Section
8-3	Thermal Energy Storage	Drawing(s) showing the location of thermal energy storage components	NA
8-3	Thermal Energy Storage	Specifications for thermal energy storage components	NA
8-3	Thermal Energy Storage	Shading calculations and/or diagrams for thermal energy storage components (if necessary)	NA
8-4	Batteries	Drawing(s) showing the location(s) and quantity of stand-alone, PV-powered devices	NA
8-4	Batteries	Specifications for all stand-alone, PV-powered devices	NA
8-5	Desiccant Systems	Drawing(s) describing the operation of the desiccant system	NA
8-5	Desiccant Systems	Specifications for desiccant system components	NA
8-6	Village Grid	Completed Interconnection Application form.	Project Manual Interconnection Application form
8-6	Village Grid	Drawing(s) showing the locations of the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	E-101 E-103 E-201

Rule #	Rule Description	Content Requirement(s)	Drawing Sheet(s)
8-6	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	Project Manual Section 48 of Construction Specifications
8-6	Village Grid	One-line electrical diagram	E-601
8-6	Village Grid	Calculation of service/feeder net computed load per NEC 220	E-602
8-6	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	E-101
8-6	Village Grid	Elevation(s) showing the terminal box, meter housing, main utility disconnect, and other service equipment	E-201
9-4	Rainwater Collection	Drawing(s) showing the layout and operation of rainwater collection systems	L-102
9-6	Thermal Mass	Drawing(s) showing the locations of water-based thermal mass systems	A-701 A-702
9-6	Thermal Mass	Specifications for components of water-based thermal mass systems	Project Manual Section of Construction Specifications
10-2	Event Sponsor Recognition	Drawing(s) showing the dimensions, materials, artwork, and content of all communications materials, including signage	X-102 X-201 X-901
10-3	Team Sponsor Recognition	Drawing(s) showing the dimensions, materials, artwork, and content of all communications materials, including signage	X-102 X-201 X-901
11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	X-101
11-4	Public Exhibit	Drawing(s) showing the dimensions, materials, artwork, and content of the handout	X-602
11-4	Public Exhibit	Drawing(s) showing the artwork and content of the team uniform	X-601

CONSTRUCTION SPECIFICATIONS

01 General Requirements

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 PROJECT INFORMATION

A. Project: Seed[POD]University of Arizona Solar Decathlon House.

1. Project Location: **The National Mall, District of Columbia**

B. Owner: University of Arizona

C. Architect: University of Arizona Solar Decathlon Team.

D. Contractor: University of Arizona Solar Decathlon Team.

E. The Work consists of: The design, build, and fabrication of an 800 s.f. solar powered home.

1.2 WORK RESTRICTIONS

A. Contractor's Use of Premises: During construction, Contractor will have full use of fabrication areas to include but not be limited to: Fabrication areas in the Architecture Building on the University of Arizona Campus. Contractor's use of premises is limited only by Owner's right to perform work or employ other contractors on portions of the Project.

1. Owner will occupy premises during construction. Perform construction both during and outside of Owner's normal working hours (8 AM to 5 PM) Monday thru Friday, other than holidays), unless otherwise agreed to in advance by Owner. Clean up work areas and return to usable condition at the end of each work period.
2. Driveways, Walkways, and Entrances: Keep driveways, parking areas, loading areas and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

B. Nonsmoking Building: Smoking is not permitted within the building or within 20 feet (7 m) of entrances, operable windows, or outdoor-air intakes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 PROJECT MANAGEMENT AND COORDINATION

A. Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.

B. Schedule and conduct progress meetings at Project site at weekly intervals. Notify Owner and Architect of meeting dates and times. Require attendance of each subcontractor or other entity concerned with current progress or involved in planning, coordination, or performance of future activities.

1. Record minutes and distribute to everyone concerned, including Owner and Architect.

1.2 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

1. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
2. Submit three copies of each action submittal. Architect will return two copies.
3. Submit two copies of each informational submittal. Architect will not return copies.
4. Architect will discard received from sources other than Contractor.

B. Place a permanent label or title block on each submittal for identification. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect. Include the following information on the label:

1. Project name.
2. Date.
3. Name and address of Contractor.
4. Name and address of subcontractor or supplier.
5. Number and title of appropriate Specification Section.

C. Identify deviations from the Contract Documents on submittals.

D. Contractor's Construction Schedule Submittal Procedure: Submit two copies of schedule within 10 days after date established for Commencement of the Work.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. Product Data: Mark each copy to show applicable products and options. Include the following:

1. Manufacturer's written recommendations, product specifications, and installation instructions.
2. Wiring diagrams showing factory-installed wiring.
3. Printed performance curves and operational range diagrams.
4. Testing by recognized testing agency.
5. Compliance with specified standards and requirements.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. Submit on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (762 by 1067 mm). Include the following:

1. Dimensions and identification of products.
2. Fabrication and installation drawings and roughing-in and setting diagrams.
3. Wiring diagrams showing field-installed wiring.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.

C. Samples: Submit Samples for review of kind, color, pattern, and texture and for a comparison of these characteristics between submittal and actual component as delivered and installed. Include name of manufacturer and product name on label.

1. If variation is inherent in material or product, submit at least 3 sets of paired units that show variations.

2.2 INFORMATIONAL SUBMITTALS

A. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

2.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit 3 copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type schedule within 30 days of date established for commencement of the Work

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

PART 3 - EXECUTION

3.1 SUBMITTAL REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Architect will review each action submittal, make marks to indicate corrections or modifications required, will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule 1 day before each regularly scheduled progress meeting.

1. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribute copies of approved schedule to Owner, Architect, subcontractors, testing and inspecting agencies, and parties identified by Contractor with a need-to-know schedule responsibility. When revisions are made, distribute updated schedules to the same parties.

END OF SECTION 013000

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Testing and inspecting services shall be performed by independent testing agencies.

B. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Architect for a decision.

C. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum. The actual installation may exceed the minimum within reasonable limits. Indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision.

D. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
6. Names of individuals making tests and inspections.
7. Description of the Work and test and inspection method.
8. Complete test or inspection data, test and inspection results, an interpretation of test results, and comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
9. Name and signature of laboratory inspector.
10. Recommendations on retesting and reinspecting.

E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, notices, receipts for fee payments, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

F. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated; and where required by authorities having jurisdiction, that is acceptable to authorities.

G. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

H. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Promptly notify Architect and Contractor of irregularities or deficiencies in the Work observed during performance of its services.
2. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
3. Do not perform any duties of Contractor.

I. Associated Services: Cooperate with testing agencies and provide reasonable auxiliary services as requested. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Security and protection for samples and for testing and inspecting equipment.

J. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

B. Comparable Product Requests:

1. Submit request for consideration of each comparable product. Do not submit unapproved products on Shop Drawings or other submittals.
2. Identify product to be replaced and show compliance with requirements for comparable product requests. Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified.
3. Architect will review the proposed product and notify Contractor of its acceptance or rejection.

C. Basis-of-Design Product Specification Submittal: Show compliance with requirements.

D. Compatibility of Options: If Contractor is given option of selecting between two or more products, select product compatible with products previously selected.

E. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
4. Store materials in a manner that will not endanger Project structure.
5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

F. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Provide products that comply with the Contract Documents, are undamaged, and are new at the time of installation.

1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
2. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Where Specifications name a single manufacturer and product, provide the named product that complies with requirements.
2. Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
4. Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements for "comparable product requests" for consideration of an unnamed product.
5. Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
6. Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements for "comparable product requests" for consideration of an unnamed manufacturer's product.
7. Where Specifications name a single product, or refer to a product indicated on Drawings, as the "basis-of-design," provide the named product. Comply with provisions for "comparable product requests" for consideration of an unnamed product by another manufacturer.

C. Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

D. Unless otherwise indicated, Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Performance Requirements: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work.

1.2 SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

B. Waste Reduction Progress Reports: Submit concurrent with each Application for Payment. Include total quantity of waste, total quantity of waste salvaged and recycled, and percentage of total waste salvaged and recycled.

C. Records of Donations and Sales: Receipts for salvageable waste donated or sold to individuals and organizations. . Indicate whether organization is tax exempt.

D. Recycling and Processing Facility Records: Manifests, weight tickets, receipts, and invoices.

E. Landfill and Incinerator Disposal Records: Manifests, weight tickets, receipts, and invoices.

F. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Administrative Requirements." Review methods and procedures related to waste management.

G. Waste Management Plan: Develop a waste management plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

1. Salvaged Materials for Reuse: Identify materials that will be salvaged and reused.
2. Salvaged Materials for Sale: Identify materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: Identify materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and

telephone numbers.

5. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

C. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

3.2 RECYCLING WASTE

A. General: Recycle paper and beverage containers used by on-site workers.

B. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

C. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

D. Metals: Separate metals by type.

E. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

F. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

G. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

H. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

I. Conduit: Reduce conduit to straight lengths and store by type and size.

3.3 DISPOSAL OF WASTE

A. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

B. Do not burn waste materials.

END OF SECTION 017419

SECTION 018113 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Definitions:

1. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
2. Recycled Content: The recycled content shall be determined by weight.

    a. "Post-consumer" material is defined as waste material generated by end users of the product, which can no longer be used for its intended purpose.
    b. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as scrap generated in a process that is reclaimed in the same process that generated it.

B. Submittals:

1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product. Submit within seven days of date established for commencement of the Work.
2. List of proposed regional materials. Submit within seven days of date established for commencement of the Work.
3. List of proposed certified wood products. Submit within seven days of date established for commencement of the Work.
4. Product Data.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Recycled Content of Materials: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of cost of materials used for Project.

1. Do not include mechanical and electrical components in the calculation.

B. Regional Materials: Provide 10 percent of building materials (by cost) that are regional materials.

C. Certified Wood: Provide a minimum of 50 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:

   a. Rough carpentry.
   b. Miscellaneous carpentry.
   c. Heavy timber construction.
   d. Wood decking.
   e. Metal-plate-connected wood trusses.
   f. Structural glued-laminated timber.
   g. Finish carpentry.
   h. Architectural woodwork.
   i. Wood paneling.
   j. Wood veneer wall covering.
   k. Wood flooring.
   l. Wood lockers.
   m. Wood cabinets.

2.2 LOW-EMITTING MATERIALS

A. Use adhesives and sealants that comply with the following limits for VOC content:

1. Wood Glues: 30 g/L.
2. Metal-to-Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Contact Adhesive: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesive: 100 g/L.
18. Structural Wood Member Adhesive: 140 g/L.
19. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, PTFE, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
20. Top and Trim Adhesive: 250 g/L.
21. Plastic Cement Welding Compounds: 350 g/L.
22. ABS Welding Compounds: 400 g/L.

23. CPVC Welding Compounds: 490 g/L.
24. PVC Welding Compounds: 510 g/L.
25. Adhesive Primer for Plastic: 650 g/L.
26. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
27. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
28. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
29. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
30. Other Adhesives: 250 g/L.
31. Architectural Sealants: 250 g/L.
32. Nonmembrane Roof Sealants: 300 g/L.
33. Single-Ply Roof Membrane Sealants: 450 g/L.
34. Other Sealants: 420 g/L.
35. Sealant Primers for Nonporous Substrates: 250 g/L.
36. Sealant Primers for Porous Substrates: 775 g/L.
37. Modified Bituminous Sealant Primers: 500 g/L.
38. Other Sealant Primers: 750 g/L.

B. Use paints and coatings that comply with the following limits for VOC content:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints, Coatings: 150 g/L.
3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
4. Clear Wood Finishes, Varnishes: 250 g/L.
5. Clear Wood Finishes, Lacquers: 350 g/L.
6. Stains: 150 g/L.
7. Primers, Sealers, and Undercoaters: 200g/L.
8. Zinc-Rich Industrial Maintenance Primers: 340 g/L.

C. Do not use composite wood or agrifiber products or adhesives that contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.1 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 3500 cu. ft. (1 070 000 L) of outdoor air per sq. ft. (sq. m) of floor area to the space. Once a space is occupied, ventilate it at a minimum rate of 0.30 cfm per sq. ft. (1.52 L/s per sq. m) of outside air. During each day of the occupied flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. Maintain these conditions until a total of 14000 cu. ft./sq. ft. (4 300 000 L/sq. m) of outside air has been delivered to the space.

END OF SECTION 018113

05 METALS

SECTION 050523 – METAL FASTENINGS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: **Product Data.**

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Bolts, A325 Steel with nuts and washers.

B. Zinc-Coated (Galvanized) Steel Sheet metal screws

C. Stainless Steel Sheet metal screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.

B. Repair, refinish, or replace damaged during installation, as directed by Architect.

END OF SECTION 050523

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Shop Drawings

B. Comply with applicable provisions of the following:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

A. Angles: ASTM A 36/A36M

B. Plate and Bar: ASTM A 36/A36M

C. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B structural tubing.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.

2.2 ACCESSORIES

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.3 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

PART 3 - EXECUTION

3.1 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

C. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened

D. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Specifications

B. Comply with SDI Publication No. 30.

C. Comply with AWS D1.3, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Uncoated Sheet Steel: HRPO Uncoated Steel ASTM A-1013 similar to “Traction Tread”

1. Traction Tread

http://www.brown-campbell.com/tracprod.htm

2.2 DECKING

A. Floor Deck: Fabricate panels Uncoated Sheet steel integrally embossed or raised pattern ribs and interlocking side laps, to comply with the following:

1. Profile Depth: As Indicated
2. Design Uncoated-Steel Thickness: 13 Gauge
3. Surface Pattern to feature a perforated “traction” pattern. Compliance with ADA requirements for pedestrian surfaces

2.3 MISCELLANEOUS

PART 3 - EXECUTION

3.1 DECK INSTALLATION

A. Place, adjust, align, and bear deck panels on structure. Do not stretch or contract side-lap interlocks.

B. Place deck panels flat and square and weld to structure without warp or deflection.

C. Cut, reinforce, and fit deck panels and accessories around openings and projections.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Shop Drawings showing details of fabrication and installation.

PART 2 - PRODUCTS

2.1 METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled Steel Floor Plate: ASTM A 786/A 786M.

E. Steel Tubing: ASTM A 500.

F. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.

2.2 FABRICATION

A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.

B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.

C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

D. Alternating Tread Devices: Fabricate alternating tread devices to comply with the IBC. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Fabricate from steel and assemble by welding or with stainless-steel fasteners. Provide brackets and fittings for installation.

E. Fabricate window frames from steel angle.

F. Fabricate Pins, and bolted connections from steel plate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.

B. Fit exposed connections accurately together to form hairline joints.

END OF SECTION 055000

SECTION 055200 - METAL RAILINGS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Shop Drawings, Structural analysis data signed and sealed by a qualified professional engineer registered in the state where Project is located.

PART 2 - PRODUCTS

2.1 RAILING SYSTEMS

A. Provide railings capable of withstanding a uniform load of 50 lbf/ ft. (0.73 kN/m) and a concentrated load of 200 lbf (0.89 kN) applied to handrails and top rails of guards in any direction. Uniform and concentrated loads need not be assumed to act concurrently.

B. Provide railing infill capable of withstanding a concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m). Infill load and other railing loads need not be assumed to act concurrently.

C. For glass-supported railings, support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

2.2 METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Pipe: ASTM A 53, Schedule 40.

C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

2.3 OTHER MATERIALS

A. Plastic infill paneling

1. Thickness for Glass Infill Panels: As required by structural loads, but not less than 3/8”

2.4 FABRICATION

A. Assemble railing systems in shop to the greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of railing members by mitering at elbow bends

C. Fabricate railing systems and handrails for connecting members by welding

D. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

E. Provide wall returns at ends of wall-mounted handrails.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fit exposed connections accurately together to form tight, hairline joints.

B. Set railings accurately in location, alignment, and elevation and free of rack.

END OF SECTION 055200

06 WOOD, PLASTICS AND COMPOSITES

SECTION 061053 - MISCELANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for wood-preservative treated wood and metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.

B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

2.2 TREATED MATERIALS

A. Preservative-Treated Materials: AWPA C2, except that lumber not in ground contact and not exposed to the weather may be treated according to AWPA C31 with inorganic boron (SBX).

1. Use treatment containing no arsenic or chromium.
2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

B. Provide preservative-treated materials for items indicated on Drawings, and the following:

1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 LUMBER

A. Dimension Lumber:

1. Maximum Moisture Content: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness

2. Retain one grade requirement and one or more species group in first two subparagraphs below depending on availability and suitability for Project. Designate load-bearing walls on Drawings.
3. Non-Load-Bearing Interior Partitions: Construction or No. 2
4. Framing Other Than Non-Load-Bearing Interior Partitions: Southern pine: SPIB or Douglas fir-larch: WCLIB, or WWPA
5. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

    a. Species: As specified for framing other than non-load-bearing interior partitions.
    b. Grade: Select Structural

B. Lumber: Construction, or No. 2 grade with 19 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

2.4 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: Plywood AC, fire-retardant treated, not less than 1/2-inch (13-mm) nominal thickness.

2.5 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

1. Power-Driven Fasteners: CABO NER-272.
2. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

B. Metal Framing Anchors: Structural capacity, type, and size indicated.

1. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, G60 (Z180) coating designation for interior locations where stainless steel is not indicated.
2. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.

C. Sill Sealer Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Securely attach rough carpentry to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for preservative-treated plywood and foam-plastic sheathing.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: DOC PS 1.

B. Oriented Strand Board: DOC PS 2.

2.2 TREATED PLYWOOD

A. Preservative-Treated Plywood: AWPA C9.

1. Use treatment containing no arsenic or chromium.
2. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

B. Provide preservative-treated plywood for items indicated on Drawings and plywood used with roofing, flashing, vapor barriers, and waterproofing.

2.3 WALL SHEATHING

A. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.

B. Gypsum Wall Sheathing:

1. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core.

C. Composite Nail Base Insulated Wall Sheathing: Polyisocyanurate foam with oriented strand board laminated to one face complying with ASTM C 1289, Type V.

2.4 ROOF SHEATHING

A. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.

2.5 SUBFLOORING AND UNDERLAYMENT

A. Combination Subfloor-Underlayment:

1. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exterior, Structural I, C-C Plugged single-floor panels.
2. Oriented-Stand-Board Combination Subfloor-Underlayment: Exposure 1 single-floor panels.

2.6 PRODUCTS

A. Fasteners: Size and type indicated.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M
2. Power-Driven Fasteners: CABO NER-272.

B. Adhesives for Field Gluing Panels to Framing: APA AFG-01.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely attach to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

B. Fastening Methods:

1. Combination Subfloor-Underlayment:

   a. Glue and nail to wood framing.
   b. Screw to cold-formed metal framing.

2. Wall and Roof Sheathing:

   a. Nail to wood framing.

b. Screw to cold-formed metal framing.

END OF SECTION 061600

SECTION 062000 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Samples for hardwood veneer plywood paneling.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

B. Softwood Plywood: DOC PS 1.

C. Hardwood Plywood: HPVA HP-1.

D. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

E. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.

F. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

2.2 EXTERIOR FINISH CARPENTRY

A. Plywood Soffits: 3/8-inch- (9.5-mm-) thick, INTERIOR STANDING AND RUNNING TRIM

2.3 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock panels complying with HPVA HP-1.

1. Face Veneer Species: Rotary-cut white birch or Maple
2. Veneer Matching: Selected for similar color and grain.
3. Thickness: 1/8 inch (3.2 mm).

B. Hardboard Paneling: Factory finished, 1/4 inch (6.4 mm) thick, complying with AHA 135.5, Class I finish.

1. Surface-Burning Characteristics: Flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.

2.4 SHELVING AND CLOTHES RODS

A. Shelving: 3/4-inch (19-mm) particleboard with, Melamine-faced particleboard with radiused and filled front edge or 1/8" steel plate with 1" turn down at face

B. Clothes Rods: 1-1/2-inch- (38-mm-) diameter, schedule 40 steel pipe

C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

2.5 RAILINGS

A. Exterior Railings: 1-1/2-inch-(38-mm diameter, schedule 40 steel pipe.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Stainless-steel

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer.

1. Use waterproof resorcinol glue for exterior applications.

C. Insect Screening for Soffit Vents: Stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condition finish carpentry in installation areas for 24 hours before installing.

B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.

C. Install standing and running trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Stagger joints in adjacent and related trim. Cope at returns and miter at corners.

D. Select and arrange paneling for best match of adjacent units. Install with uniform tight joints.

END OF SECTION 062000

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data for solid-surfacing materials, Shop Drawings and Samples showing the full range of colors, textures, and patterns available for each type of finish.

B. Quality Standard: Architectural Woodwork Institute's "Architectural Woodwork Quality Standards."

C. Forest Certification: Provide woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

D. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is completed, and HVAC system is operating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardboard: AHA A135.4.

B. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.

C. Particleboard: ANSI A208.1, Grade M-2.

D. Softwood Plywood: DOC PS 1.

E. Hardwood Plywood and Face Veneers: HPVA HP-01, made with adhesive containing no urea formaldehyde].

F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

2.2 CABINET HARDWARE AND ACCESSORY MATERIALS

A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

B. Wire Pulls: Back mounted, solid metal, 5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter].

C. Catches: Magnetic catches, BHMA A156.9, B03141

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081

E. Drawer Slides: BHMA A156.9, B05091.

Drawer Slides: Grade 1 HD-100

F. Drawer Locks: BHMA A156.11, E07041.

G. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to 15 percent moisture content.

2.3 INTERIOR WOODWORK

A. Complete fabrication to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

C. Flush Wood Paneling for Transparent Finish: Custom grade.

1. Wood Species: Rotary cut Birch or Maple veneer
2. Matching of Adjacent Veneer Leaves: Book match.
3. Veneer Matching within Panel Face: Center-balance match.
4. Panel Matching: Select and arrange panels for similarity of grain pattern and color between adjacent panels

D. Wood Cabinets for Transparent Finish: Custom grade.

1. AWI Type of Cabinet Construction: Flush overlay
2. WI Construction Style: Style A, Frameless.
3. WI Door and Drawer Front Style: Flush overlay.
4. Wood Species and Cut for Exposed Surfaces: White birch, plain sawn or sliced
5. Grain Direction: As indicated.
6. Matching of Veneer Leaves: Book match.
7. Veneer Matching within Panel Face: Center-balance match.
8. Semiexposed Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces
9. Drawer Sides and Backs: Solid-hardwood lumber.
10. Drawer Bottoms: Hardwood plywood.

E. Solid-Surfacing Material Countertops: Custom grade.

1. Solid-Surfacing Material Thickness: 1 1/4 inch (13 mm).
2. Fabricate tops in one piece with shop-applied backsplashes and edges.
3. Install integral sink bowls in countertops in shop.

F. Mild Steel Door and Drawer faces

1. Steel surfacing Material Thickness: 1/8 inch (13 mm).
2. Fabricate drawer and door faces from one piece to ensure uniform grain structure, similar to book matching wood door faces.
3. Spot weld ¼" threaded studs to bolt faces to cabinet and drawer bodies.

2.4 SHOP FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

A. Finishes: Same grades as items to be finished.

B. Finish architectural woodwork at the fabrication shop; defer only final touch up until after installation.

1. Apply one coat of sealer or primer to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces.
2. Apply a vinyl wash coat to woodwork made from closed-grain wood before staining and finishing.
3. After staining, if any, apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

C. Transparent Finish: AWI finish system water based finish system

D. Transparent Finish: WI finish System water based finish system

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Install woodwork to comply with referenced quality standard for grade specified.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed

shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Fasten with countersunk concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed nailing, countersunk and filled flush with woodwork.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

G. Anchor paneling to supports with concealed panel-hanger clips and by blind nailing on back-up strips, splined-connection strips, and similar associated trim and framing.

H. Cabinets: Install so doors and drawers are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm)o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips

I. Anchor countertops securely to base units. Seal space between backsplash and wall.

END OF SECTION 064023

SECTION 066400– PLASTIC PANELING

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data,Shop Drawings andmanufacturer's color charts showing the full range of colors available.

B. Warranties: Provide standard manufacturer's written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace products that fail in materials or workmanship for the period of 2 years.

PART 2 - PRODUCTS

2.01 Panelite

A. Panelite Panels

http://www.e-panelite.com/downloads/Panelite_Panels_Oct08.pdf

1. Panelite Hardware

http://www.e-panelite.com/downloads/Panelite_Partitions_Oct08.pdf

2.02 3-form

A. 3-form panels

http://www.3-form.com/materials-varia.php

1. 3-form hardware

http://ww.3-form.com/hardware-catalog-Slide01.php

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set panels level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.

B. Fasten panels securely in place, Install with concealed fasteners, unless otherwise indicated.

C. Adjust operating parts and hardware for smooth, quiet operation [**and weathertight closure**]. Lubricate hardware and moving parts.

END OF SECTION 066400

07 Thermal and Moisture Protection

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS

A. Rubberized-Asphalt Sheet: 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Products:

a. Tamko TW Metal and Tile Underlayment

http://www.tamko.com/ProductDisplayPage/tabid/53/ControlType/productDisplay/itemid/1575/Default.aspx

B. Wall Insulation Drainage Panels: Extruded-polyiso board insulation complying with ASTM C 578, Type IV or Type VI, fabricated with shiplap or channel edges and with one side having grooved drainage channels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Clean, prepare, and treat substrates. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Remove oil, form-release agents, curing compounds, and other contaminants or coatings.

C. Remove projections and fill honeycomb, aggregate pockets, holes, and other voids.

D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks.

E. Apply primer to substrates at required rate and allow it to dry.

F. Install self-adhering sheet waterproofing according to manufacturer's written instructions and recommendations in ASTM D 6135.

G. Apply and firmly adhere sheets. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps.

H. Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

I. Prepare, treat, and seal surfaces at terminations, penetrations, drains, and protrusions according to ASTM D 6135.

J. Repair tears, voids, and lapped seams not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches (150 mm) beyond repaired areas in all directions.

K. Install protection course over waterproofing membrane immediately. Use adhesive or tape applied according to manufacturer's written instructions. Do not penetrate waterproofing.

1. Lap edges and ends of geotextile to maintain continuity.

END OF SECTION 071326

SECTION 071500 – SHEET METAL FLASHINGS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: **Shop Drawings**

PART 2 - PRODUCTS

2.01 SHEET METAL FLASHINGS

A. Flashing and Trim: Formed from 18gage nominal thickness, mild steel . Provide flashing and trim as required to seal against weather and to provide finished appearance.

B. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

C. Fabricate all sheet metal flashings per Drawings

PART 3 - EXECUTION

3.01 INSTALLATION

A. Anchor flashings securely in place, with provisions for thermal and structural movement. Install flashings with concealed fasteners unless otherwise indicated. Where exposed, use fasteners finished to match wall panels.

B. Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of wall panel assemblies. Provide types of gaskets, fillers, and sealants as indicated, or as recommended by panel manufacturer.

C. Separate dissimilar metals and metal panels from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.

END OF SECTION 071500

SECTION 072112 - BOARD INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 INSULATION PRODUCTS

A. Surface-Burning Characteristics: ASTM E 84, and as follows:

1. Flame-Spread Index: 25 or less where exposed; otherwise, as indicated in Part 2 "Insulation Products" Article.
2. Smoked-Developed Index: 450 or less.

B. Flexible Glass-fiber faced Polyisocyanurate Board Insulation: ASTM C 1289, Type I, [Class 1 or 2] [Class 1] [Class 2], faced on both sides with aluminum foil, with flame-spread index of 75 or less for unfaced core material.

2.2 ACCESSORIES

A. Sheet Radiant Barrier: ASTM C 1313, foil on one side, flame-spread index of 25 or less, and water-vapor transmission of 1 perm, maximum.

B. Vapor Retarder: Reinforced polyethylene 6 mils (0.15 mm)

C. Eave Ventilation Troughs: Preformed, metal louvers designed to fit between roof framing members and to provide cross-ventilation between attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.

B. Extend vapor retarder to extremities of areas to be protected from vapor transmission.

Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape.

END OF SECTION 072112

SECTION 072116 - BLANKET INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 INSULATION PRODUCTS

A. Surface-Burning Characteristics: ASTM E 84, and as follows:

1. Flame-Spread Index: 25 or less where exposed; otherwise, as indicated in Part 2 "Insulation Products" Article.
2. Smoked-Developed Index: 450 or less.Usually select Type IV in first paragraph below if extruded polystyrene is used.

B. Natural Cotton Fiber Insulation
1. Fire Rating: Flame Spread – 5 (Class A), Smoke Developed – 35 (Class-A)
2. Mold/Mildew/Fungi Resistance: Pass-No Growth (ASTM C 739)
3. Corrosion Resistance: Pass (ASTM C 739)
4. Odor Emission: Pass (ASTM C 739)
5. Moisture Absorption: Pass – Less that 15% (ASTM C 739)
6. Retardant used also acts as excellent pest inhibitor.
7. Environmentally safe, sustainable, non-allergenic, non-hazardous, non-formaldehyde, non-itch insulation product.

2.2 ACCESSORIES

A. Sheet Radiant Barrier: ASTM C 1313, foil on one side, flame-spread index of 25 or less, and water-vapor transmission of 1 perm, maximum.

B. Vapor Retarder: Reinforced polyethylene 6 mils (0.15 mm)

C. Eave Ventilation Troughs: Preformed, metal louvers designed to fit between roof framing members and to provide cross-ventilation between attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.

B. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape.

END OF SECTION 072116

SECTION 072760–BREATHABLE MEMBRANE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Manufacturers Instructions: Provide manufacturers instructions showing recommended procedures and sequence of installation of breathable membrane in Rainscreen installations

1.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver Materials to project site in original containers with seals unbroken, wrapped in a polyethelyne sleeve, labeled with manufacturer's name, and product brand name.

B. Store rolls under cover, on a clean, level surface, either flat or upright.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products:

1. Vaproshield: Hydrophobic Weather Resistive Barrier for VM Zinc.

http://www.vaproshield.com/products/wrapshieldhs/

2. Or similar

2.2 UNDERLAYMENT PHYSICAL PROPERTIES

A. Thickness and weight: 0.023 inches thick and 5.161 oz/sq.yd.

B. Tensile Strength: ASTM D883, Pass

C. Water Resistance (control and weathered specimins): AATCC-127, Pass

D. Water Vapor Transmission: ASTM E96, Pass

F. Low Temperature Bend: AC38, Pass

G. Flamespread Index: ASTM E-84, Pass

H. Smoke Development Index: ASTM E-84, Pass

2.3 ACCESSORIES

Membrane Flashing

Flashing Rolls: Manufacturer provided for open joint rainscreen applications

Tape

Single Sided Tape

3” wide manufacturer provided sealing tape

Double Sided Tape

1” Manufacturer provided double sided tape to seal air barrier to substrate

one inch wide butyl rubber tape

Caulks and Sealants

As approved by Membrane manufacturer

Fasteners

Wood Sheathing Substrate Application

Minimum No. 12 gage [0.0129-inch-shank diameter (2.11mm)] corrosion-resistant steel nails having a minimum 3/8” diameter head

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements and other conditions affecting performance.

3.2 SURFACE PREPARATION

A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean and dry substrate for breathable membrane application.

3.3 INSTALLATION

A. Install per Manufacturers instructions

END OF SECTION 07276

SECTION 074213 - METAL WALL PANELS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data**, Shop Drawings,** and color Samples.

B. Warranties: Provide manufacturer's standard written warranty, signed by manufacturer agreeing to promptly repair or replace metal wall panels that show evidence of deterioration of factory-applied finishes within [**20**] [**10**] <**Insert number**> years from date of Substantial Completion.

1.2 SUMMARY

A. This Section includes the following sheet metal wall systems:

1. Factory Formed and Field Assembled VM ZINC® Flat Lock wall system.

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for secondary support framing supporting sheet metal wall panel assemblies
2. Division 7 Section "Building Insulation" for wall insulation.
3. Division 7 Section "Sheet Metal Flashing and Trim" for fascia, copings, flashings and other sheet metal work not part of sheet metal wall panel assemblies.
4. Division 7 Section "Joint Sealants" for field-applied sheet metal wall panel assemblies sealants.

1.3 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weather tight system

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide complete VM ZINC® alloy sheet metal wall panel assembly, including, but not limited to factory formed metal wall panels, cleats, clips, anchors and fasteners, sheet metal flashing and drainage components related to sheet metal wall panel assembly, fascia panels, trim, wood battens, skip sheathing, underlayment, and accessories as indicated and as required for a weather tight installation.

B. Installation: All VM ZINC® sheet metal wall panel assembly and materials shall be installed using the best available industry standards and the means and methods recommended in the manufacturer's published information, or whichever is more stringent.

C. Thermal Movements: Provide sheet metal wall panel assembly that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal wall panel assembly thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

D. Water Infiltration: Provide sheet metal wall panel assembly that does not allow water infiltration to building interior, with metal flashing and connections of sheet metal wall panel assembly lapped to allow moisture to run over and off the material.

1.5 SUBMITTALS

A. Shop Drawings: Show fabrication and installation layouts of sheet metal wall panel assembly, including plans, elevations, and keyed references to termination points. Distinguish between shop- and field-assembled work. Shop drawings to be reviewed by Umicore Building Products USA, Inc. prior to fabrication. Include the following:

1. Details for forming sheet metal wall panel assembly, including seams and dimensions.
2. Details for joining and securing sheet metal wall panel assembly, including layout of fasteners, clips, and other attachments. Include pattern of seams.
3. Details of termination points and assemblies, including fixed points.
4. Details of expansion joints, including showing direction of expansion and contraction.
5. Details of wall penetrations.
6. Details of special conditions.
7. Details of connections to adjoining work.
8. Details of the required accessory items.
9. Sheet metal wall panel assembly and attachments.

B. Samples for Verification: For each type of exposed component required, prepared on Samples of size indicated below:

1. Sheet Metal Wall panel assembly: 24 inches (600 mm) long by actual panel width, including finished seam. Include fasteners, cleats, clips, battens, closures, and other attachments.
2. Trim and Closures: 24 inches (600 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 24-inch- (600-mm-) long Samples for each type of accessory.

C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed sheet metal wall panel assembly similar in material, design, forming method and extent to that indicated for this Project and with a record of successful in-service performance. Provide evidence of installer participation in Umicore Building Products USA Inc.® PRO-ZINC Training Course.

B. Sheet Metal Wall Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate sheet metal wall similar to that required for this Project and whose products have a record of successful in-service performance. Provide evidence of installer participation in Umicore Building Products USA Inc. PRO-ZINC Training Course.

C. Sheet Metal Wall panel assembly Standard: Comply with VM ZINC® Architectural Binder, Installation Manual, or best industry standards, whichever is more stringent. Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Mockups: Before installing sheet metal wall panel assembly, construct mockups for each form of construction required to verify selection made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using exposed and concealed materials and forming methods indicated for completed work.

1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by the Architect.
2. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weather tight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

E. Protect foam-plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. VM ZINC® sheet: Electrolytic, 99.995 percent pure zinc with alloying additives of titanium and copper.

1. Manufacturer:
   a. UMICORE BUILDING PRODUCTS USA Inc., -

http://www.vmzinc-us.com/

   1) Phone: 919-874-7173
   2) Fax: 919-874-7140
   3) Email: **info@vmzinc-us.com**
2. Available thickness: 0.039 inch (1.00 mm)
3. Surface Aspects:
   a. VM QUARTZ ZINC® : A zinc with a dark gray aspect on both sides
   b. VM ANTHRA ZINC®: A zinc with a black aspect on both sides.

4. Alloy Properties:

Periodic table reference	Zn
Thickness tolerance	+/- 1/1000" (0.025 mm)
Density	200 lb/in^3 (7.2 kg/dm^3)
Thermal expansion	1/64"/ft 212° F (2.2 mm/m 100°
Melting point	788° F (420° C)
Re-crystallization point	572° F (300° C)
Limit of elasticity: Rp 0.2	>= 14,504 PSI (100 N/mm^2)
Tensile strength	>= 21,756 PSI (150 N/mm^2)
Elongation at fracture	>= 40%
Elongation in creep test (50 N/m 7250 PSI over a period of 60 min	0.1%
Vickers hardness	>= 40
Heat conductivity	110 W/mk
Young's modulus	11,603,200 PSI (80,000 N/mm^2
Not magnetic	
UV resistant	
Non flammable	

1. 5. VM ZINC® Premium Zinc Manufacturing Standard exceeds EN 988:

Specification	VM ZINC® Tolerance
Alloy Tolerances	
Copper (%)	0.08 – 0.20
Titanium (%)	0.07 – 0.12
Aluminum (%)	<=0.015
Dimensional Tolerances	
Thickness	+/- 0.02mm
Width	+2 / -0 mm
Length	+5 / -0 mm
Saber	<= 1.5 mm/m
Flatness	<= 2mm

2.2 WEATHER RESISTIVE BARRIER (WRB) MATERIALS

A. Available Products: Subject to compliance with requirements, weather resistive barrier products that may be incorporated into the Work include, but are not limited to, the products specified.

B. Hydrophobic Weather Resistive Barrier: Frameshield by PROCTOR for VM ZINC®. Fabric Underlayment and Slip Sheet: High permeability, spun bonded non-woven polypropylene fabric

1. Weight: 3 oz./sq.yd. (1000g/sq.m.)
2. Thickness: 0.020 inch (0.50 mm)
3. Water Vapour Transmission 9.79 Perms (1.96 grams/kPa*h*m) per ASTM E 96 Method A

C. Flashing Membrane: Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by flashing membrane manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
2. Low Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
3. Available Products:
   a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "HR" High Performance Underlayment.
   b. Grace, W. R. & Co.; Vycor Ultra.
   c. Henry Company; Perma-Seal PE.
   d. Colbond, EnkaThermaflash Butyl Flashing

2.3 THERMAL INSULATION FOR FIELD-ASSEMBLED METAL WALL PANELS

A. Refer to Division 7 Section "Building Insulation."

B. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (**asphalt felt or glass-fiber mat facing)**, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.

1. Fasteners for wall Panels: Self-drilling or self-tapping 410 stainless hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling 410 stainless screws with pancake head.
3. Blind Fasteners: High-strength stainless-steel rivets.

2.5 UMICORE BUILDING PRODUCTS FACTORY FORMED WALL ELEMENTS

A. Flat Lock Seam Metal Wall Panels. Formed with flat lock seam at panel edges and smooth, flat pan; designed to be field assembled in sequential installation by engaging lower edge of each panel to upper edge of panel below and mechanically attaching panels to supports using concealed clips located under upper edges of panels.

1. Factory Formed Flat Lock Panels, Flat Lock panels with recessed joint and Shingles
    a. Flat lock panels, A wall system based on factory formed custom sized rectangular shaped VM ZINC® elements featuring formed interlocking welt at all edges. Panels are secured with concealed fastener and clip arrangement.
    b. System includes full range of factory formed clips, fasteners, flashings and terminations.
    c. Thickness: 0.039 inch (1.00mm)
    d. Available finishes: [QUARTZ-ZINC®] [ANTHRA-ZINC®]

2.6 CLIPS AND FASTENERS

A. VM ZINC® Clips for Flat Lock Panels: 300 Series Stainless Steel Clips. Thickness: 0.024" (0.6mm). The clip is pre-punched for attachment into the substrate. Designed to withstand negative load requirements.

B. Fastener for Flat Lock Panels: Oval Head, Self-drilling screws, 300 Series Stainless Steel. All fasteners to seat in pre-punched holes of VM ZINC® Clips to eliminate potential for contact and abrasion between fastener head and panel. Fastener head profile shall eliminate telegraphing through metal panel. Fasteners shall be selected to resist all negative design load requirements. Minimum pullout strength: 112 lbf (50 daN)

1. Available products:
    a. #10 x 1 –1/2" Screws Pancake head Type A Phillips Drive stainless
2. Design professional and installer to confirm the withdraw and rupture performance for all fastener and clip combinations during the submittal process.

C. Fasteners for Trim Attachments

1. 1. Fasteners for Flashing and Trim
    a. Blind fasteners or self-drilling 410 stainless screws with pancake head
2. Blind Fasteners: High-strength stainless-steel rivets
    a. High-strength stainless steel

2.7 SOLDERING AND SEALING

A. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

2.8 ACCESSORIES

A. Sheet Metal Wall Panel Assembly Accessories: Provide components required for a complete sheet metal wall assembly including trim, copings, fasciae, corner units, edges closures, clips, flashings, sealants, and similar items. Match material and finish of sheet metal wall, unless otherwise indicated.

1. Closures: Provide closures at edges, fabricated of same metal as sheet metal wall.
2. Clips: Minimum 0.0396-inch(1.0mm) thick, 300 series stainless-steel panel clips designed to withstand negative load requirements.
3. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch-(0.64mm) thick 300 series stainless-steel.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from VM ZINC® PLUS zinc Sheet. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, rakes, corners, bases, framed openings, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent sheet metal wall.

2.9 FABRICATION

A. General: Factory formed sheet metal wall panel assemblies to comply with Umicore Building Products USA Inc.'s Published Recommendations and details reviewed by Umicore Building Products USA Inc., and industry best standards that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal wall and accessories at the shop to greatest extent possible.

B. Fabricate sheet metal wall panels to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.

1. Lay out sheet metal wall panels so cross seams, when required, are made in direction of flow with higher pans overlapping lower pans. Stagger cross seams.
2. Fold and cleat eaves and transverse seams.
3. Form and fabricate sheets, seams, strips, cleats, edge treatments, integral flashings, and other components of metal walls to profiles, patterns, and drainage arrangements shown and as required for leak proof construction.

C. Metal Protection: VM ZINC® Panels and Materials shall not be stored or installed so that they come in contact with or are located beneath areas with copper or copper containing components.

PART – 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, sheet metal wall supports, and other conditions affecting performance of work.

1. Examine primary and secondary wall framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed.
2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances.
3. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for wall drains, flashings, and penetrations through sheet metal wall.
4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating sheet metal wall to verify actual locations of penetrations relative to seam locations of sheet metal wall before sheet metal installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 METAL WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal wall panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures edges and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until insulation, weather resistive barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
10. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Allowable Erection Tolerance

1. Maximum Alignment Variation: 1/8 in (3 mm)
2. Fasteners: Use fasteners of type and size that will secure the wall components in compliance with requirements of the project. Clip fasteners shall be selected with heads that will seat flush to the deck, eliminating potential for contact and abrasion with the panel, and telegraphing.
3. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a weather tight installation.

3.3 UMICORE BUILDING PRODUCTS FACTORY FORMED VM ZINC® WALL PANEL ELEMENTS INSTALLATION

A. General: Install ,Umicore Building Products factory formed VM ZINC® wall panels elements in compliance with Umicore Building Products USA's published recommendations, Designer approved Shop Drawings, and industry best standards. User Guides are available from UMICORE Building Products and should form the basis of design.

B. Flat Lock Panel: Fasten Flat Lock Panels to substrate supports with concealed clips at each flat lock joint at location, spacing and with fasteners recommended by UMICORE Building Products.

1. Install clips to supports with specified fasteners
2. Nest flat lock seams and fasten together by interlocking, fully engaged to provide weather tight joints.
3. Form all laps and joints to shed water.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of dirt and debris with warm water (no high pressure) and gently rubbing the panels in the same direction as the grain of the zinc using a clean cotton cloth.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Remove protective films within 60 days of installation. On completion of sheet metal wall installation, clean finished surfaces, including removing unused fasteners, metal filings, rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

END OF SECTION 074213

SECTION 076500 - FLEXIBLE FLASHINGS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings.

PART 2 - PRODUCTS

2.01 WATERPROOFING MATERIALS

A. Rubberized-Asphalt Sheet: 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side **and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction**.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Clean, prepare, and treat substrates. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Remove oil, form-release agents, curing compounds, and other contaminants or coatings.

C. Remove projections and fill honeycomb, aggregate pockets, holes, and other voids.

D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks.

E. Apply primer to substrates at required rate and allow it to dry.

F. Install self-adhering sheet waterproofing according to manufacturer's written instructions and recommendations in ASTM D 6135.

G. Apply and firmly adhere sheets. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps.

H. Bridge and cover [**isolation joints**] [**expansion joints**] [**and**] discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

I. Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

J. Prepare, treat, and seal surfaces at terminations, penetrations, drains, and protrusions according to ASTM D 6135.

K. Repair tears, voids, and lapped seams not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches (150 mm) beyond repaired areas in all directions.

L. Install finish materials over waterproofing membrane immediately. Do not penetrate waterproofing.

END OF SECTION 076500

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color Samples.

B. Warranties: Provide manufacturer's standard written warranty, signed by manufacturer agreeing to promptly repair or replace roof specialties that show evidence of deterioration of factory-applied finishes within 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mild Steel Sheet: ASTM A 36

B. Self-Adhering Sheet Underlayment, High Temperature: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F (116 deg C) and passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

C. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements.

1. Exposed Penetrating Fasteners: Gasketed screws with heads matching color of metal.
2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel.

D. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.

2.2 ROOF SPECIALTIES

A. SPRI Wind Design Standard: Provide roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings

B. Gutters and Downspouts:

1. Gutters: Manufactured in uniform section lengths, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish expansion joints, and expansion-joint covers.

   a. Gutter Style: As indicated on Drawings
   b. Mild Steel Sheet – A36
   c. Pre-formed Zinc panel

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement.

B. Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment.

C. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

D. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless indicated.

E. Fastener Sizes: Use fasteners of sizes that will penetrate substrate or sheathing not less than 3/4 inch (19 mm) for screws.

F. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters firmly to PV racking system with racking system fasteners. Slope to downspouts.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and color Samples.

B. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.

B. Sealant for Use in Building Expansion Joints:

1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; [Class 50] [Class 100/50]; for Use NT.

C. Sealant for General Exterior Use Where Another Type Is Not Specified:

1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT.

D. Sealant for Exterior Traffic-Bearing Joints, Where Slope Precludes Use of Pourable Sealant:

1. Single-component, nonsag urethane sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use T.

E. Sealant for Exterior Traffic-Bearing Joints, Where Slope Allows Use of Pourable Sealant:

1. Single-component, pourable urethane sealant, ASTM C 920, Type S; Grade P; Class 25; for Use T.

F. Sealant for Use in Interior Joints in Ceramic Tile and Other Hard Surfaces in Kitchens and Toilet Rooms and Around Plumbing Fixtures:

1. Single-component, mildew-resistant silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT; formulated with fungicide.

G. Sealant for Interior Use at Perimeters of Door and Window Frames:

1. Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

H. Acoustical Sealant:

1. Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission as demonstrated by testing according to ASTM E 90.

2.2 MISCELLANEOUS MATERIALS

A. Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

D. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 1193.

B. Install sealant backings to support sealants during application and to produce cross-sectional shapes and depths of installed sealants that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal perimeters, control joints, openings, and penetrations with a continuous

bead of acoustical sealant. Install acoustical sealant at both faces of partitions. Comply with ASTM C 919.

END OF SECTION 079200

08 Openings

SECTION 081423 - CLAD WOOD DOORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MOLDED-HARDBOARD-FACED DOORS

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. Faces: 1/8-inch- (3.2-mm-) molded mild sheet steel, molded to panel configuration indicated, with smooth finish.

C. Construction: Assemble with Crosslinked PVA adhesive.

D. Shop fit doors to suit frame-opening sizes indicated and to comply with clearances specified.

E. Shop machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with WDMA's "How to Store, Handle, Finish, Install, and Maintain Wood Doors."

1. Install fire-rated doors to comply with NFPA 80.

B. Align and fit doors in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.

END OF SECTION 081423

SECTION 084433 - SLOPED GLAZING ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, and Shop Drawings

PART 2 - PRODUCTS

2.1 SLOPED GLAZING SYSTEMS

A. Photovoltaic Racking System

1. Solar Living Designs

http://www.solarlivingdesign.com/our_products/what_we_offer.html

B. Performance Requirements:

1. Limit deflection of framing members normal to wall plane to 1/175 of clear span[for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m)] or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Limit deflection of framing members parallel to glazing plane to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
3. Structural Testing: Systems tested according to ASTM E 330 at 150 percent of inward and outward wind-load design pressures do not evidence material failures, structural distress, deflection failures, or permanent deformation of main framing members exceeding 0.2 percent of clear span.
4. Air Infiltration: Limited to 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of system surface area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
5. Water Penetration: Systems do not evidence water leakage when tested according to ASTM E 331 at minimum differential pressure of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
6. Thermal Transmittance: Average U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K).

C. Aluminum: ASTM B 209 (ASTM B 209M) sheet; ASTM B 221 (ASTM B 221M) extrusions.

D. Framing Members:

1. Framing-Member Type: Self-supporting

2. Glass Retention: Pressure caps on four sides

E. Glazing: Photovoltaic panels specified in Photovoltaic Energy Production Section

F. Non-Structural / Miscellaneous Sealant: ASTM C 920, Type S, Grade NS, Class 25, compatible with structural sealant and other system components.

1. Color: Matching structural sealant.

G. Fasteners and Accessories: Compatible with adjacent materials, corrosion resistant, nonstaining, and nonbleeding. Finish exposed fasteners to match framing components. Use stainless-steel screws, ASTM A 193/A 193M for fastening aluminum cap retainers and cover fasteners with aluminum trim.

H. Fabrication: Factory assemble units to the greatest extent possible. Fabricate components to drain water passing joints, condensation, and moisture migrating within the system to the exterior. Fabricate continuous aluminum curb with watertight joints.

I. Aluminum Finish: Class II, clear anodic finish; AA-M12C22A31; complying with AAMA 611

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Rigidly secure nonmovement joints. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding. Seal joints watertight unless otherwise indicated.

B. Isolate metal surfaces in contact with incompatible materials, including wood, by painting contact surfaces with bituminous coating or primer, or by applying sealant or tape recommended by manufacturer.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the sloped glazing assembly to exterior.

D. Install framing components true in alignment with established lines and grades to the following tolerances:

1. Level: 1/8 inch in 20 feet (3 mm in 6 m);1/4 inch in 40 feet (6 mm in 12 m).
2. Aligned Surfaces: Limit offset from true alignment to 1/32 inch (0.79 mm) for surfaces separated by less than 3 inches (76.2 mm), otherwise limit offset to

1/8 inch (3 mm).

3. Location: Limit variation from plane or location to 1/8 inch in 12 feet (3 mm in 3.7 m); 3/16 inch (7.4 mm) over total length.

3.2 FIELD QUALITY CONTROL

A. Perform water-spray test per AAMA 501.2 requirements. Repair or remove and replace Work that does not meet requirements or that is damaged by testing and retest.

END OF SECTION 084433

SECTION 085123 - STEEL WINDOWS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data**, Shop Drawings**

PART 2 - PRODUCTS

2.01 STEEL WINDOWS

A. Products:

1. Custom fabricated Steel windows

B. Window Types: As indicated on Drawings.

1. Awning.
2. Fixed.

C. Performance Requirements: AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermal Transmittance: Whole-window U-factor not more than **0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K** at 15-mph (24-km/h) wind velocity and winter temperatures per **NFRC 100**.
2. Solar Heat-Gain Coefficient: Whole-window SHGC not more than **0.40**per NFRC 200.

D. Construction: Custom fabricated as indicated on Drawings
1. Welded mild steel frames.

E. Provide gear-type rotary operators for awning windows.

F. Equip units with **vinyl-coated, glass-fiber** mesh insect screens at operable sashes.

G. Glaze units with **clear**, **low-e coated,argon-filled,** sealed insulating glass, complying with Division 08 Section "Glazing."

H. Finish: Uncoated mild steel

I. Provide silicone sealant joint between steel frames and glaze units complying with Division 07 “Joint Sealants”

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels. Provide proper support and anchor securely in place.

B. Set back faces of frame in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

C. Adjust operating panels, screens, and hardware to provide a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

D. Clean steel surfaces and glass immediately after installing windows. Remove nonpermanent labels from glass surfaces.

END OF SECTION 085123

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Hardware schedule.

B. Deliver keys to Owner.

PART 2 - PRODUCTS

2.1 HARDWARE

A. [**Available**]Manufacturers:

1. <**Insert manufacturer's name.**>

B. Hinges:
1. Select from options in five subparagraphs below.
2. **Stainless-steel** hinges with stainless-steel pins for exterior.
3. **Stainless-steel Pivot sets for exterior pivot doors**
4. Steel, Weld-On Barrel Hinges

C. Locksets and Latchsets:

1. BHMA A156.2, Series 4000, **Grade 1** for bored locks and latches.
2. **Lever handles** on locksets and latchsets.
3. Provide trim on exit devices matching locksets.

D. Key locks to Owner's **new** master-key system.

1. Cylinders with **five**-pin tumblers **and removable cores**.
2. Provide construction keying.
3. Provide key control system, including cabinet.

E. Provide wall stops or floor stops for doors without closers.

F. Provide hardware finishes as follows:

1. Hinges: Matching finish of lockset/latchset.
2. Locksets, Latchsets, and Exit Devices: Satin chrome plated
3. Other Hardware: Matching finish of lockset/latchset.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware in locations recommended by the Door and Hardware Institute unless otherwise indicated.

3.2 HARDWARE SCHEDULE

A. Hardware Set No. 1

1. Stainless Steel Pivot Set
2. Bored entry handleset**(F94)**
3. Bored auxiliary deadlock, key **outside, thumbturn inside**
4. Door knocker.
5. Threshold and weather stripping.

B. Hardware Set No. 2

1. Stainless Steel Hinges
2. Bored entry handleset**(F94)**
3. Bored auxiliary deadlock, key **outside, thumbturn inside**
4. Door knocker.
5. Threshold and weather stripping.

C. Hardware Set No. 3:

1. Steel Weld-On Barrel Hinges
2. Closer/Opener Gas Shock assist
3. Steel Handle
4. Bored auxiliary deadlock, key **outside, thumbturn inside**
5. Threshold and weather stripping.

D. Hardware Set No. 4:

1. Bipassing sliding door set including overhead track, hangers, floor guide, and flush pulls.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and 12-inch- (300-mm-) square Samples.

B. Fire-Resistance-Rated Assemblies: Provide products that comply with NFPA 80 and are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for applications indicated.

C. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS

Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. PPG Sungate 500

http://corporateportal.ppg.com/NA/Glass/ResidentialGlass/Homeowners/ProductInformation/ProdInfoSungate.htm

2.2 INSULATING-GLASS TYPES

A. Glass Type [GL-1]: Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch (25 mm)
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully Tempered Float Glass
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass.
6. Visible Light Transmittance: 76 percent minimum.
7. Winter Nighttime U-Factor: .35 maximum.
8. Summer Daytime U-Factor: .35 maximum.
9. Solar Heat Gain Coefficient: .73 maximum.
10. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are contained in GANA's "Glazing Manual."

B. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

C. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

C. Safety Glazing Products: For tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; 4.0-mmnominal thickness.

1. Tint Color: [Blue] [Black] [Bronze] [Gold] [Gray] [Green] [Peach] [Pink] <Insert color>.

C. Mirror Mastic: An adhesive setting compound, asbestos free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

E. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.2 FABRICATION

A. Mirror Edge Treatment: Rounded polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

B. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

B. Wall-Mounted Mirrors: Install mirrors with [mastic and]mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points.
2. Mirror Clips: Place a felt or plastic pad between mirror and each clip. Locate clips so they are symmetrically placed and evenly spaced.
3. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

C. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION 088300

SECTION 089000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Provide louvers complying with performance requirements indicated as demonstrated by testing according to AMCA 500-L.

B. Submittals: Product Data**, Shop Drawings**.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.

2.2 LOUVERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product(s) **indicated on Drawings** or comparable product by one of the following:

B. **Horizontal**, Formed metal, Storm-Resistant Louvers:

1. Louver Depth: 4 inches (100 mm)
2. Aluminum Thickness: 0.060 inch (1.5 mm) for blades and 0.080 inch (2.0 mm) for frames.
3. Free Area: Not less than 5.0 sq. ft. (0.46 sq. m) for 48-inch- (1.2-m-) wide by 48-inch- (1.2-m-) high louver.
4. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 600-fpm (3.0-m/s) free-area **exhaust** velocity.
5. Wind-Driven Rain Performance: Not less than **80** percent effectiveness when subjected to a rain fall rate of 3 inches (75 mm) **per hour and a wind speed of** 29 mph (13 m/s)] [8 inches (200 mm) **per hour and a wind speed of** 50 mph (22.4 m/s) at a core area intake velocity of 300 fpm (1.5 m/s).

2.3 LOUVER SCREENS

A. Provide screen at interior face of each exterior louver. Fabricate screen frames from same kind and form of metal as indicated for louver to which screens are attached.

1. Screening: **Stainless-steel**] 1/4-inch- (12.7-mm-) square mesh.

2.4 LOUVER FINISHES

A. Aluminum Louvers: Clear anodic finish, AAMA 611, **AA-M12C22A41, Class I, 0.018 mm**or thicker.

B. Stainless-Steel Louvers: **No. 4** finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install louvers level, plumb, and at indicated alignment with adjacent work.

B. Provide perimeter reveals of uniform width for sealants and joint fillers, as indicated.

C. Use concealed anchorages where possible.

D. Build wall vents (brick vents) into masonry.

E. Protect metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION 089000

09 Finishes

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.2 METAL FRAMING AND SUPPORTS

A. Steel Framing Members, General: ASTM C 754.

1. Steel Sheet Components: ASTM C 645. Thickness specified is minimum uncoated base-metal thickness.
2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating.

B. Rainscreen Furring:

1. Studs and Runners: In depth indicated and 0.0179 inch (0.454 mm) thick unless otherwise indicated.
2. Rigid Hat-Shaped Furring Channels: In depth indicated and 0.0179 inch (0.454 mm).

2.3 ACCESSORIES

A. General: Comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Acoustical Sealant for Concealed Joints: Nonsag, latex sealant complying with ASTM C 834.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

B. Isolate steel framing from building structure, except at floor, to prevent transfer of loading imposed by structural movement.

1. Where studs are installed directly against exterior walls, install foam-gasket isolation strip between studs and wall.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.2 PANEL PRODUCTS

A. Provide in maximum lengths available to minimize end-to-end butt joints.

B. Interior Gypsum Board: ASTM C 36/C 36M or ASTM C 1396/C 1396M, in thickness indicated, with manufacturer's standard edges. **Type X where indicated**.

C. Glass-Mat, Water-Resistant Gypsum Backing Board: ASTM C 1178/C 1178M, of thickness indicated. **Type X where required for fire-resistance-rated assemblies and where indicated**

1. Product: G-P Gypsum; Dens-Shield Tile Guard.

D. Cementitious Backer Units: ANSI A118.9.

2.3 ACCESSORIES

A. Trim Accessories: ASTM C 1047, formed from galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet. For exterior trim, use accessories formed from hot-dip galvanized-steel sheet, plastic, or rolled zinc.

1. Provide cornerbead at outside corners unless otherwise indicated.

2. Provide LC-bead (J-bead) at exposed panel edges.
3. Provide control joints where indicated.

B. Aluminum Accessories: Extruded-aluminum accessories indicated with **manufacturer's standard corrosion-resistant primer**.

C. Joint-Treatment Materials: ASTM C 475/C 475M.

1. Joint Tape: Paper unless otherwise recommended by panel manufacturer.
2. Joint Compounds: **Setting-type taping compound and drying-type, ready-mixed, compounds for topping**.
3. Skim Coat: For final coat of Level 5 finish, use **setting-type, sandable topping compound**
4. Cementitious Backer Unit Joint-Treatment Materials: Products recommended by cementitious backer unit manufacturer.

D. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834.

E. Sound-Attenuation Blankets: ASTM C 665, Type I (unfaced).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gypsum board to comply with ASTM C 840.

1. Isolate gypsum board assemblies from abutting structural and masonry work. Provide edge trim and acoustical sealant.
2. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.

B. Install cementitious backer units to comply with ANSI A108.11.

C. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

D. Finishing Gypsum Board: ASTM C 840.

1. At concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies, provide Level 1 finish: Embed tape at joints.
2. At substrates for tile, provide Level 2 finish: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges.
3. Unless otherwise indicated, provide Level 4 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.
4. Where indicated, provide Level 5 finish: Embed tape and apply separate

first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges. Apply skim coat to entire surface.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

G. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

END OF SECTION 092900

SECTION 096229 - CORK FLOORING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

B. Extra Materials: Deliver to Owner one box for every **50** boxes or fraction thereof, of each color and pattern of cork flooring installed.

PART 2 - PRODUCTS

2.1 FLOATING CORK FLOOR TILE

A. Products:

1. Expanko Vallarex Cork Floor

http://www.expanko.com/VALLAREX/Docs/pdf/401 About Vallarex.pdf

B. Cork Floating Floor shall be made of 100% cork and HDF (High Density Fiber Board). Thickness of the cork surface shall be 1/8" with a density greater than 33 lbs/ft^3. MDF core shall have a thickness of 1/4" and density greater than 47 lbs/ft^3. Acoustical cork backing shall have a thickness of 1/16" and a density greater than 25 lbs/ft^3. Overall thickness of floating floor planks shall be 1/2" (nominal).

C. Fire-Test Response: Critical radiant flux classification of **Class I, not less than 0.45 W/sq. cm** per ASTM E 648.

D. Tongue and groove shall be machined into planks to tolerances, which ensure tight and level seaming of the floor when installed per specification.

E. Style: Specify name as listed on manufacturers sample

F. Physical Properties:
1. Dimensions: Specify tile dimension and thickness in inches
   a. Standard dimensions: 12" X 36" X 1/2"(nom.)
2. Finish: Water- based Matte Polyurethane. Three Coats

G. Planks shall be packaged face to face in shipping and storage cartons.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 3.01 Sub-floor preparation

1. A. Prepare concrete or plywood sub-floor according to manufacturers recommendations
2. B. Conduct calcium chloride moisture tests to ensure that moisture emission levels are within acceptable levels.
3. C. On concrete sub-floors, if moisture level warrants, apply a sealer that shall achieve the moisture control as specified by manufacturer.
4. D. Provide detailed sub-floor preparation guidelines to those responsible for sub-floor preparation.

B. 3.02 Application

1. A. Provide detailed manufacturers' installation instructions to floor installer.
2. B. Floating Floor installation shall commence when all other trades have completed work.
3. C. Conditions on site for acclimation and installation shall be maintained for 72 hours prior, during and 72 hours after installation between 65°F and 75°F with relative humidity between 45% and 65%.
4. D. Compare Floating Floor with submitted approved samples to ensure installation of the correct materials.
5. E. Inspect material, as it is installed for manufacturing defects.
6. F. Maintain sub-floor temperature for 72 hours prior, during and 72 hours after installation between 65°F and 75°F.
7. G. Install ExpankoVallarex Cork Floating Floor material according to manufacturers' instructions.
8. H. Tile pattern: Vallarex floating floor shall be installed in an ashlar (staggered joint) pattern.
9. I. Install material using only those sealers and floor preparation materials recommended by the manufacturer.
10. J. After floor installation is complete, install floor transitions and base according to instructions.

3.2 Curing, Cleaning and Protection

A. After installation, the flooring shall require a minimum of 12 hours for final acclimation. Do not finish or clean floor during this period. After 12 hours, the floor should be cleaned with a well wrung-out damp mop and an approved general cleaner according to Expanko's detailed maintenance instructions.

B. Expanko recommends the application of one or two additional coats of the Expanko approved water-based matte polyurethane to seal floor joints. This should be done 72 hours after installation. Use only those products and processes approved by Expanko.

C. Only foot traffic shall be permitted on floor for 12 hours after installation. Do not use rolling carts, ladders or any other object on the floor that can cause damage.

D. Protect the floor against scratching and gouging with material suited to the type of traffic it shall be submitted to during the completion of construction/renovation.

E. After completion of construction, the floor shall be cleaned according to manufacturers' instruction.

F. Provide manufacturers detailed post-installation maintenance instructions to those responsible for post-installation maintenance.

END OF SECTION 096229

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data. **Include printout of MPI's "MPI Approved Products List" with product highlighted.**
2. Samples.

B. Mockups: Full-coat finish Sample of each type of coating, color, and substrate, applied where directed.

C. Extra Materials: Deliver to Owner 1 gal. (3.8 L) of each color and type of finish coat paint used on Project, in containers, properly labeled and sealed.

PART 2 - PRODUCTS

2.1 PAINT

A. Products:

1. Green Planet Paints

http://www.greenplanetpaints.com/index.cfm?fuseaction=category.display&category_ID=267&type=264&CFID=21559695&CFTOKEN=46615954

2.

B. Material Compatibility: Provide materials that are compatible with one another and with substrates.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. Use paints and coatings that comply with the following limits for VOC content:

1. Flat Paints and Coatings: 0g/L.
2. Nonflat Paints, Coatings: 0 g/L.
3. Primers, Sealers, and Undercoaters: **0**g/L.

D. Colors: As **selected**

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.

C. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

3.2 APPLICATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Paint exposed surface unless otherwise indicated.

1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
2. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint the back side of access panels.
4. Color-code mechanical piping in accessible ceiling spaces.
5. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.

C. Apply paints according to manufacturer's written instructions.

1. Use brushes only for exterior painting and where the use of other applicators is not practical.
2. Use rollers for finish coat on interior walls and ceilings.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

END OF SECTION 099100

10 Specialties

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T6 or 6463-T6.

C. Sheet Steel: ASTM A 1008/A 1008M, 0.0359-inch (0.9-mm) minimum nominal thickness.

D. Tempered Glass: ASTM C 1048, Kind FT (fully tempered).

E. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

F. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.2 TOILET AND BATH ACCESSORIES

A. Manufacturers:

1. Design Within Reach or similar

2. Custom Fabrication

B. Toilet Tissue Dispenser: A-505

1. Basis-of-Design Product: Custom fabricated steel assembly
2. Mounting: **Surface mounted with concealed anchorage**
3. Material: **Stainless steel**
4. Capacity: **Designed for** 4-1/2- or 5-inch- (114- or 127-mm-) **diameter-core tissue rolls**

C. Medicine Cabinet : A-505

1. Basis-of Design Product: Custom fabricated assembly
2. Description: 12”x60” mild steel built in cabinet
3. Mounting: Built In
4. Material and Finish: Oiled steel

D. Towel Bar A-505:

1. Basis-of-Design Product: Custom Fabricated Stainless Steel assembly
2. Description: 1/2-inch- (19-mm-) **round tube with circular end brackets**
3. Mounting: Flanges with **concealed** fasteners.
4. Length: 30 inches (762 mm).
5. Material and Finish: **Stainless steel**

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS[AND BRACKETS]

A. Portable Fire Extinguishers: See sheet F-102. Multipurpose Dry-Chemical Type. NFPA 10, listed and labeled for the type, rating, and classification of extinguisher.

1. Multipurpose Dry-Chemical Type: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, in enameled-steel container.

B. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for fire extinguishers indicated, with plated or baked-enamel finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install mounting brackets in locations indicated at 54 inches (1372 mm) above finished floor to top of fire extinguisher.

B. Install fire extinguishers in mounting brackets where indicated.

END OF SECTION 104416

11 Equipment

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Allowances: See Division 01 Section "Price and Payment Procedures" for appliance allowances.

B. Submittals: Product Data.

C. Regulatory Requirements: Comply with provisions of the following product certifications:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
4. NAECA: Provide residential appliances that comply with NAECA standards.

D. Energy Ratings: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

A. Electric Cooktop: 30-inch (762-mm) built-in cooktop with four burner elements.

1. Products:

a. Kuppersbusch EKWH

http://www.kuppersbuschusa.com/Documents/Installation/honeycomb_cooktop/EKWE-EKWH_install.pdf

b. Gaggenau CE 261 112

B. Electric Wall Oven: Built-in, single, electric, self-cleaning wall oven with broiler unit.

1. Products:

a. Bosch HBL8450UC

http://www.boschappliances.com/products/specs_dimensions_popup.aspx?product_id=673

b. Gaggenau EB 290

C. Exhaust Hood: 30-inch (762-mm) ventilating exhaust hood with variable-speed fan.

1. Fan Control: Wall -mounted switch, with separate light switch.
2. Weatherproof wall cap with backdraft damper and rodent-proof screening.

D. Refrigerator/Freezer: Freestanding, frost-free, two-drawer/one-door refrigerator with side-by-side freezer.

1. Fresh Food Compartment Volume: [7.0 cu. ft. (0.2 cu. m)]
2. Freezer Compartment Volume: [4.9 cu. ft. (0.12 cu. m).

3. Products:

a. Perlick H2FR-S

http://www.homeportfolio.com/catalog/Product.jhtml?prodId=150964

E. Dishwasher: Built-in, undercounter, automatic dishwasher, sized to replace 24-inch-(610-mm-) base cabinet,

1. Products:

a. Fisher & Paykel: DD24SCX6 Single EZKleen Stainless Steel

http://www.fisherpaykel.com/admin/pdfs/pdf_installations/599625C_DD24S_installA2_USCAw.pdf

F. Clothes Washer: Freestanding, front loading, stackable, automatic clothes washer with [4.0 -cu. ft. (0.11-cu. m)capacity

1. Products:

a. Samsung WF219ANB

http://www.samsung.com/us/system/consumer/product/2009/05/09/wf219anwxaa/WF219ANB_spec.pdf

G. Electric Clothes Dryer: Freestanding, front-loading clothes dryer, 7-cu. ft. (0.198-cu. m) capacity.

1. Products:

a. Samsung DV419AEW

http://www.samsung.com/us/consumer/detail/support.do?group=homeappliances&type=washersdryers&subtype=dryers&model_cd=DV419AEW/XAA&mode=C

PART 3 - EXECUTION

3.1 INSTALLATION

A. Built-in Appliances: Securely anchor to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

B. Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Test each item of residential appliances to verify proper operation. Make necessary adjustments.

D. Verify that accessories required have been furnished and installed.

END OF SECTION 113100

12 Furnishings

SECTION 122413 – WINDOW TREATMENTS

PART 1 - GENERAL

1.1 Section Includes:

1. Motorized interior solar and/or privacy roller shades
2. Motorized interior room darkening roller shades
3. Motorized interior dual solar and/or privacy and/or room darkening roller shades
4. Motorized interior roller shade accessories
5. Motorized interior roller shade control systems

1.2 REFERENCES

A. National Fire Protection Association (NFPA)

1. 1989 NFPA 701 small scale Vertical Burn Test and rated “PASS”
2. 1996 NFPA 701 small scale Vertical Burn (telephone booth test) and rated “PASS”

B. ASTM International (ASTM)

1. ASTM G-22-80 results for ATCC6538 (Staphylococcus aureus) an ATCC13388 (Pseudomonas aeroginosa) indicating minimum 5mm (0.197 inches) “No Growth Contact Area”.
2. ASTM G-21-85 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.results for ATCC9642, ATCC9348 and ATCC9645 indicating “No Growth”.

C. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

1. C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
2. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

D. Underwriters Laboratories, Inc. (UL)

1. Electrical: Integrated motor control systems and components approved AS A SYSTEM by either Underwriter Laboratories (UL) or Electronic Testing Laboratories (ETL).

E. European Commission (CE) - Harmonized European Standard.

F. Norma Official Mexicana (NOM).

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets with performance specifications demonstrating compliance with specified requirements, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Submit manufacturer's descriptive literature and details for each product type specified. Details indicate materials, finishes, construction, and dimensions of individual components, profiles, and mounting requirements.

4. Submit wiring diagrams, details on integration to lighting control systems, AV systems, and building management systems, installation instructions, and operating instructions.

5. Submit current certificates demonstrating all line voltage components of the system are either UL Listed or UL recognized. All low voltage components within the system shall be powered by UL listed transformer or UL recognized class 2 transformers or power supplies and wired as NEC Class 2 circuits.

6. Submit test reports indicating compliance with fabric properties specified.

C. Shop Drawings; include:

1. Provide head, jamb and sill details, and relevant dimensions for mounting requirements for each product type and mounting condition.

2. Provide shade schedule indicating room number, opening size(s), quantities and key to details.

3. Provide one-line wiring system diagrams including connection details and overall arrangement of shades and control locations supplied by this section for installation and connection under division 16.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be qualified to install and commission the specified products by prior factory training, experience, demonstrated performance, and acceptance of any requirement of the manufacturer, subsidiary of the manufacturer, or licensed agent.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Do not deliver shades to the project until all concrete, masonry, plaster, painting and other wet work has been completed and is dry.

C. Deliver shades to project in protective packaging, uniquely labeled to identify each shade for each opening. Schedule delivery to prevent delays to completion of work, but to minimize on-site storage time.

D. Store materials in a dry, secure place. Protect from weather, surface contaminants, corrosion, construction traffic, and all other potential damage.

1.6 WARRANTY

A. Provide manufacturer's standard warranty covering 2-year parts and labor and 8 years limited parts warranty to repair and replace defective equipment.

B. Provide manufacturer's upgraded [10] year warranty to repair and replace defective equipment.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Lutron Electronics Co., Inc.; 7200 Suter Road, Coopersburg, PA 18036-1299 Telephone (800) 523-9466 http://www.lutron.com

B. [Basis of design product: Lutron Sivoia QED or subject to compliance and prior approval with specified requirements of this section, one of the following:

1. Lutron

2. Lutron Shading Systems

http://www.lutron.com/shadingsolutions/overview_resi.asp?s=17000&t=17900

2.2 APPLICATION/SCOPE

2.3 SYSTEM REQUIREMENTS

A. Aesthetics

1. Symmetrical light gaps of no more than 0.75 inch typical or 0.625 inch (20mm) minimum

2. Shade mounting position can be adjusted while the shade is installed to ensure perfect shade centering.

2.4 ROLLER SHADES

A. Mounting:

1. Roller shade brackets provide symmetrical light gaps of 0.75inch (20 mm) on each side of shade

2. Universal mounting brackets can be used for wall, ceiling and jamb mount.

3. Two-piece mounting bracket provides level, projection, and shade centering adjustments from mounting bracket.

4. System shall have a roller shade leveling adjustment that allows level adjustment while the roller shades are mounted to the brackets.

5. System shall allow a side-to-side adjustment of up to ±0.375 inch (9 mm) on each side while the shade is mounted to the bracket to properly center shade over the window.

6. System shall have a projection adjustment of up to 0.50 inch (12 mm) allowing the shade to clear the trim or move the shade closer to the window in order to have a tighter seal between the fabric and the window.

7. System dual brackets shall be provided to permit two shades rollers to be mounted in the same opening
8. Coupling
9. A single EDU shall be capable of driving multiple shades with a coupling pin.
10. This pin allows for precision adjustment of the bottom bar levels without removing the roller from its installed point or removing fabric from the roller tube.

A. Fire – Provide shade fabrics tested in accordance with:

1) 1989 NFPA 701 large scale Vertical Burn Test and rated "PASS."
2) 1999 NFPA 701 small scale Vertical Burn (telephone booth test) and rated "PASS."

B. Manufacturing

2.5 FABRIC SELECTION

A. Light-Filtering Fabrics
B. Privacy and/or Solar Fabrics
C. Room Darkening Fabrics
D. PVC-Free Fabrics

2.6 CONTROLS

A. Wall Mounted Controls:

1. Low voltage wallstations are able to electronically set and reconfigure shade open and close limits, shade preset positions, system groups, and system subgroups at the control without rewiring and without access to the Electronic Drive Unit.
2. Faceplates attach using no visible means of attachment
3. Low voltage wallstations fit into a standard backbox.
4. Engraved artwork scheduled for controls, such as borders and logos, are applied in a method designed to resist removal by scratching, cleaning, etc.

Manufacturer ensures the following items regarding product color:

a. Product color matches NEMA standard WD1, Section 2, and the maximum color deviation from this standard shall not exceed D

E=1, CIE L*a*b color space units. For non-NEMA colors, color match coordination shall be provided on request.

b. Color variation of any control in the same product family shall not exceed D E=1, CIE L*a*b color units.

c. Visible parts shall exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674-89. Manufacturer to submit proof of testing upon request

d. Wall stations are laser engraved with appropriate description. Silk-screen borders, logos, and graduations use a graphic process that chemically bonds to faceplate, resistant to removal by scratching and cleaning.

5. Wallstation(s) provide an immediate local LED response upon button activation to indicate that a system command has been sent from the wallstation. LED remains lit contingent upon receiving system confirmation of the successful completion of the command.

6. Wallstation(s) have removable button assemblies that can be replaced in the field to change colors, button configurations, and engraving.

7. Wallstation buttons are backlit.

8. Wallstations are capable of simultaneously controlling one or more shades, up to the maximum number of shades in the system.

9. Wallstations are of type: Refer to Wallstation Schedule for operation requirements.

a. Two-Button Wallstation:
   1) Wallstation has buttons for selecting the following for one group of shades: full-open and full-close.

b. Three-Button Wallstation:
   1) Wallstation has buttons for selecting the following for one group of shades: full-open, full-close, and one programmable preset position.

c. Two-Button Wallstation with Raise/Lower:
   1) Wallstation has buttons for selecting the following for one group of shades: full-open, full-close, and raise/lower.

d. Three-Button Wallstation with Raise/Lower:
   1) Wallstation has buttons for selecting the following for one group of shades: full-open, full-close, one programmable preset position, and raise/lower.

e. Four-Button Wallstation with Raise/Lower and Infrared Reception:
   1) Wallstation has buttons for selecting the following for one group of shades: full-open, full-close, two programmable preset positions, and raise/lower.

2) Wallstation has an infrared receiver. Remote controls shall be able to electronically set and reconfigure shade open and close limits, shade preset points, system groups, and system subgroups through the infrared receiver at the wallstation without rewiring and without access to the Electronic Drive Unit.

f. Four-Button Wallstation for Dual-Mount or Two-Group Applications:
   1) Wallstations provide control for two separate groups of shades.
   2) Wallstations take one system address and wire as one wallstation.
   3) Wallstations provide buttons for selecting the following for each of the shade groups: full-open and full-close.

g. Six-Button Wallstation for Dual-Mount or Two-Group Applications:
   1) Wallstations provide control for two separate groups of shades.
   2) Wallstations take one system address and wire as one wallstation.
   3) Wallstations provide buttons for selecting the following for each of the shade groups: full-open, full-close, and one programmable preset position.

h. Five-Button Wallstation with Raise/Lower:
   1) Wallstations provide buttons for selecting the following for one group of shades: full-open, full-close, three programmable preset positions, and raise/lower.

i. Multi-group keypad for control of multiple groups of electronic shades
   1) Wallstations provide buttons for controlling 2 groups of electronic shades: full-open, full-close, one programmable preset position, and raise/lower.
   2) Wallstations provide buttons for controlling 2 groups of electronic shades: full-open, full-close, and one programmable preset position.
   3) Wallstations provide buttons for controlling [2] [3] groups of electronic shades: full-open, full-close, and raise lower.
   4) Wallstations provide buttons for controlling [2] [3] [4] groups of electronic shades: full-open and full-close.

B. IR Transmitters and Receivers:

1. IR Receivers are available on system wallstation, as an attachment to the Electronic Drive Unit, or on the system contact closure input board. Refer to drawing for schedule of operation.
2. IR Receivers connect directly to the Electronic Drive Unit and do not require additional tools or interfaces.
3. IR Receivers include circuitry to reduce degraded performance from ambient interference such as electronic ballast noise or sunlight.

4. Color: [White IR Receiver with white wiring.] [Royal Plum IR Receiver with black wiring.]
5. Through use of IR extensions, the receiver may be mounted on any flat surface up to 50 feet from the Electronic Drive Unit.
6. Remote Controls electronically set and reconfigure shade open and close limits, shade preset points, system groups, and system subgroups at the control without rewiring and without access to the Electronic Drive Unit.
7. System Remote Controls are Lutron Sivoia QED Hand-held Infrared Transmitters. Refer to drawing for schedule of operation.
8. IR transmitters are of type: Refer to control schedule for operation requirements.

9. Open/close infrared hand-held transmitter provides OPEN/CLOSE and momentary raise and lower functions.
10. 3-preset, infrared hand-held transmitter provides OPEN/CLOSE, three preset stop points and momentary raise and lower functions.
11. Multi-function hand-held infrared Transmitter provides individual and group control of shades for open, close, and momentary raise/lower functionality.
12. Control operates up to 4 shades or groups of shades.
13. Control operates both light filtering and blackout shades on the same window.
14. Multi-function light and window treatment hand-held Infrared transmitter provides individual control of up to 2 shades or 2 groups of shades and preset lighting from the same remote.
15. Shade operation allows for open, close, and momentary raise/lower functionality.
16. Lighting functions include presets 1,2,3,4, and off.

C. Interfaces:

1. Interface with Lutron Grafik Eye System:
   a. Shade system interfaces to Lutron Grafik Eye lighting system to provide single system control of daylight and electric light in the space.
   b. Interface (s) provides buttons for selecting the following for one group of shades: full-open, full-closed, three programmable preset positions, and raise/lower.
   c. Interface(s) provides an immediate local LED response upon button activation to indicate that a system command has been sent from interface.
   d. Interface(s) is capable of simultaneously controlling one or more shades, up to the maximum number of shades in the system, without affecting the

lighting control system.

e. Interface(s) faceplate attaches using no visible means of attachment.

f. Interface(s) has removable button assemblies that can be replaced in the field to change colors, button configurations, and engraving.

g. Interface(s) functions are configured through the lighting control system.

h. Interface buttons have backlighting.

2. Operation Through HomeWorks Lighting Control System:

   a. Shade system interfaces to Lutron HomeWorks lighting system to provide single system control of daylight and electric light in the space.

   b. Electronic Drive Unit is controlled and programmed as a zone of light within the lighting control system

   c. System provides two-way communication to ensure that a command has been sent and completed.

   d. Control provides two-way communication between Electronic Drive Unit and HomeWorks lighting control system so that system software displays actual shade position in percentage increments.

   e. System groups and subgroups shall be setup or changed from the software without rewiring the system.

   f. Lighting control system configures shade open and close limits; shade preset points, system groups, and system subgroups in system software without rewiring and without access to the Electronic Drive Unit.

   g. A shade or group of shades are programmed to any button in the system utilizing a variety of programming logic:

      1) Toggle

      2) Manual sequence

      3) Automatic sequence

      4) Conditional

   h. System provides integrated astronomic timeclock for automatic control of shades

   i. System provides Vacation Mode which moves shades to a preset level automatically to create the appearance that the home is occupied

      1) Vacation mode records system usage for up to 14 days

      2) Vacation mode replays system usage upon activation.

3) Vacation mode can be replayed with a “randomization option” to create the appearance that the home is occupied while the user is away from home.

j. System provides Security Mode, which can include shade and light zones.

1) Security mode can moves shades to a preset level upon activation

2) Security mode can disable keypad functionality to block unwanted usage.

PART 3- EXECUTION

3.1 EXAMINATION

A. Begin installation after substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install shades in windows level and plumb to provide smooth operation.

C. Install in accordance with manufacturer’s product data and approved shop drawings.

D. A factory-qualified technician shall perform Field measurement and installation.

3.4 ADJUSTING

A. Adjust level, projection, and shade centering directly from mounting bracket.

B. Adjust fabric on tube if visibly telescoping.

3.5 CLEANING

A. Touch up damaged finishes and repair minor damage in order to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.

B. Clean exposed surfaces, including metal and shade fabric, using non-abrasive materials and methods recommended by the shade fabric manufacturer. Remove and replace work that cannot be satisfactorily cleaned.

3.6 DEMONSTRATION

A. Demonstrate operation method and instruct owner's personnel in the proper operation and maintenance of the window shade systems.

B. Manufacturer’s Instructions:

1. Installation, Programming, and Maintenance instructions to be included in product packaging.
2. 24-Hour / 7-Day Factory Technical Support shall be available to aid with unforeseen installation difficulties.

3.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion

END OF SECTION

SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and material Samples.

B. Verify dimensions by field measurements; measure for countertops after base cabinets are installed.

PART 2 - PRODUCTS

2.1 CASEWORK

A. Comply with KCMA A161.1. Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit.

B. Comply with KCMA A161.2 for plastic-laminate countertops.

C. Forest Certification: Provide cabinets produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "Principles and Criteria for Forest Stewardship."

D. Cabinets:

1. Products:

   a. Custom Fabricated Casework

2. Face Style: Flush overlay
3. Cabinet Style: Frameless.
4. Door and Drawer Fronts: Mild Steel sheet.
5. Face Frame Finish: Melamine.
6. Exposed Cabinet End Finish: Wood.
7. Exposed Wood: Maple clear solid wood or hardwood plywood with Grade A faces per HPVA HP-1, selected for compatible color and grain.
8. Exposed Plastic Laminate: NEMA LD 3, Grade VGS, through-color plastic laminate.
9. Thermoformed-Vinyl-Faced Panels: Medium-density fiberboard, ANSI A208.2, with thermoformed vinyl overlay.
10. Door and Drawer Pulls: Back-mounted decorative pulls

11. HingesConcealed European-style self-closing hinges.
12. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides with nylon-tired, ball-bearing rollers.

E. Plastic-Laminate Countertops and Splashes:

1. Plastic Laminate: NEMA LD 3, Grade HGS
2. Backing: Plastic-laminate backer sheet, NEMA LD 3, Grade BKL.

F. Solid-Surface-Material Countertops and Splashes: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2, 1 inch (25.4 mm) thick

G. Products:

a. Richlite or similar

http://www.richlite.com/

H. Countertop Configuration:

1. Front Style: Straight, slightly eased at top.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces by using concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.

B. Install cabinets without distortion so doors and drawers fit openings properly and are aligned.

C. Install level and plumb to a tolerance of 1/8 inch in 8 feet (3.2 mm in 2.4 m).

D. Fasten each cabinet to adjacent unit and to structural members of wall construction. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm)o.c.

1. Use No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.
2. Use toggle bolts through metal backing behind gypsum board.

E. Fasten plastic-laminate countertops by screwing through corner blocks in base units into underside of countertop. Spline and glue joints in countertops and use concealed mechanical clamps.

1. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.
2. Seal edges of cutouts by saturating with varnish.

F. Fasten solid-surface countertops by screwing through corner blocks in base units into underside of countertop. Align adjacent surfaces. Form seams 1/8 inch (3.2 mm) wide and adhere with manufacturer's recommended joint adhesive in color to match countertop. Dress joints smooth, remove surface scratches, and clean entire surface.

1. Seal edges of cutouts by saturating with varnish.

END OF SECTION 123530

22 Plumbing

SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES AND TEST PLUGS

A. Pressure Gages: Direct-mounting, indicating-dial type complying with ASME B40.100. Dry metal case, minimum 2-1/2-inch (63-mm) diameter with red pointer on white face, and plastic window. Minimum accuracy 3 percent of middle half of range. Range two times operating pressure.

B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating 500 psig at 200 deg F (3450 kPa at 93 deg C).

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.

D. Install unions at final connection to each piece of equipment.

E. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.

F. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.2 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.3 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

D. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).

E. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser

clamps.

3.4 VIBRATION ISOLATION AND SEISMIC CONTROL DEVICE INSTALLATION

A. Adjust vibration isolators to allow free movement of equipment limited by restraints.

B. Install resilient bolt isolation washers and bushings on equipment anchor bolts.

C. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

END OF SECTION 220500

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Quality Assurance: Labeled with maximum flame-spread index of 25 and maximum smoke-developed index of 50 according to ASTM E 84.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

C. Factory-Applied Jackets: When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

PART 3 - EXECUTION

3.1 PIPE INSULATION INSTALLATION

A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install

insulation continuously through penetrations. Seal penetrations. Comply with requirements in Division 07 Section "Penetration Firestopping."

D. Flexible Elastomeric Insulation Installation:

1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Interior Piping System Applications: Insulate the following piping systems:

1. Domestic hot water.
2. Recirculated domestic hot water.
3. Roof drain bodies and horizontal rainwater leaders of storm water piping.
4. Exposed water supplies and sanitary drains of fixtures for people with disabilities.

F. Do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Sanitary drainage and vent piping.
3. Drainage piping located in crawlspaces unless otherwise indicated.
4. Chrome-plated pipes and fittings, except for plumbing fixtures for people with disabilities.
5. Piping specialties, including air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.2 EQUIPMENT INSULATION SCHEDULE

A. Domestic water and domestic hot-water hydropneumatic tank insulation shall be the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.

B. Domestic hot-water storage tank insulation shall be the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick

C. Domestic water storage tank insulation shall be the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.

3.3 INDOOR PIPING INSULATION SCHEDULE

A. Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawlspaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

B. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be the following:

   a. Flexible Elastomeric: 1/2 inch (13 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

   a. Flexible Elastomeric: 1 inch (25 mm) thick.

C. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be the following:

   a. Flexible Elastomeric: 3/4 inch (19 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:

   a. Flexible Elastomeric: 1 inch (25 mm) thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
   c. Polyolefin: 1 inch (25 mm) thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Comply with NSF 14 for plastic, potable domestic water piping and components.

B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Hard Copper Tubing: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper with wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Copper Unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
2. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

B. Soft Copper Tubing: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper with copper pressure fittings, cast-copper-alloy or wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

C. CPVC Piping: ASTM F 441/F 441M, Schedule 40 pipe with ASTM F 438, CPVC Schedule 40 socket-type fittings.

D. PEX Tube and Fittings: ASTM F 877, SDR 9 PEX tubing and ASTM F 1807, metal insert-type fittings with copper or stainless-steel crimp rings.

1. Manifold: ASTM F 877 plastic or corrosion-resistant-metal assembly, with a plastic or corrosion-resistant-metal valve for each outlet.

E. PVC Pipe: ASTM D 1785, Schedule 40.

1. PVC Fittings: ASTM D 2466, Schedule 40, socket type.

F. Special-Duty Valves:

1. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
2. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.
3. CPVC and PVC Union Ball Valves: MSS SP-122, with full-port ball, socket or threaded detachable end connectors, and pressure rating not less than 150 psig (1035 kPa) at 73 deg F (23 deg C)
4. CPVC and PVC Non-Union Ball Valves: MSS SP-122, with full- or reduced-port ball, socket or threaded ends, and pressure rating not less than 150 psig (1035 kPaat 73 deg F (23 deg C)
5. CPVC and PVC Butterfly Valves: With lever handle and pressure rating not less than 150 psig (1035 kPa) at 73 deg F (23 deg C) .
6. CPVC and PVC Check Valves: Swing or ball-check design and pressure rating not less than 150 psig (1035 kPa) at 73 deg F (23 deg C)

G. Transition Fittings: Manufactured piping coupling or specified piping system fitting. Same size as pipes to be joined and pressure rating at least equal to pipes to be joined.

H. Flexible Connectors: Stainless-steel, corrugated-metal tubing with wire-braid covering. Working-pressure rating a minimum of 200 psig (1380 kPa).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.

B. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for wall penetration systems.

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

D. Install domestic water piping with 0.25 percent slope downward toward drain for horizontal piping and plumb for vertical piping.

E. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

F. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

1. Soldered Joints: Comply with procedures in ASTM B 828 unless otherwise indicated.

G. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.

H. Support vertical piping at each floor.

I. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

3.2 INSPECTING AND CLEANING

A. Inspect and test piping systems as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

B. Clean and disinfect potable and non-potable domestic water piping by filling system with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

3.3 PIPING SCHEDULE

A. Aboveground Distribution Piping: Type L (Type B), hard copper tubing, Type M (Type C), hard copper tubing, CPVC piping, PEX piping, or Schedule 40 PVC piping.

3.4 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Install gate valves close to main on each branch and riser serving two or more plumbing fixtures or equipment connections and where indicated.

C. Install gate or ball valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated.

D. CPVC and PVC ball, butterfly, and check valves may be used in matching piping materials.

E. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.

F. Install swing check valve on discharge side of each pump and elsewhere as indicated.

G. Install ball valves in each hot-water circulating loop and discharge side of each pump.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Pipe-Applied, Atmospheric Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

B. Hose Connection Vacuum Breakers: ASSE 1011, nickel-plated bronze, with nonremovable and manual drain features and garden-hose threaded connection.

C. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013.

D. Water Regulators: ASSE 1003.

E. Balancing Valves: MSS SP-110 for two-piece, copper-alloy ball valves, with memory stop.

F. Thermostatic Mixing Valves: Manually adjustable, bronze body. Include check stop and union on hot- and cold-water-supply inlets.

G. Clothes Washer Outlet Boxes: Enameled steel box and face plate with combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.

H. Hose Bibbs: Bronze body in [chrome-plated finish, with removable composition disc, threaded or soldered inlet, garden-hose threaded outlet, and wheel handle.

I. Ball-Valve-Type, Hose-End Drain Valves: MSS SP-110, with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

J. Stop-and-Waste Drain Valves: MSS SP-110 for ball valves or MSS SP-80 for gate valves.

K. Water Hammer Arrester: Bellows or piston type with pressurized cushioning chamber.

L. Strainers: Y-pattern, bronze body, 125-psig (860-kPa) minimum steam working pressure.

M. Water Filters: Cartridge type, including housing, fittings, filter cartridges, and cartridge end caps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers at each water-supply connection to mechanical equipment and where required by authorities having jurisdiction.

B. Install hose bibbs with integral or field-installed vacuum breaker.

END OF SECTION 221119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data. Include certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PUMPS

A. Horizontally Mounted, In-Line, Separately Coupled Centrifugal Pumps: Factory-assembled and -tested, in-line, single-stage, separately coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontal. Rated for 125-psig (860-kPa) minimum working pressure and minimum continuous water temperature of 225 deg F (107 deg C).

1. Products:

   a. Flotec FP4022

http://www.hardwareworld.com/Shallow-Jet-Pump-34-HP-p10KAVB.aspx

2. Casing: Radially split, bronze, with threaded companion-flange connections.
3. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
4. Impeller Material: ASTM B 584, cast bronze or stainless steel.
5. Shaft and Shaft Sleeve: Steel shaft with copper-alloy shaft sleeve.
6. Seal: Mechanical; with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
7. Bearings: Oil lubricated; bronze-journal or ball type.
8. Motor: Resiliently mounted to pump casing.

2.2 MOTORS

A. NEMA MG 1, "Standard for Motors and Generators." Include NEMA listing and labeling.

http://www.nema.org/stds/mg1.cfm

B. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

C. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.

C. Support pumps and piping so weight of piping is not supported by pump volute.

D. Install electrical connections for power, controls, and devices.

E. Suspend in-line pumps independent from piping. Use continuous-thread hanger rods and vibration isolation hangers. Fabricate brackets or supports as required for pumps.

F. Install vertical in-line pumps on concrete bases.

G. Connect piping with valves that are at least the same size as piping connecting to pumps.

H. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

I. Install shutoff valve and strainer on suction side of pumps.

J. Install nonslam check valve and throttling valve on discharge side of pumps.

K. Install thermostats in hot-water return piping.

L. Install pressure gages test plugs on suction and discharge of each pump. Install at integral pressure gage tappings where provided.

END OF SECTION 221123

SECTION 221200

PART 1 - POTABLE WATER STORAGE TANKS

PART 2 - GENERAL

2.01 SECTION REQUIREMENTS

A. Submittals: Product Data, andmanufacturer's color charts showing the full range of colors available for factory-applied finishes.

B. Comply with USDA and FDA regulations for storage and processing of food

C. Verify dimensions by field measurements before ordering tank

D. Warranties: Provide standard manufacturer's written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace products that fail in materials or workmanship for the period of **10** years.

PART 3 - PRODUCTS

3.01 MATERIALS

A. Linear Polyethylene plastic

B. Ultraviolet light stabilizers and fillers

C. Pigment upon request

3.02 MANUFACTURERS – See Drawings for Sizes)

A. Tank Depot

http://www.tank-depot.com/

1. Competition supply tank

B. Tank Depot
1. Trombe wall storage Tank

C. Go-To Tanks

http://www.gototanks.com/

1. Competition waste water Tank

D. Tank Depot

1. Greenhouse and Landscaping Tank

PART 4 - EXECUTION

4.01 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.

B. Fasten tanks securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.

ENDOF SECTION 221200

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Minimum Pressure Requirement for Soil, Waste, and Vent: 10-foot head of water (30 kPa).

B. Comply with NSF 14, "Plastic Piping Components and Related Materials," for plastic piping components.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. Copper Drainage Tube and Fittings: ASTM B 306, Type DWV drawn temper with wrought -copper, Type DWV drainage fittings.

B. PVC Plastic, DWV Pipe and Fittings: ASTM D 2665, Schedule 40, plain ends with PVC socket-type, DWV pipe fittings.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.

B. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

C. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for wall penetration systems.

1. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.

Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

G. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

H. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

K. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure unless otherwise indicated.

L. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.

3.2 PIPE SCHEDULE

A. Aboveground Applications: PVC plastic, DWV pipe and fittings with solvent-cemented joints, Copper drainage tube and fittings with soldered joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. PVC Backwater Valves: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

B. Cleanouts, P-104:

1. Application: Wall cleanout
2. Body or Ferrule: Plastic.
3. Clamping Device: Required.
4. Outlet Connection: Threaded.
5. Closure: Plastic plug.
6. Adjustable Housing Material: Plastic with threads.
7. Frame and Cover Material and Finish: Rough bronze.
8. Frame and Cover Shape: Round.
9. Top-Loading Classification: Heavy Duty.

C. Floor Drains, P-104:

1. Standard: ASME A112.3.1.
2. Pattern: Floor drain.
3. Body Material: Stainless steel.
4. Seepage Flange: Not required.
5. Clamping Device: Not Required.
6. Outlet: Side.

D. Air-Gap Fittings: ASME A112.1.2, chrome-plated brass cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor unless otherwise indicated.

1. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

F. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.

G. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices.

END OF SECTION 221319

SECTION 223300 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

C. Comply with performance efficiencies prescribed in ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings."

D. Warranties: Submit a written warranty executed by manufacturer agreeing to repair or replace water heaters that fail in materials or workmanship within five years from date of Substantial Completion. Failures include, but are not limited to, tanks and elements.

PART 2 - PRODUCTS

2.1 WATER HEATERS, GENERAL

A. Insulation: Suitable for operating temperature and required insulating value. Include insulation material that surrounds entire tank except connections and controls.

B. Anode Rods: Factory installed, magnesium.

C. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

D. Drain Valve: Factory or field installed.

2.2 ELECTRIC WATER HEATERS

A. Products

1. E-tech

http://www.aers.com/etech.html

B. Household, Instantant Electric Water Heaters: UL 174, Thermostat- Control, Instantaneous Electric Water Heaters: UL 499, 0.5-gal. (1.89-L)capacity; with 150-psig (1035-kPa) working-pressure rating; 120 volts, 750 watts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature and pressure relief valves and extend to closest floor drain.

B. Install vacuum relief valves in cold-water-inlet piping.

C. Install shutoff valves and unions at hot- and cold-water piping connections.

D. Make piping connections with dielectric fittings where dissimilar piping materials are joined.

E. Electrically ground units according to authorities having jurisdiction.

END OF SECTION 223300

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data for each type of plumbing fixture, including trim, fittings, accessories, appliances, appurtenances, equipment, and supports.

B. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 WATER CLOSET Vitreous-China Water Closet: Round front, siphon-jet type, Wall mounted, dual flush Water Closet

1. Basis-of-Design Product: Caroma or comparable product by one of the following:

2. Design Consumption: 1 gal./flush (3.8 L/flush) Toilet Seat: Round front, solid plastic closed front with cover with bumpers and hardware, Residential class.

B. Flushometer Valve: Brass body, brass or copper pipe or tubing inlet with wall flange and tailpiece with spud, screwdriver check stop, and vacuum breaker. Polished, chrome-plated, exposed metal parts. Consumption: 1.0 gal./flush (3.8 L/flush).

1. Basis-of-Design Product: Caroma or comparable product by one of the following:

C. Fixture Support: Combination carrier designed for standard mounting height. Include additional faceplate and coupling for water closet at wide pipe space. Compact-type carrier for back-to-back water-closet installation is prohibited.

2.2 SHOWER

A. Mixing-Valve Faucet and Miscellaneous Fittings: Single-lever, thermostatic and pressure-balance antiscald-type faucet; maximum 2.5-gpm (0.16-L/s) flow rate.

1. Basis-of-Design Product: Kohler K-T10940-4 or comparable product by one of the following:

2. Include ball, gate, or globe valves on supplies if check stops are not included with faucet.
3. Body Material: Solid brass
4. Finish: Polished chrome-plate
5. Shower Arm, Flow-Control Fitting: 1-1/2 gpm (0.1 L/s).
6. Hand-held showers.

B. Drain: NPS 2 (DN 50), nickel-bronze-strainer, floor drain.

2.3 SINK <Insert drawing designation.>

A. Undercounter type, 0.063 inch (1.6 mm).

1. Basis-of-Design Product: Caroma Liano Under Counter Sink or comparable product by one of the following:

http://www.caroma.com.au/CMSTemplates/CaromaDorf/Images/Products/4440/3486/orig-pdf-24bpp-8a.pdf

B. Faucet: Solid brass Maximum 2.5-gpm (0.16-L/s) flow rate.

1. Basis-of-Design Product: Kohler K-T945-4 or comparable product by one of the following:

http://www.us.kohler.com/onlinecatalog/pdf/1023410_4.pdf

2. Type: Center set with inlets on 4-inch (102-mm) centers

3. Finish: Brushed Stainless.
4. Handle(s): Dual, metal knobs
5. Spout: Integral with body with aerator 1-1/2-gpm (0.1-L/s) laminar flow.

C. Drain(s): 1-1/2-inch (38-mm) grid strainer with 1-1/2-inch (38-mm) removable, stainless-steel strainer bucket.

PART 3 - EXECUTION

3.1 INSTALLATIONS

A. Install fitting insulation kits on fixtures for people with disabilities.

B. Install fixtures with flanges and gasket seals.

C. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

D. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.

E. Fasten wall-mounted fittings to reinforcement built into walls.

F. Fasten counter-mounting plumbing fixtures to casework.

G. Secure supplies to supports or substrate within pipe space behind fixture.

H. Install individual supply inlets, supply stops, supply risers, and tubular brass traps with cleanouts at fixture.

I. Install water-supply stop valves in accessible locations.

J. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes unless otherwise indicated.

K. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

L. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

M. Install piping connections between plumbing fixtures and piping systems and plumbing equipment. Install insulation on supplies and drains of fixtures for people with disabilities.

N. Ground equipment.

END OF SECTION 224000

23 HVAC

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES AND TEST PLUGS

A. Pressure Gages: Direct-mounting, indicating-dial type complying with ASME B40.100. Dry metal case, minimum 2-1/2-inch (63-mm) diameter with red pointer on white face, and plastic window. Minimum accuracy 3 percent of middle half of range. Range two times operating pressure.

B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating of 500 psig at 200 deg F (3450 kPa at 93 deg C).

PART 3 - EXECUTION

3.1 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

END OF SECTION 230500

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Certified TAB reports.

B. TAB Firm Qualifications: **AABC**, **NEBBorTABB** certified.

C. TAB Report Forms: Standard TAB contractor's forms approved by Architect.

D. Perform TAB after leakage and pressure tests on **air** distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine the approved submittals for HVAC systems and equipment.

C. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

F. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

G. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended

controller.

2. Dampers and valves are in the position indicated by the controller.
3. Integrity of dampers and valves for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

H. Report deficiencies discovered before and during performance of test and balance procedures.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in **inch-pound (IP)andmetric (SI)** units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare schematic diagrams of systems' "as-built" duct layouts.

B. For variable-air-volume systems, develop a plan to simulate diversity.

C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

D. Verify that motor starters are equipped with properly sized thermal protection.

E. Check for airflow blockages.

F. Check condensate drains for proper connections and functioning.

G. Check for proper sealing of air-handling unit components.

H. Check for proper sealing of air duct system.

3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data; number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Set system controls so automatic valves are wide open to heat exchangers.
5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.5 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus **10** percent.
2. Air Outlets and Inlets: Plus or minus **10** percent.

END OF SECTION 230593

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Shop Drawings detailing operating control sequences of each item of HVAC equipment and system andProduct Data for controllers, sensors, operators, control panels, thermostats, humidistats, actuators, and control valves and dampers.

B. System Description: Integral Controls system for Sanyo Multi Split Systems

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install control wiring concealed, except in mechanical rooms, and according to requirements specified in Division 26 Sections.

END OF SECTION 230900

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Comply with ASME B31.5, "Refrigerant Piping," and with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

PART 2 - PRODUCTS

2.1 TUBES AND FITTINGS

A. Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B) and ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

D. Brazing Filler Metals: AWS A5.8.

2.2 VALVES

A. Thermostatic Expansion Valve: Comply with ARI 750; forged brass or steel body, stainless-steel internal parts, copper tubing filled with refrigerant charge for 40 deg F (5 deg C) suction temperature; 450-psig (3100-kPa) working pressure, and 240 deg F (116 deg C) operating temperature.

B. Solenoid Valves: Comply with ARI 760; 240 deg F (116 deg C) temperature rating, 400-psig (2760-kPa) working pressure, 240 deg F (116 deg C) operating temperature; and 24-V normally closed holding coil.

2.3 REFRIGERANT PIPING SPECIALTIES

A. Refrigerant: ASHRAE 34, R-410A.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements in Division 23 Section "Common Work Results for HVAC" for basic piping installation requirements.

B. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 23 Section "Common Work Results for HVAC" for wall penetration systems.

C. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.

D. Belowground, install copper tubing in PVC conduit. Vent conduit outdoors.

E. Insulate suction lines to comply with Division 23 Section "HVAC Insulation."

F. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

G. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.

H. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to solenoid valves, thermostatic expansion valves, and compressors unless they are furnished as an integral assembly for device being protected:

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

END OF SECTION 232300

SECTION 233423 – EXHAUST FANS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Bath Exhaust Fans shall be U.L Listed for use over bath tubs and showers when connected to GFCI protected branch circuit.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Exhuast fans shall be Energy Star qualified and have an energy efficient permanent split capacitor motor

PART 2 - PRODUCTS

2.01 BATH EXHAUST FANS

A. Basis-of-Design Product:

1. Broan QTR080 (Bathroom Exhaust Fan)

http://www.broan.com/ImageLibrary/broan/pdf/Specifications/99043401.pdf

2. Or similar based on architect approval

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: **Stainless-steel**, louvered or egg-crate grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Motion Sensor: Motion detector with adjustable shutoff timer.
4. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
5. Filter: Washable aluminum to fit between fan and grille.

2.02 KITCHEN EXHAUST FAN

A. Basis-of-Design Product:

1. Broan P5 (Kitchen Exhaust Fan)

http://www.broan.com/ImageLibrary/broan/pdf/Specifications/99042720.pdf

2. Or similar based on architect approval

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: **Stainless-steel**, louvered or egg-crate grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Motion Sensor: Motion detector with adjustable shutoff timer.
4. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
5. Filter: Washable aluminum to fit between fan and grille.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install per manufacturers reccomendations

B. Ceiling-Mounted Units: Suspend units from structure using steel wire or metal straps.

D. Ground exhaust fans.

END OF SECTION 233423

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and color charts for factory finishes.

PART 2 - PRODUCTS

2.1 OUTLETS AND INLETS

A. Diffusers and Wall and Ceiling Grilles:

1. Products:

a. Hendrick Screen. Wedge Tread V-Wire Screen.

2. Material: Stainless Steel.
3. Finish: Stainless Steel
4. Mounting: Surface Mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel unless otherwise indicated. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 238126 – SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data,Shop Drawings.

B. Split-system to by Energy Star compliant

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Sanyo KMHS1272 Evaporator head/Heat Pump

http://www.sanyohvac.com/assets/documents/service/Service_KMHS_7-9-12-18-24_72_Series_Rev_A.pdf

B. Sanyo CMH1972 Condenser

http://www.ajmadison.com/cgi-bin/ajmadison/CMH1972.html

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.

B. Fasten Condenser and Heat pumps securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.

C. Install according to manufacturers installation instructions.

END OF SECTION

235613 Heating Solar Collectors – Evacuated Cylinders

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data,Shop Drawings.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Apricus, Evacuated cylinder, AP22

http://www.apricus.com/html/solar_collector_technical_info.htm

B. Apricus Solar hot water dissapator AP-HD

http://www.apricus.com/html/solar_heat_dissipator.htm

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install according to manufacturers specifications by a certified installer

B. Conform to SD Building Code regarding the use and location of Pressure and Temperature relief devices

C. System components containing fluids shall be protected with pressure- and temperature-relief valves. Relief devices shall be installed in sections of the system so that a section cannot be valved off or isolated from a relief device. The submitted design must clearly indicate the location of each T&P relief device required. Provisions for safely discharging any relived water or steam must also be indicated on the plans.

D. Hydronic piping shall conform to Table M2101.1. Approved piping, valves, fittings and connections shall be installed in accordance with the manufacturer's installation instructions. Pipe and fittings shall be rated for use at the operating temperature and pressure of the hydronic system. Please indicate that all materials used for design meet the materials standards indicated in Table M2101.1. No other piping materials or joining methods will be permitted other than those SPECIFICALLY listed by the code.

E. Hydronic piping shall be tested hydrostatically at a pressure of not less than 100 pounds per square inch (psi) (690 kPa) for a duration of not less than 15 minutes. All T&P relief devices shall operate at pressures under 100psi.

END OF SECTION

26 Electrical

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. Comply with 2008 NEC

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Raceways:

1. EMT: ANSI C80.3, zinc-coated steel, with setscrew or compression fittings.
2. ENT: NEMA TC 13, complying with UL 1653.
3. FMC: Zinc-coated steel.
4. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
5. LFMC: Zinc-coated, flexible steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
6. RNC: NEMA TC 2, with NEMA TC3 fittings.
7. Raceway Fittings: Specifically designed for raceway type used in Project.

B. Wireways: Sheet metal sized and shaped, with hinged or screw covers.

C. Surface Raceways:

1. Metal: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
2. Plastic: PVC, extruded and fabricated to size and shape indicated in color selected, with snap-on cover and mechanically coupled connections with plastic fasteners.

2.2 CONDUCTORS AND CABLES

A. Conductors:

1. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
2. Conductors, Larger Than No. 10 AWG: Stranded copper.
3. Insulation: Thermoplastic, rated at 75 deg C minimum.
4. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

B. Cable Type NM-B and Type NMC-B Cable: Comply with UL 719 with Type THHN/THWN conductors complying with UL 83.

C. Cable Type SEU: Comply with UL 854 with Type THHN/THWN conductors complying with UL 83 or Type XHHW-2 conductors complying with UL 44.

D. Cable Type UF-B: Comply with UL 493 with Type THHN/THWN conductors complying with UL 83.

2.3 GROUNDING MATERIALS

A. Conductors: Solid for No. 8 AWG and smaller, and stranded for No. 6 AWG and larger unless otherwise indicated.

1. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
2. Bare, Solid-Copper Conductors: Comply with ASTM B 3.
3. Bare, Stranded-Copper Conductors: Comply with ASTM B 8.

B. Ground Rods: Copper-clad steel, sectional type; 5/8 by 96 inches (16 by 2400 mm) in diameter.

C. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts with clamp-type pipe connectors sized for pipe.

D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 ELECTRICAL IDENTIFICATION MATERIALS

A. Raceway Identification Materials: Snap-around, color-coding bands; flexible, preprinted, color-coded acrylic, or Self-adhesive, color-coding vinyl tape; flexible, preprinted, self-adhesive vinyl.

B. Conductor Identification Materials: Color-Coding Conductor Tape: Self-adhesive vinyl tape 1 to 2 inches (25 to 50 mm) wide.

C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, polyethylene tape with continuous metallic strip or core.

D. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with circuit identification legend machine printed by thermal transfer or equivalent process.

E. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

F. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1.0-mm) galvanized-steel backing; and with colors, legend, and size required for application.

G. Equipment Identification Labels: Engraved, laminated acrylic or melamine label; punched or drilled for screw mounting. White letters on a dark-gray background; red letters for emergency systems.

H. Fasteners: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.5 SUPPORT AND ANCHORAGE COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly, and provide finish suitable for the environment in which installed.

1. Channel Dimensions: Selected for structural loading.

B. Raceway and Cable Supports: As described in NECA 1.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and fittings.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded malleable-iron body and insulating wedging.

E. Mounting, Anchoring, and Attachment Components:

1. Powder-Actuated Fasteners: Threaded-steel stud.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete.
3. Concrete Inserts: Steel or malleable-iron, slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, high strength; complying with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 GENERAL ELECTRICAL EQUIPMENT INSTALLATION REQUIREMENTS

A. Install electrical equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

B. Install electrical equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.

C. Install electrical equipment to allow right of way for piping and conduit installed at required slope.

D. Install electrical equipment to ensure that connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.

E. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Comply with requirements in Division 08 Section "Access Doors and Frames."

G. Install sleeve and sleeve seals of type and number required for sealing electrical service penetrations of exterior walls.

H. Comply with NECA 1.

3.2 RACEWAY AND CABLE INSTALLATION

A. Outdoor Raceways Applications:

1. Exposed or Concealed: IMC.
2. Underground, Single Run: RNC.
3. Connection to Vibrating Equipment: LFMC.
4. Boxes and Enclosures: Metallic, NEMA 250, Type 3R or Type 4.

B. Indoor Raceways Applications:

1. Exposed or Concealed: EMT.
2. Connection to Vibrating Equipment: FMC; in wet or damp locations, use LFMC.
3. Damp or Wet Locations: IMC.
4. Boxes and Enclosures: Metallic, NEMA 250, Type 1, unless otherwise indicated.

C. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Install pull wires in empty raceways.

E. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch (1830-mm) maximum length of flexible conduit.

F. Install raceways and cables conceal within finished walls, ceilings, and floors unless otherwise indicated.

G. Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

3.3 WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway

B. Exposed Feeders, Branch Circuits, and Class 1 Control Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway or Nonmetallic-sheathed cable, Type NM or NMC.

C. Feeders and Branch Circuits Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway or Nonmetallic-sheathed cable, Type NM or NMC.

D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.

E. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.4 GROUNDING

A. Underground Grounding Conductors: Install bare copper conductor,No. 2/0AWG minimum. Bury at least 24 inches (600 mm) below grade.

B. Pipe and Equipment Grounding Conductor Terminations: Bolted.

C. Underground Connections: Welded.

D. Connections to Structural Steel: Bolted.

E. Install grounding conductors routed along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

F. Install ground rods driven into ground until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

G. Make connections without exposing steel or damaging coating if any.

H. Install bonding straps and jumpers in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

I. Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

J. Bond to equipment mounted on vibration isolation hangers and supports so vibration is not transmitted to rigidly mounted equipment.

K. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

L. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

1. Measure ground resistance not less than two full days after last trace of

precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

2. Perform tests by fall-of-potential method according to IEEE 81.
3. Report measured ground resistances that exceed the following values:

    a. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
    b. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
    c. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

4.

5. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.5 IDENTIFICATION

A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive color coding tape-in bands or snap-around, color-coding bands:

1. Fire-Alarm System: Red.
2. Security System: Blue and yellow.
3. Telecommunication System: Green and yellow.

B. Power-Circuit Conductor Identification: For No. 3 AWG conductors and larger, at each location where observable, identify phase using color-coding conductor tape.

C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.

D. Warning Labels for Enclosures for Power and Lighting: Comply with 29 CFR 1910.145; identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

E. Equipment Identification Labels:

1. Labeling Instructions:

    a. Indoor Equipment: Adhesive film label with clear protective overlay or Self-adhesive, engraved, laminated acrylic or melamine label. Provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Electrical switchgear and switchboards.
c. Transformers.
d. Motor-control centers.
e. Disconnect switches.
f. Enclosed circuit breakers.
g. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

F. Verify identity of each item before installing identification products.

G. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

H. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

I. Install system identification color banding for raceways and cables at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

J. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Ungrounded service, feeder and branch-circuit conductors.

1. Colors for 240/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

2. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points.

K. Underground-Line Warning Tape: Continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Fasten hangers and supports securely in place, with provisions for thermal and structural movement. Install with concealed fasteners unless otherwise indicated.

B. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods, unless otherwise indicated or required by Code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Spring-tension clamps.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.7 SLEEVE AND SLEEVE-SEALS INSTALLATION

A. Cut sleeves to length for mounting flush with both wall surfaces.

B. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

C. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.

D. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

E. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 DEVICES

A. Line-Voltage Surge Protection: An integral part of the lighting control devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

B. Outdoor Photoelectric Switches: Solid state, with SPST or DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, and microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 15-second minimum.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.

C. Indoor, Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit complying with UL 773A, with separate relay unit rated for 20-A ballast load at 120- and 277-V ac. Cadmium sulfide photoresistors are not acceptable.

1. Light-Level Monitoring Range: [10 to 200 fc (108 to 2152 lx)] [100 to 1000 fc (1080 to 10 800 lx)], with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: Adjustable from 5 to 300 seconds.
3. Indicator: Two LEDs.

D. Indoor, Wall-Switch Occupancy Sensors:

1. Type: Dual technology (passive infrared and ultrasonic)]
2. Voltage: 120/277 V.

3. Time Delay: Adjustable up to 20 minutes.
4. Field of View: 150 degrees.
5. Minimum Coverage Area: 900 sq. ft. (84 sq. m).

E. Outdoor, Weatherproof Motion Sensors:

1. Type: Passive infrared.
2. Voltage: 120/277 V.
3. Time Delay: Adjustable up to 15 minutes.
4. Field of View: 180 degree.
5. Detection Range: 110 feet (34 m).
6. Minimum Switch Rating: 1000-W incandescent, 500-VA fluorescent.

F. Emergency Shunt Relay: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; coil rating of 120 V; and complying with UL 924.

2.2 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 26 Section "Common Work Results for Electrical."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 22 AWG, complying with Division 26 Section "Common Work Results for Electrical."

C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 16 AWG, complying with Division 26 Section "Common Work Results for Electrical."

D. UPT Cable: 100 ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, [Category 5e] [Category 6].

   a. Multipurpose: MP or MPG or MPP or MPR.
   b. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
   c. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

C. Label time switches and contactors with a unique designation.

D. Verify actuation of each sensor and adjust time delays.

END OF SECTION 260923

SECTION 260936 - MODULAR DIMMING CONTROLS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MANUAL MODULAR MULTISCENE DIMMING CONTROLS

A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.

B. Dimmers and Dimmer Modules:

1. Comply with UL 508.
2. Include integral or external filters to suppress audible noise and radio-frequency interference.
3. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

C. Description: Wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, or three-gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.

D. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.

E. Each manual, modular, multiscene-dimming controller shall include a master control and remote controls.

F. Each zone shall be configurable to control the following:

1. Fluorescent lamps with electronic or magnetic ballasts.
2. LED lamps

G. Memory: Retain preset scenes through power failures for at least seven days.

H. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices."

I. Master-Scene Controller: Suitable for mounting in a single, flush, wall box.

1. Switches: Master off, group dim, group bright, and selectors for each scene.
2. LED indicator lights, one associated with each scene switch, and one for the master off switch.

J. Fluorescent Zone Dimmer: Suitable for operating lighting fixtures and ballasts specified in Division 26 Section "Lighting," and arranged to dim number of scenes indicated for the master-scene controller. Scene selection is at the master-scene controller for setting light levels of each zone associated with scene.

1. Switch: Slider style for setting the light level for each scene.
2. LED indicator lights, one associated with each scene.
3. Electrical Rating: 1000VA, 120 V.

K. Incandescent Zone Dimmer: Operate incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.

1. Switch: Slider style for setting the light level for each scene.
2. LED indicator lights, one associated with each scene.
3. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counter. Conceal raceway and cables except in unfinished spaces.

C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

E. Label each scene control button with approved scene description.

END OF SECTION 260936

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Enclosure: Totally enclosed, nonventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

C. Enclosure: Totally enclosed, nonventilated, NEMA 250, Type 3R

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Taps:

1. Transformers Smaller Than 3 kVA: None.
2. Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
3. Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

E. Energy Efficiency for Transformers Rated 15 kVA and Larger: Comply with NEMA TP 1, Class 1 efficiency levels, as tested according to NEMA TP 2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten transformers securely in place, with provisions for thermal and structural movement. Install with concealed fasteners unless otherwise indicated.

B. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.

C. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Division 26 Section "Common Work Results for Electrical."

D. Construct concrete bases and anchor floor-mounting transformers according to requirements in Division 26 Section "Common Work Results for Electrical."

E. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

F. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

END OF SECTION 262200

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Common Work Results for Electrical."

B. Enclosures: Flush- and surface-mounted cabinets; NEMA 250, Type 1.

1. Front: Secured to box with concealed trim clamps.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity].

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity]
2. Main and Neutral Lugs: compression or Mechanical type.
3. Ground Lugs and Bus Configured Terminators: Compression or Mechanical type.
4. Feed-Through Lugs: Compression or Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Doors: Omit in fused-switch panelboards.

B. Mains: Circuit breaker.

C. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in or Bolt-on circuit breakers.

D. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

E. Branch Overcurrent Protective Devices: Fused switches.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Mains: Circuit breaker or lugs only.

B. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.

C. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating or interrupting capacity to meet available fault currents.

1. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-

intensity discharge (HID) lighting circuits.

2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Common Work Results for Electrical."

C. Stub four empty 3/4-inch (19-mm) conduits from panelboard into accessible or designated ceiling space; stub four empty conduits into floor.

D. Arrange conductors into groups; bundle and wrap with wire ties.

E. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory.

END OF SECTION 262416

SECTION 262713 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Shop Drawings.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Coordinate with utility companies for services and components they furnish.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by Solar Decathlon officials.

B. Meter Sockets: Comply with requirements of electrical power utility company.

C. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

D. Modular Meter Center: Factory-coordinated assembly of a main service disconnect device, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below:

1. Comply with requirements of utility company for meter center.
2. Housing: NEMA 250, Type 3R enclosure.
3. Minimum Short-Circuit Rating: 22,000 A symmetrical at rated voltage.
4. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers
5. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and to house loadcenters and panelboards that have 10,000-A interrupting capacity.

    a. Identification: Provide legend identifying tenant's address.
    b. Physical Protection: Tamper resistant, with hasp for padlock.

6. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to NECA 400 switchboard installation requirements.

END OF SECTION 262713

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 DEVICES

A. Convenience Receptacles: NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498.

B. Duplex GFCI Convenience Receptacles: 125 V, 20 A, straight blade, [feed] [non-feed]-through type. NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

C. Duplex TVSS Convenience Receptacles: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.

D. Snap Switches: NEMA WD 1 and UL 20. Single-pole, double-throw, momentary contact, center-off switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

E. Wall-Box Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

1. Control: Continuously adjustable slider with single-pole or three-way switching to suit connections. Comply with UL 1472.
2. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

F. Combination TV and Telephone Outlet: Single RJ-45 jack for 100-ohm, balanced, 4-

pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

G. Wall Plates, Finished Areas: Satin-finish stainless steel,; fastened with metal screws having heads matching plate color.

H. Wall Plates, Unfinished Areas: Galvanized steel with metal screws.

I. Wall Plates, Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet locations.

J. Multi-outlet Assemblies: Components produced by a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles. Metal, with manufacturer's standard finish raceway with No. 12 AWG wire.

K. Finishes:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Install devices and assemblies plumb, level, and square with building lines.

C. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

D. Install unshared neutral conductors on line and load side of dimmers.

E. Mount devices flush, with long dimension vertical, and grounding terminal of receptacles on top unless otherwise indicated. Group adjacent devices under single, multigang wall plates.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 MOLDED-CASE CIRCUIT BREAKERS

A. Description: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with field-adjustable instantaneous trip settings.
3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
4. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
5. GFEP Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

B. Features and Accessories:

1. Lugs: Suitable for number, size, trip ratings, and conductor material.
2. Ground-Fault Protection: Comply with UL 1053; integrally mounted, type with ground-fault indicator; relay with adjustable pickup and time-delay settings, and push-to-test feature.

2.2 ENCLOSURES

A. NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Sections "Common work Results for Electrical."

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

END OF SECTION 262816

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data for each luminaire, including lamps.

B. Fixtures, Emergency Lighting Units, Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Coordinate ceiling-mounted luminaires with ceiling construction, mechanical work, and security and fire-prevention features mounted in ceiling space and on ceiling.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Exterior Luminaires: Comply with UL 1598 and listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

F. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2.2 BALLASTS

A. Ballasts for Linear Fluorescent Lamps:

1. Electronic: Comply with ANSI C82.11; instant-start type.

   a. Sound Rating: A, except B for T12/HO and T12/Slimline lamp ballasts.
   b. BF: 0.85 or higher.
   c. Power Factor: 0.95 or higher.

2. Electromagnetic: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
3. For Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.
4. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures [0 deg F (minus 18 deg C)] [minus 20 deg F (minus 29 deg C)] and higher.
5. Dimmer Controlled: Electronic type.

   a. Dimming Range: 100 to 5 percent of rated lamp lumens.
   b. Ballast Input Watts: Can be reduced to 20 percent of normal.
   c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

B. Ballasts for Compact Fluorescent Lamps: Electronic programmed rapid-start type, complying with ANSI C 82.11.

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. BF: 0.95 or higher unless otherwise indicated.
5. Power Factor: 0.95 or higher.

2.3 LAMPS

A. T5 Fluorescent Lamps: Rated 28 W maximum (specified in light fixture schedule), nominal length specified by light fixture, and average rated life of 20,000 hours unless otherwise indicated.

B. LED Wattage specified in light fixture schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units level, plumb, and square with ceiling and walls, and secure.

B. Suspended Lighting Fixture Support:

1. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
2. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

C. Adjust aimable lighting fixtures to provide required light intensities.

D. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's written instructions.

END OF SECTION 265000

27 Communications

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

PART 3 - EXECUTION

3.1 GENERAL COMMUNICATION EQUIPMENT INSTALLATION REQUIREMENTS

A. Install communication equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

B. Install communication equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.

C. Install communication equipment to allow right of way for piping and conduit installed at required slope.

D. Install communication equipment to ensure that connecting pathways and cables are clear of obstructions and of the working and access space of other equipment.

E. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

F. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Comply with requirements in Division 08 Section "Access Doors and Frames."

G. Install sleeve and sleeve seals of type and number required for sealing communication service penetrations of exterior walls.

3.2 SLEEVE AND SLEEVE-SEALS INSTALLATION

A. Cut sleeves to length for mounting flush with both wall surfaces.

B. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

C. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

D. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

E. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.3 FIRESTOPPING

A. Apply firestopping to communications penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07 Section "Penetration Firestopping."

END OF SECTION 270500

SECTION 271013 - STRUCTURED RESIDENTIAL CABLING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, system schematic, floor plans with cabling point labeling, and cabling color scheme.

B. Performance Requirements: Coordinate the features of materials and equipment so they form an integrated system complying with TIA/EIA-570-A. Match components and interconnections for optimum performance.

C. Comply with NFPA 70, "National Electrical Code."

D. Comply with TIA/EIA-570-A.

PART 2 - PRODUCTS

2.1 DISTRIBUTION DEVICE

A. Description: Equipment to support network, including signal amplification, cross connects, network hubs, and service terminations.

1. Auxiliary disconnect outlet and distribution device cords for television service.
2. Cross-connect devices, patch panels, cable termination devices, and accessories shall meet the data transmission speed and bandwidth of the associated cabling.
3. Comply with TIA/EIA-570-A, Grade 1 service standard.
4. Comply with TIA/EIA-570-A, Grade service standard noted on Drawings.

B. Television: Distribution device shall have space for satellite network lines, and distribute in-home generated video and radio-frequency sources.

1. Place outlet cabling in a star topology.
2. Provide space for installation of signal amplification and conditioning.
3. Distribute in-home generated video sources to same outlet as cable television service.
4. Accommodate the installation and connection of a cable gateway distribution device furnished by access provider.

C. Voice and Data: Ethernet-type data network in a star topology, supporting data transmission rates of at least 250 Mbps. Data network hub shall have capacity for outlets indicated on Drawings, plus two spares.

1. Cross Connect: Modular IDC-type, cross-connect device with modules designed for punch-down caps or tools.
2. Hub: 10/100 Base-T hub with modular RJ-45 jacks and 12-V dc power supply.
3. Fiber-Optic Data Cable Connector Field: Modular, cross-connect panels with duplex cable connectors. Factory-made patch cords, dual-fiber cable. Comply with TIA/EIA-570-A, Grade 2 service standard.

D. Speaker Cable: Cross-connect panel with number of speaker cables connected to distribution device, plus 25 percent.

E. Equipment Enclosure: Modular with equipment mounting rails to accept all specified components; 14-1/2 inches (368 mm) wide, suitable for mounting between studs.

1. Mounting: [Surface] [Flush] [Semiflush].
2. Door: Hinged, lockable.

F. Power Outlets: UL 1449; cabinet mounted, with [one] [two] 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacle(s), with surge protection, and including the following:

1. LED indicator lights for power and protection status.
2. Peak Single-Impulse Surge Current Rating: [33] [26] [13] kA per phase.

G. Incoming Telephone Line Surge Protection: UL 497; cabinet-mounted, dial-up line surge suppressor for each line.

1. Working Voltage: [200] <Insert value> V.
2. Maximum Clamping Voltage: [270] <Insert value> V.

H. Incoming Television Line Surge Protection: Cabinet-mounted, coaxial cable surge suppressor for each cable, 0.3-dB maximum insertion loss at 5 to 1000 MHz. Rated for maximum surge current of 5000 A.

2.2 CABLE

A. UTP Cable: Comply with TIA/EIA-568-B.2, Category 5e. 24 AWG, 100 ohms, 4 pair.

1. NFPA 70, Types CMG and CMP.

B. Combination Cables: Designed for home networking; may be used provided the requirements for single-cable types are met.

C. Speaker Cables: 2-conductor cable, No. 14 AWG, UTP, PVC jacketed, UL Type CL3. Use two different jacket colors and a consistent conductor color.

D. Security Device Cables: Multiconductor, No. [22] [18] AWG, UTP, with red PVC jacket, and complying with NFPA 70, Type CL2 and TIA/EIA-570-A-1 requirements.

E. Fire and Carbon Monoxide Warning Device Cables: Multiconductor, No. 18 AWG, twisted pair, with red PVC jacket, and complying with NFPA 70, Type FPL and TIA/EIA-570-A-1 requirements.2.3 RACEWAYS

A. Nonmetallic Flexible Raceway and Fittings: UL 2024. One-piece, plastic, dual-voltage, two-gang box and bracket, with molded-in nailing flanges.

2.4 WIRING DEVICES

A. Modular; each outlet configuration field fabricated from factory-made components. Listed and labeled as complying with TIA/EIA-568-B.2, TIA/EIA-B.3, and UL 1863.

B. Mount connectors on single or multigang faceplate.

1. Faceplates: High-impact plastic; colors as selected by Architect. Colors shall be white.
2. Outlet shall accept the following components:

   a. Telephone and Data Jacks: IDC connector for UTP, modular, RJ-45.
   b. MATV: Type F.
   c. Voice: RCA type.
   d. Security Camera: BNC.
   e. Speaker: Banana jack.

2.5 GROUNDING AND BONDING

A. Materials: Comply with NFPA 70 and UL 467.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and with applicable requirements in Division 27 Section "Common Work Results for Communications."

B. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with BICSI RNCM.

B. Install firestopping according to TIA/EIA-569-A.

C. Ground equipment complying with ANSI-J STD-607-A.

D. Cable Installation:

1. Install exposed cable parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
2. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
3. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
4. Secure and support cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from boxes, outlets, and terminals.
5. Install UTP cable using techniques, practices, and methods that are consistent with Category 5e rating of components and that ensure Category 5e performance of completed and linked signal paths, end to end.

    a. Do not untwist more than 1/2 inch (13 mm) of Categories 5e and 6 cable at connector terminations.

6. Install security device cable between the security system cabinet and the device as follows:

    a. Two-Conductor Cable: Magnetic switches at doors and windows,

    b. Four-Conductor Cable: PIR sensors and glass-break sensors; keypad locations.

7. Install fire and carbon monoxide warning device cable between the security system cabinet and the outlet as follows:

    a. Four-Conductor Cable: Smoke detectors, combination strobe/horn appliance.
    b. Four-Conductor Cable: Heat detectors, horns.

8. Protection against Physical Damage:

    a. Install cabling and nonmetallic raceways complying with NFPA 70, "Wiring Methods" Article. All cabling in this Section shall comply with provisions for nonmetallic-sheathed cabling listed in that article.
    b. Install insulated grommets or bushings when cable passes through openings in metal studs or enters boxes and cabinets.
    c. Installing cable in shallow grooves, as described in NFPA 70, "Wiring Methods" Article, is not permitted.

9. Outdoor Coaxial Cable:

    a. Outdoor connections shall be installed in enclosures complying with NEMA 250, Type 4X. Connectors shall be corrosion resistant with

properly designed O-rings to keep out moisture.

b. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

E. Wiring within Distribution Device:

1. Group cable-connecting hardware into separate logical fields.
2. Train conductors to terminal points with no excess.
3. Use lacing bars to restrain cable, to prevent straining connections, and to prevent bending cable to smaller radii than minimums recommended by manufacturer.

F. Separation from EMI Sources:

1. Comply with TIA/EIA-570-A for separating telecommunication cabling from potential EMI sources, including electrical power lines and equipment. Comply with the following minimum separation distances from possible sources of EMI:

   a. Power Lines or Electrical Equipment near Open Cabling or Cabling in Nonmetallic Raceways: 2 inches (50 mm).
   b. Electrical Motors and Transformers, 5 kVA or HP and Larger: 48 inches (1220 mm).
   c. Fluorescent Fixtures: 5 inches (125 mm).

2. Maintain electrical branch circuit conductors (line, neutral, and grounding wires) together by sheathing or bundling to minimize inductive coupling. 2 inches (50 mm) may be reduced if cabling crosses at right angles.
3. Install cabling in grounded metallic raceways where the required separation is not practical.

3.2 IDENTIFICATION

A. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Within Connector Fields in Distribution Devices: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

B. Cable Schedule: Post in distribution device. List incoming and outgoing cables and their designations, origins, and destinations. Furnish an electronic copy of final comprehensive schedules for Project.

END OF SECTION 271013

28 Electronic Safety and Security

SECTION 283100 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. System Description: Noncoded, conventional, hardwired, zoned, 24-V dc loop system.

1. Initiating Device Circuits: NFPA 72, Class B, Style B.
2. Notification Appliance Circuits: NFPA 72, Class B, Style Y.

B. Submittals: Product Data and system operating description.

C. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals, make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations.

D. Comply with NFPA 72.

E. UL listed and labeled.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 FACP

A. General: Modular, power-limited design with electronic modules, UL 864 listed.

B. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.

C. Secondary Power: 24-V dc supply system with sealed lead calcium batteries and automatic battery charger and an automatic transfer switch.

2.2 ALARM-INITIATING DEVICES

A. Smoke Detectors: Kidde - Smoke Alarm, Ionization, Exit Light, Battery Back Up Kidde

Ionization Smoke Alarms can be operated as a single station unit or interconnected with up to 24 Kidde devices on one wiring system. 1285E

http://www.n-hawk.com/cgi-bin/n-hawk/scan/fi=products/st=db/co=1/sf=sku/se=KID1285E/op=eq/nu=0/ml=50/tf=sku/to=x/sp=results_item

2.3 NOTIFICATION APPLIANCES

A. Low-Level Chimes: Vibrating type with 75 dBA.

2.4 WIRE AND CABLE

A. General: UL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and test systems according to NFPA 72. Comply with NECA 1.

B. Wiring Method: Install wiring in metal raceways. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

END OF SECTION 283100

32 Exterior Improvements

SECTION 328400 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Design 100 percent water-coverage irrigation system for exterior plants indicated.

B. Minimum System Pressure Rating: 150 psig (1035 kPa).

C. Submittals: Product Data and Shop Drawings showing sprinkler layout and flow characteristics. Include wiring diagrams.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Pipe Materials: PE, ASTM F 771; PE 3408 compound; SIDR 15.

1. Insert Fittings: ASTM D 2609, nylon or propylene plastic.

B. Pipe Materials: PVC pipe, ASTM D 2241, PVC 1120, SDR 26.

1. Fittings: PVC plastic pipe fittings, ASTM D 2467, Schedule 80, socket type with ASTM F 656 primer and ASTM D 2564 solvent cement.

C. Curb Valves: Bronze body, ground-key plug or ball with wide tee head.

1. Curb-Valve Casing: Similar to AWWA M44 for cast-iron valve casings.

D. Plastic Ball Valves: MSS SP-122, PVC.

E. Bronze Gate Valves: Solid wedge; nonrising bronze stem; Class 125 bronze body and screw-in bonnet and malleable-iron, bronze, or aluminum handwheel.

F. Manual Control Valves: Globe valves.

G. Automatic Control Valves: Bronze or plastic diaphragm-type, normally closed, with manual flow adjustment, and operated by 24-V ac solenoid.

H. Automatic Drain Valves: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig (17 to 20 kPa).

I. Antisiphon, Pressure-Type Vacuum Breakers: Spring-loaded check valve.

J. Pressure Regulators: Single-seated, direct-operated type with integral Y-pattern strainer.

K. Quick-Couplers: Two-piece assembly, with coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

L. Sprinklers: Plastic housing; flush, surface, fixed pattern, with screw-type flow adjustment.

M. Bubblers: Fixed pattern, with screw-type flow adjustment.

1. Shrubbery: Fixed pattern, with screw-type flow adjustment.
2. Pop-up, Spray: Fixed pattern, with screw-type flow adjustment and stainless-steel spring.
3. Pop-up, Rotary Spray: Gear drive, full-circle and adjustable part-circle type.
4. Pop-up, Rotary Impact: Impact drive, full circle and part circle as indicated.
5. Aboveground, Rotary Impact: Impact drive, full circle and part circle as indicated.

N. Emitters: Plastic body with single outlet, to deliver flow at approximately 20 psig (138 kPa) at a flow rate indicated on the planting schedule.

O. Drip Tubes: Flexible PVC, NPS 1/2 (DN 15)

P. Automatic Control System: Low-voltage system, made for control of irrigation-system automatic control valves. Controller operates on 120-V ac; provides 24-V ac power to control valves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Lay piping on solid subbase, uniformly sloped without humps or depressions. Slope circuit piping down toward drain valve a minimum of 0.4 percent.

C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone to 12 inches (300 mm) below grade. Cover with asphalt-saturated felt and excavated material.

D. Minimum Cover: Provide the following minimum cover over top of buried piping:

1. Pressure Piping: 36 or18 inches (915 or 460 mm) below frost depth, whichever is greater.
2. Circuit Piping: 12 inches (300 mm).
3. Drain Piping: 12 inches (300 mm).
4. Sleeves: 24 inches (600 mm).

E. Install water meters in meter boxes with shutoff valve on meter inlet. Include valve on meter outlet and valved bypass around meter.

F. Install pressure regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet and valved bypass.

G. Sprinklers: Flush circuit piping with full head of water and install sprinklers after hydrostatic test is completed.

END OF SECTION 328400

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and product certificates.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

PART 2 - PRODUCTS

2.1 PLANTING MATERIALS

A. Tree and Shrub Material: Nursery grown, with healthy root systems, well shaped, fully branched, healthy, and free of insects, eggs, larvae, defects, and disfigurement.

B. Ground Covers and Plants: Established and well rooted in pots or similar containers.

2.2 SOIL AND AMENDMENTS

A. Topsoil: ASTM D 5268, with pH range of 5.5 to 7, free of stones 1 inch (25 mm) or larger and other extraneous materials harmful to plant growth.

B. Lime: ASTM C 602, Class T, agricultural limestone.

C. Compost: Well-composted, stable, and weed-free organic matter; pH range of 5.5 to 8.

D. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

E. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

F. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 10 percent phosphoric acid.

G. Commercial Fertilizer: Commercial-grade complete fertilizer, consisting of 1 lb/1000 sq. ft. (0.5 kg/100 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

H. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium; 5 percent nitrogen; 10 percent phosphorous; 5 percent potassium; by weight.

I. Mineral Mulch: Granite chips.

1. Size Range: 3/4 inch (19 mm) maximum, 1/4 inch (6 mm) minimum.
2. Color: Readily available natural gravel color range.

J. Weed-Control Barrier: Polypropylene or polyester nonwoven fabric.

2.3 MISCELLANEOUS

A. Edgings: Uncoated Mild steel not less than 4 inches (102 mm) deep, with accessories and stakes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Planting Bed Establishment: Loosen subgrade to a depth of 8 inches (200 mm)] Remove stones sticks, roots, and rubbish. Spread planting soil mixture to a depth of 8 inches (200 mm), but not less than required to meet finish grades. Work first layer into top of loosened subgrade.

B. Trees and Shrubs: Excavate pits with sides sloped inward and with bottom of excavation slightly raised at center to assist drainage. Excavate approximately three times as wide as ball diameter. Scarify sides of plant pit smeared or smoothed during excavation.

1. Set trees and shrubs plumb and in center of pit with top of ball flush with adjacent finish grades.
2. Remove burlap and wire baskets from tops of balls and partially from sides, but do not remove from under balls. Carefully remove root balls from containers without damaging root ball or plant. Do not use planting stock if ball is cracked or broken before or during planting operation.
3. Place planting soil mix around ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Water again after placing and tamping final layer of planting soil mix.
4. Prune, thin, and shape trees and shrubs after planting.

C. Plant ground cover and plants 12 inches (300 mm) apart. Dig holes large enough to allow root spread. Plant stock working soil around roots and leave a slight saucer around plants to hold water. Water after planting. Do not cover plant crowns with wet soil.

D. Mulching: Before mulching, install weed-control barriers. Apply organic mulch, 3 inches (75 mm) thick, and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

E. Edgings: Install edgings and anchor with stakes driven below top elevation of edging.

F. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, adjusting and repairing, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

G. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.

END OF SECTION 329300

41 – MATERIAL PROCESS AND HANDLING

SECTION 412200 – CRANES AND HOISTS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: **Product Data**

B. Comply with UL 1703

C. Cane and operator to be contracted in Washington DC for the competition

PART 2 - PRODUCTS

2.01 PRODUCT NAME

A. 120 Ton Truck Crane provided by Crane and rigging company, contracted in Washington, DC.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Operate according to manufacturer recommendations

B. Verify that load limits for crane shall not be exceeded.

END OF SECTION 412200

SECTION 416516 – MOBILE GENERATORS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: **Product Data**

B. Comply with Solar Decathlon Rules

PART 2 - PRODUCTS

2.01 PRODUCT NAME

A. AC DELCO 6500 Watt Generator, Electric Start

http://www.hardwarestore.com/media/pdf-misc/116454.pdf

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide necessary spill containment measures to comply with Solar Decathlon Rules

B. Operate only to manufacturers recommended specifications

END OF SECTION 416516

48 Electrical Power Generation

SECTION 481413 – SOLAR ENERGY COLLECTORS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data, Flash data for individual module performance

B. Comply with UL 1703

C. Verify dimensions by field measurements before fabrication and indicate on Shop Drawings.

D. Warranties: Provide standard manufacturer's written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace products that fail in materials or workmanship for the period of 2 years.

PART 2 - PRODUCTS

2.01 PRODUCT NAME

A. Sanyo HIT double 195 DA3

http://us.sanyo.com/Dynamic/customPages/docs/solarPower_HIT_Double_Installation_Manual_DA3_010109.pdf

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation by qualified photovoltaic installer per manufacturer directions.

B. Field verify location of all structure

C. Coordinate string sizing with Construction Documents

D. Confirm compatibility of string sizing with photovoltaic panels and inverters.

END OF SECTION 481413

SECTION 481916 – ELECTRICAL POWER GENERATION INVERTERS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: **Product Data**

B. Comply with UL 1703

PART 2 - PRODUCTS

2.01 PRODUCT NAME

A. Fronius IG Plus 3.0

http://www.fronius.com/cps/rde/xchg/SID-62BAA6CB-83B7169B/fronius_usa/hs.xsl/2714_1454.htm

B. Fronius IG Plus 7.5

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation by qualified photovoltaic installer per manufacturer Instruction.

B. Coordinate string sizing and Inverter configuration with Construction Documents

C. Confirm compatibility of string sizing with photovoltaic panels and inverters.

END OF SECTION 481916

STRUCTURAL CALCULATIONS

Stamped structural calculations bearing a “Wet Signature” are to be received from BuroHappold Engineering in hard copy (per event rules) in a separate document to event organizers.

DETAILED WATER BUDGET

See sheet P-102 of the Construction Documents for location of water tanks
See Sheet P-601 for schedules of water tank sizes

						Tank Designation				
						D-1	**T-1**	**G-1**	**L-1**	**W-1**
Contest 7	Hot Water	15	Ga	20	300	300				*300*
Contest 8-3	Clothes Washer	10	Ga	10	100	100		*100*		
Contest 8-5	Dishwasher	5	Ga	5	25	25				*25*
Contest 9-1	Cooking	1	Ga	4	4	4		*4*		
Contest 9-3	Cooking	10	Ga	2	20	20				*20*
	Trombe Wall	50	Ga	8	400		400*			
	Greenhouse	20	Ga	1	20			20*		
	Landscape	100	Ga	1	100				100	
Tank Supply Requirement					719	**449**	**400**	**20**	**100**	
Tank Removal Requirement							***400***	***104***	***100***	***345***
Total Supply Requirement						**969**				
Total Removal Requirement						**969**				
						Black indicates Supply requirement *Red Italics* indicate Waste Requirement * indicates a closed loop system				

SUMMARY OF UNLISTED ELECTRICAL COMPONENTS

All electrical components used in the design of the UA Solar Decathlon Team house shall carry an approved agency's listing per Section 6.7 of the Solar Decathlon Building Code.

RETAIL PV PRICE QUOTE

The following pricing was a web based quote from http://www.greenboxusa.com
Pricing reflects (46) Sanyo 195 HIT Double Solar Modules of the same specification used in the UA Solar Decathlon Team Design.

Assuming each panel produces 195W at $1053.89 per module the Price per Watt comes to $5.40

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Please review your address data and the product totals with additional charges

Bill To

First Name:	Matt	Street:	1040 N. Olive Rd
Last Name:	Gindlesparger	City:	Tucson
Company Name:	University of Arizona Solar Deca	Country:	United States
Email Address:	mgindle@email.arizona.edu	State:	Arizona
Tax Exempt:		ZIP Code:	85721
		Telephone:	5204441476

Edit Bill To Address

Product ID	Product Name	SKU/EAN	Quantity	Unit Price	Amount	TAX
951	Sanyo 195 HIT Double Solar Module	HIT195DOUBLE	46	$1,053.89	$48,478.94	0.00 %

Subtotal $48,478.94

Total $48,478.94

Back Continue

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https://www.greenboxusa.com/Default.aspx?tabid=679&cartpageno=4 Page 1 of 1

SUMMARY OF RECONFIGURABLE FEATURES

Reconfigurable features in the UASTD SEED[pod] include the following:

- Retractable shading devices in the south wall assembly (does not change the architectural footprint)
- Alternate Dining configuration for dining competition (expanding, rolling, dining table)
- Operable windows
- Operable window vents for natural ventilation

INTERCONNECTION APPLICATION FORM

Solar Decathlon 2009
Interconnection Application Form

University of Arizona Solar Solar Decathlon Team

Lot #104

PV SYSTEMS

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
Sanyo HIT Double195 DA3	(46) Modules in the following string configuration: (6) strings of (6) modules (2) strings of (5) modules	195w X 46 modules = 8.97Kw

Total DC power of all arrays is **8.97kW**

INVTERTERS

Inverter Manufacturer	Model Number	Voltage	Rating (kVA or kW)	Quantity
Fronius	IG Plus 3.0-1 uni	208V / 240V / 277V	2344 kVA	1
Fronius	IG Plus 7.5-1 uni	208V / 240V / 277V	7031 kVA	1

Total AC power of all inverters is **9375kVA**

- See sheet E-601 of the Construction Documents for One-line electrical schematic
- See sheet E-602 for service/feeder net computed load and neutral load (NEC 220) calculations
- See sheet E-101 for electrical site information including service point.

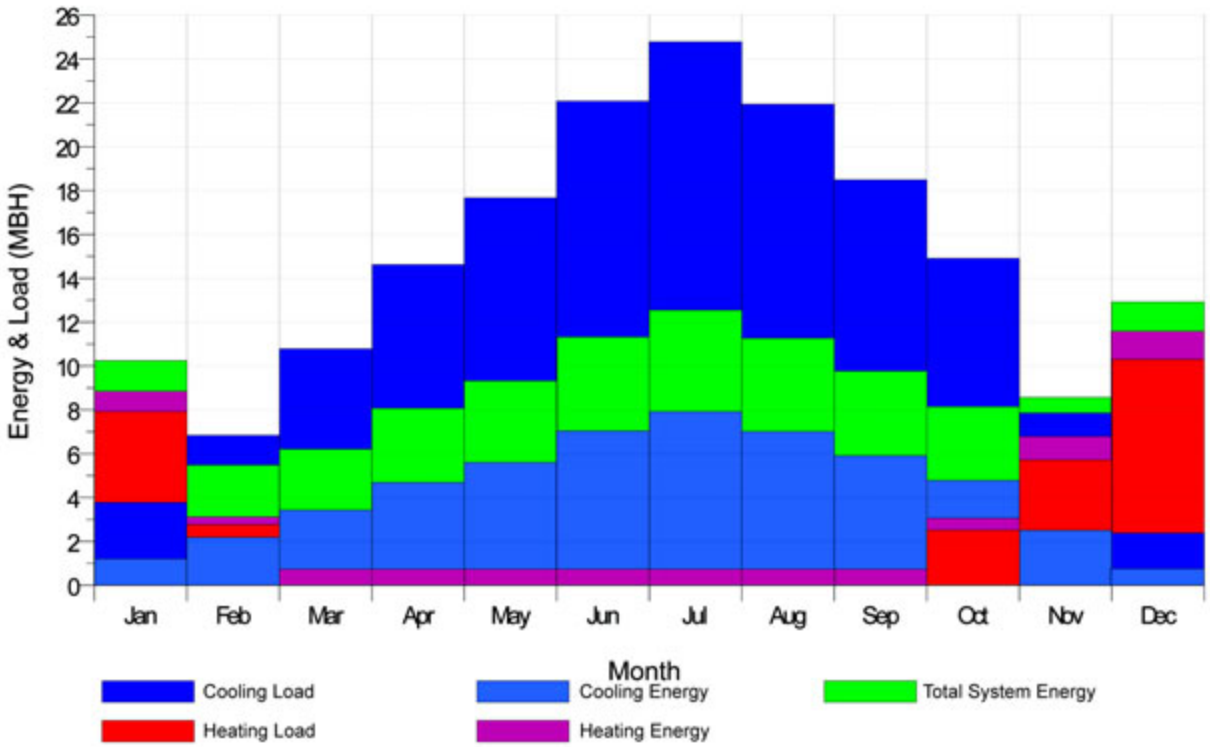
See sheet E-201 for terminal box elevation, meter, distribution panel, load center and service equipment.

ENERGY ANALYSIS RESULTS AND DISCUSSION

The computer generated energy model was accomplished in partnership with the engineers at Burrow Happold in Los Angeles, CA. The analytical process was iterative and directly affected key decisions regarding the design of the mechanical systems and the envelope materials used.

The process began by creating two energy models, one being the benchmark or reference case and the other being the proposed design with its initial assumptions. The benchmark represents a home of similar size and proportion comparative to the proposed design; however, the benchmark is modeled representing commonplace, standard materials and constructions. Comparative to the benchmark, the initial design model reflect the use of integrated double side solar panels, a double skin roof and south facade with translucent materials, large windows on the North facade, windows on both the East and West, and no shading. The results showed that the initial design performed about 22% worse in both heating and cooling compared to the benchmark. The results also showed that the interior luminance levels of the initial design far exceeded standards and comfort.

The results from modeling the initial design led to the addition of a trombe wall ventilation system and thermal mass on the south facade to help mitigate both heat gain and loss from southern sun exposure and internal habitation. Along with the refinement of the envelope, the proposed HVAC system responded to the air conditioning demands as an unconventional, complex network individual parts working together to achieve optimum performance with high energy efficiency. Subsequent design considerations led to the addition of more performative envelope materials and constructions, which when modeled, produced more favorable performance results. This allowed the once complex mechanical system to be refined to a more compact, conventional approach that responded to both the spatial and economic concerns in the developing design.



HEALTH AND SAFETY PLAN

University of Arizona Solar Decathlon Team

Health and Safety Officer: Matthew Williams
Faculty Advisor: Matt Gindlesparger

Approved: 10/06/2008
Revision: 05/13/2009

Matt Gindlesparger

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1. Statement of Policy

The 2008 University of Arizona Solar Decathlon Team (UASDT) shall at all times maintain a safe and healthful work by identifying and controlling any and all potential safety hazards throughout the process of preparation for and participation in the 2008 Solar Decathlon Event.

The UASDT team shall comply with the Code of Federal Regulations, Title 29, Part 1910, *General Industry Safety and Health Standards* and PRT 1926, *Safety and Health Standards for the Construction Industry*, and all other applicable codes and standards.

This safety plan shall apply to everyone working on or with the UASDT both during the preparation for and participation in the Event.

The rights and responsibilities of all those working on or with the UASDT during the Event shall be posted with an OSHA poster or equivalent. All participants are entitled to a safe and healthful working environment in accordance with the work site Occupational Safety and Health Administration (OSHA) poster.

2. Assignment of OSH Responsibility

Dale Clifford shall be the designated Safety Manager and is responsible for the safety and health of all on-site OSH-related activities. Administration and compliance is delegated to all appropriate construction managers, team leaders, and designated team safety officers.

All team members have the authority and responsibility to question OSH-related activities and shut down work with a "Stop Work" order. Work shall not continue until a resolution is met between all appropriate officials and the issuer of the stop work order.

3. Emergency Procedures

In the event of an incident with injuries, and all other types of emergencies, the following procedures shall be followed:

- All work shall immediately stop and the scene shall be secured to prevent further injuries.
- Emergency response shall be contacted via calling 911 or the UA campus police at 520.621.8273 should the accident occur on campus.
- First aid, if needed, shall be provided at a level proportionate to the training of the responder.
- Team members are to remain present until a public safety officer takes charge of the scene.
- The Solar Decathlon Headquarters, Organizers, or Event Staff shall be called and notified.
- The UASDT Emergency Contact List shall be consulted and the pertinent contacts notified.

The UASDT team shall at all times have access to an on-site, university or event-provided list of local clinics and hospitals.

All medical and emergency contact information for each UASDT member shall at all times be present on the construction site.

First Aid supplies shall at all times be present at the constructions site. First Aid shall only be performed by trained individuals.

Fire and rescue procedures shall follow those outlined in the Fire Life-Safety Plan.

4. Accidents

Through proper planning and administration, all efforts shall be made to minimize the occurrence of accidents. In the event of an accident, work shall immediately stop and the pertinent safety procedures, as listed above, shall be followed. An incident report form, which is to be provided by the Event organizers, shall be completed, reviewed, and submitted for official review and investigation. Work shall resume only after an investigation has taken place and corrective measures are taken to prevent reoccurrence.

5. Hazard Analysis

It is the responsibility of the entire team to perceive and anticipate all possible safety hazards. Team members should take time throughout each day to assess and anticipate possible safety hazards that come along with work activities. As necessary, the site shall be re-organized to respond to perceived safety hazards. Hazards shall be immediately reported to on site team leaders and the Safety Manager so that the severity can be established and preventative measures taken.

Potential hazards associated with the project include but are not limited to:

- Power tool usage
- Material handling
- Tripping and falling hazards
- Electrical hazards including shocks and electrocution
- Ladder usage
- Fatigue and dehydration
- Vehicular hazards
- Improper use or implementation of personal safety equipment

6. OSH Requirements and Procedures

Access Control, Signs, and Barricades

- A rope barrier shall be provided around the UASDT designated site.
- All UASDT participants shall be required to wear nametags or other identification allowing recognition of those not affiliated with the UASDT. All individuals not involved with the UASDT team shall be instructed to remain outside the designated boundary to ensure their safety during construction.

Accident Reporting

- Refer to section 4 of this document titled “Accidents”

Alcohol and Drugs

- There will be no alcohol or drugs permitted on or near the construction site.

Compressed Air Equipment

- All compressed air equipment is used during setup and shall be operated and maintained in accordance with the provided owner’s manual.

Cranes and Rigging

- Cranes and riggers will be used for assembly and transportation of the individual house components. All crane and rigging procedures shall be completed by either licensed operators, riggers, or by apprentice operators and riggers under the supervision of their instructors.
- All hoists and cranes shall be inspected prior to use.
- No one is allowed under a suspended load at any time under any circumstance.
- All rigging equipment shall be marked with its load rating for its approved configurations.
- All on site rigging shall be confirmed as rated to within the capacity of the load to be lifted by the UASDT Safety Officer.
- All rigging shall be inspected prior to its use.
- All sharp edges shall be padded to protect both the rigging and the load.

- Care shall be taken not to shock load the rigging, cranes or hoists.
- Know where your loads center of gravity is located and ensure loads are balance prior to lifting and moving.
- Follow the lift plan depicted within the construction drawings.
- Use tag lines to help guide the load
- A designated signal person shall be in place during all rigging and lifting operations.

Electrical Systems and Equipment

- All electrical work will be completed by licensed electricians or electrical apprentices under the direction of their instructors.
- Electrical safe work practices must comply with NFPA 70E, Standard for Electrical Safety in the Workplace.
- Lockout/Tagout (LOTO) procedures shall be followed at all times in accordance with the University of Arizona's Energy Control Plan or Lockout/Tagout Program

Emergency Response, First Aid, and Medical Services

- The steps outlined in section 3 of this document, Emergency Procedures, shall be followed in the event of an emergency.
- The site shall be equipped with a first aid kit.
- The site shall at all times have a binder including information pertaining to all participants' emergency contacts and other pertinent medical information such as allergies.

Fall Protection

- Whenever UASDT members are engaged in construction/maintenance activities and are exposed to a potential fall of 6 feet or greater from an unprotected side or edge, the OSHA Fall Protection Standard for Construction applies (29 CFR 1926.501). The UASDT shall provide personal fall arrest system to protect the team member from a fall. Examples of common work tasks requiring fall protection equipment include but are not limited to: roofing, installation and maintenance of PV panels, and installation and maintenance of evacuated cylinders.

Fire Prevention and Response

- The house shall be equipped with a fire extinguisher located within the kitchen area.
- In the event of a fire, all UASDT members shall be responsible for following the procedures outlined within the Fire-Life Safety Plan.

General Rules and Regulations

- The UASDT shall comply with all general rules and regulations outlined by the Solar Decathlon Event Organizers.
- Horseplay, practical jokes, scuffling, and other acts which tend to endanger the safety of others are strictly prohibited
- UASDT members must behave in a safe manner at all times.

Hand and Power Tools

- All hand and power tools shall be organized and stored on site in locked tool chests or a closed utility trailer.
- Laboratory Coordinators and Shop Monitors will be responsible for the check-out and check-in of all hand and power tools
- All students will be instructed on the proper use of hand and power tools.
- Each tool shall be inspected prior to use to ensure all safety guards and features are in place and functioning properly.
- Hand and power tools are ONLY to be used for their intended purpose.
- All instruction and safety manuals are to be maintained on site in the tool room file cabinet.
- All power tools are to be shall be GFCI protected at the outlet or by pigtail.

Hazard Communication

- The UASDT shall comply to the University of Arizona's Hazard Communication Program. It provides guidance for reducing chemically-related illnesses and injuries at work and achieving compliance with OSHA's Hazard Communication standard.

- The UASDT must identify and list the hazardous chemicals relating to the project during construction as well as assembly and disassembly on site.
- Members of the UASDT must ensure that all containers of hazardous chemicals are labeled and that MSDS's are obtained for each chemical/
- MSDS's shall be kept on site in the tool room file cabinet.

Hazardous Waste

- Hazardous waste is not expected to be produced throughout the project
- In the event that disposal of hazardous substance is necessary, it will be disposed of in the manor stated in the coinciding material safety data sheet for that material.

Hearing Conservation

- Hearing protection shall be made available at all times to all UASDT participants including but not limited, students, staff, volunteers and visitors.
- Anytime power tools are in use, the operator shall use hearing protection.
- All on-site participants are expected to use the proper hearing protection when a recognizable need is present.
- A list of power tools which generate above average noise levels and thus necessitate extra caution include but are not limited to:
    - Grinders
    - Saws
    - Routers

Housekeeping

- Trash and recycling bins will be provided on-site by the UASDT.
- Housekeeping shall take place at the conclusion of each day or after smaller, individual tasks.

Ladders and Scaffolds

- Ladders and scaffolding will be required on-site.
- Erection and use of ladders shall be consistent with OSHA criteria
- Ladders are set up at a 75 degree angle to the ground and extended three feet above the top the area which we are trying to reach. This is for better stability and also to enable easy access on and off the ladder. The ladder is placed on level ground for better stability. If level ground is not present the ground is either leveled or the ladder is moved to where there is level ground.
- When using scaffolding we check to make sure it corresponds to ANSI A10.8, Safety Requirements for Scaffolding. The scaffolding is then placed on level ground and embedded into the ground or the wheels are locked.
- If the scaffolding is of the rolling variety it maintains a 4:1 height to base ratio.
- Guardrails shall be placed on all open sides of the scaffolding to prevent falls.
- If necessary, a PFAS shall be used in conjunction with ladders or scaffolding.
- All participants shall be instructed on the proper and safe use of ladders and scaffolds.
- Ladders and scaffolds shall be inspected daily for signs of damage or wear which would necessitate repair or replacement.

Lifting

- All participants shall be instructed on the proper and safe techniques of lifting.
- When necessary, ergonomic safety equipment shall be provided and utilized.

Material Handling

- At times, a third party will be contracted to facilitate the rigging and lifting operations of the assembly and disassembly sequences.
- The UASTD will be utilizing a fork truck for certain operations. The fork truck shall only by operated by a licensed operator.
- During fork truck operation, team members must maintain a safe working distance.

Motor Vehicle Operations

- Only properly licensed UASDT members shall operate any motor vehicle associated with the UASDT.

Personal Protective Equipment (PPE)

- A minimum level of PPE for all construction, assembly, and disassembly activities is safety glasses with side shields, hardhat, safety boots, long pants and shirt with minimum 3" sleeves. This minimum level of PPE shall be worn at ALL times by UASDT participants throughout the construction phase as well as during the event. Other Personal Protective Equipment (PPE) may be required to enter the construction site.
- Proper PPE shall be used at all times and shall include but not limited to hard hats, gloves, safety goggles, dust masks, and any other tool specific safety equipment.
- Some examples of tool specific PPE shall include but be limited to:
    - Face shields for grinding operations
    - Welding helmet with appropriate shading for type of welding performed and leathers for welding operations
    - Respirator and gloves for use with chemicals.
- All participants shall be train in the proper use of PPE.
- All participants shall be responsible for determining when additional PPE is required.

Hot Work Activities

- Hot work activities are expected throughout the duration of construction.
- Hot work activities shall include but are not limited to welding, plasma cutting, grinding, cutting (metal), or any other activity where a spark, flame, or intense heat are present.
- All welding and cutting shall be done prior to the Event and preformed by properly trained students or other individuals associated with the UASDT.
- A Hot Work Permit shall be obtained from the University of Arizona Risk Management and Safety Department and shall be displayed on the office wall of the shops
- Fire extinguishers are located throughout the shop and one is located directly adjacent to the welding cabinet.
- All combustible materials shall be removed or protected within 35 feet of the work area
- Fire watch shall be maintained for 30 minutes after the completion of work

7. Training

- Key members and crew leaders of the UASDT shall receive construction safety training provided by the University of Arizona Risk Management and Safety department
- All participants shall receive a mandatory site orientation/training seminar prior to the start of work. The seminar shall include; general shop orientation and training, overview of the UASDT Health and Safety Plan, location of first aid kits, as well as training and administration of PPE.
- In order to participate in the construction phases of the Event, all students shall be trained in the proper and safe techniques pertaining to all hand and power tools used in the construction of the UASDT competition house.
- Specific training shall be administered in areas of particular concern including but not limited to: Ladders and scaffolding, welding.

8. Work Site Inspections

Work site inspections will be carried out daily. Any deficiencies perceived shall be immediately corrected in accordance with the Event rules and regulations as well as OSH regulations and procedures. If any member of the UASDT perceives an imminent danger, they are expected to issue a “Stop Work” order, and work is not to continue until the necessary corrective measures are in place to remove the threat.

FIRE-LIFE SAFETY PLAN

University of Arizona Solar Decathlon Team

Principle Author: Matthew Williams
Faculty Advisor: Matt Gindlesparger

Approved: 10/06/2008

Matt Gindlesparger

1. Introduction

The purpose of the Fire-Life Safety Plan is to ensure the safety of the UASD team, Judges, Jurors, Organizers, and visitors in the event of a fire emergency. Throughout the course of continued development, construction, and participation in the Solar Decathlon, the information contained within this plan shall be updated to reflect any changes made.

2. Evacuation Routes

Primary Interior Evacuation Routes
-The primary evacuation route shall be through the main entrance along the east wall of the competition house, exiting out onto the deck and then main entry ramp along the north facade.
-The secondary evacuation route shall be through the bedroom exiting out onto the main exit ramp along the south facade.

Accessibility of Routes
-All evacuation routes shall have a minimum clearance width of 32" and ADA accessible threshold heights less than 1/2".
-All evacuation routes and exit doors shall have adequate height clearances.
-All areas within the house are within 20' from a point of egress.
-The distribution of exits along both the east and west walls shall prohibit the bottlenecking of exit paths.

Controlling Occupant Capacity
Occupant capacity shall be monitored by the UASD tour guides. The maximum number of occupants in the house shall be limited to 30 persons.

3. Possible Hazards

Fire and Smoke Sources
-All sources of fire and smoke shall be rated below the flame-spread index of 200 and a smoke development below 450 to maintain compliance with the Solar Decathlon Building Code.

Tripping Hazards
-Tripping hazards exist at the main entry and exit sliding doors. The sliding doors shall have a sill height less than 1/2" above the finished floor.
-There shall be no other tripping hazards, such as cords and boxes, placed along the intended tour path or areas intended for public access.
Protrusions Affecting the Blind
-The UASD competition house shall be compliant with protrusions affecting the blind, per IBC Section 1003.3, and all evacuation routes shall have adequate clearance above and below height restrictions.

Other Hazards
-The UASD competition house will include a moveable wall feature separating the bedroom from the other living spaces. The moveable wall shall be fitted with a break mechanism and posted with signage asking the public to not lean on or push so as to prevent any unwanted accidental motion.
-The induction cooktop and other appliances within the kitchen will have the possibility of being accidentally turned on during the public tours. The counters shall be posted with a sign asking the public not to tamper with any controls so as to prevent any unwanted use and accidents.

4. Evacuation Plan

Scene Control
-All tour guides and other UASD team members shall at all times be alert to the presence of fire and other emergencies.
-In the event of an emergency within the UASD competition house, the following procedure is to be followed.

1. If the presence of smoke or fire is detected, the tour guides and/or other UASD team members shall immediately evacuate by helping the public follow the proper evacuation routes and exits and direct them to the designated staging areas as outlined in the evacuation plans.
2. At the staging area, the Project Manager and tour guides shall account for all other team members and visitors who were in the house or on its grounds during the occurrence of the emergency.
3. A visual and audible check must be completed of the house and evacuated grounds before any rescue or medical duties are performed by trained individuals.
4. After the full evacuation is completed, the Firewatch Captain or designee shall immediately inform the pertinent NREL and DOE official on the National Mall are alerted to and informed about the situation, and that appropriate actions are taken.
5. Only after the house and its surrounding areas are evacuated, the designated Firewatch Captain and/or designee shall attempt to extinguish the fire.
6. If attempts to extinguish the fire fail, the Firewach Captain and/or designee shall immediately evacuate and work to keep the public clear of the area.
7. If the fire becomes excessively large, the Firewatch Captain or designee shall inform the neighboring sites to the incident and to clear their sites as well.
8. An assessment of damages shall be made after the situation has ended in order to determine the next course of corrective action. NREL and DOE officials shall be included to offer direction and support to the UASD team.

5. Fire-Life Safety Training

All UASD team members that will be on site during any portion of the Solar Decathlon Event shall participate in a fire safety and response training session prior to arrival on the National Mall. During this training run by the Firewatch Captain, the evacuation routes and procedures shall be reviewed and scenarios practiced for full team understanding.

Some UASD team members shall participate in certified CPR and First Aid training programs for certification prior to arriving at the competition site. These persons shall carry their certification at all times, and be readily identifiable should an emergency occur.

At all times, the emergency procedures outlined in the UASD Safety Plan shall be followed by all team members and visitors.

SUBJECTIVE CONTEST SUPPORT DOCUMENT

Architectural Design Narrative

SEED [pod] Solar Energy Efficient Dwelling

The housing boom that recently took place in the American Southwest has been short sighted, profit-driven and has largely disregarded the sensitive desert ecosystem. In general, we as architects, designers, developers and policy makers have only begun to address the implications of current energy consumption in the building sector, the largest contributor to CO_2 emissions. Across the country there has been significant encroachment upon natural areas with the proliferation of cookie cutter "homes" that are marketed as energy efficient. The building method employs high insulation factors, coupled with tight construction (low air infiltration) and windows with accidental views. The final effect is a relatively low-cost home that dissociates the inhabitant from the environment; in effect the inhabitant is living in a hermetically sealed container–not unlike living in a "thermos."

In response, our research group has undertaken the design of a net-zero home, a home that situates the inhabitant in harmony with the environment and draws all of its required energy from the sun. Once sitedin Tucson, the modular components of the home will be reconfigured to engage the landscape and take advantage of microclimatic conditions of the Sonoran Desert.

Climatic Conditions and Design Strategy

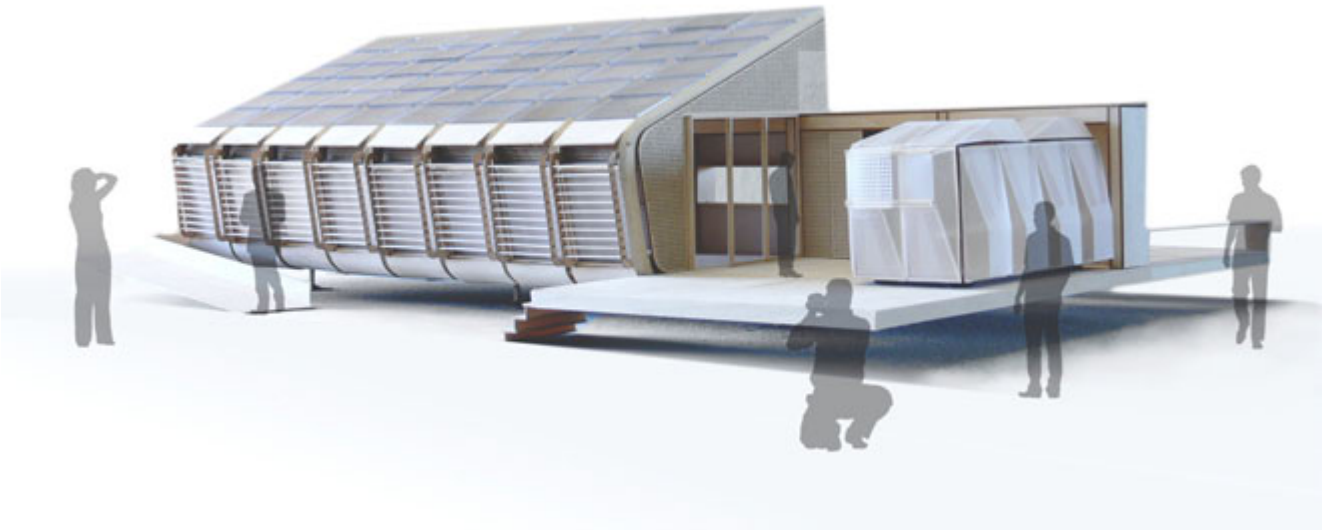
Tucson, Arizona, is located in the Sonoran Desert at LATITUDE: 32 Deg. 07 Min. N LONGITUDE: 110 Deg. 56 Min. W at an elevation of 2584' above sea level. The arid Sonoran Desert, with limited cloud cover, has a climate characterized by a year-round average diurnal temperature swing of 26°F. This large temperature swing creates continuously changing microclimates in the regions surrounding buildings and is thermally registered within buildings, depending upon the level of active mechanical environmental control systems in operation. This variable environment enables the team to employ a control strategy for the building envelope to form a "selective filter" that advantageously interacts with energy flows of light and heat.

In the desert, no home is complete without strategies for effective water harvesting, storage and distribution; intelligent use of water is integral to a sustained desert population. The home will cycle all gray water to the greenhouse for biofiltration and plant transpiration will passively provide the majority of the home's cooling needs, thus serving as an evaporative cooler, a strategy that lessens reliance on mechanical cooling. This medium of cooling is particularly suited to the Sonoran region.

Building Strategies

Building siting and geometry as a passive means of engaging the built and natural environment is a

vernacular technology that has tied buildings to place throughout history. Native peoples implemented effective siting and orientation and precise positioning of shading devices to mitigate summer heat gain; they also advantageously positioned building openings to provide passive cooling and natural ventilation. The regional intelligence of early builders fostered a harmonious built relationship with the environment that stemmed from experience with the natural world. These early builders conceived of buildings as selective filters that regulated the conditioned space in response to environmental fluctuations, in effect tuning themselves, through the instrument of building, to the environment. The design process of the SEED[pod] has taken full account of the field studies of the vernacular and sought to augment the capability of the home through advances in building technology to give precedent to a new technological regionalism.



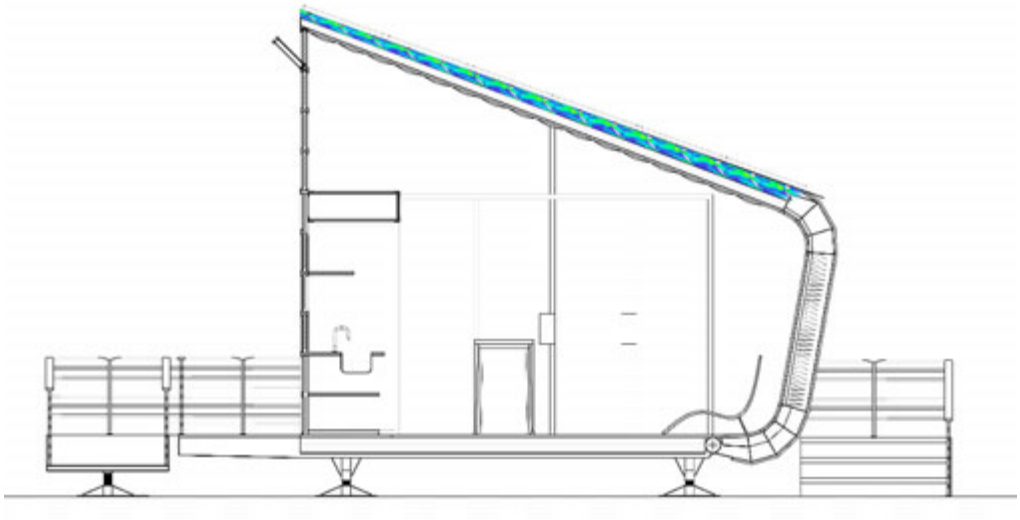
View of the operable louvers on the south facade and PV panels integrated into the envelope.

Engineering Design Narrative

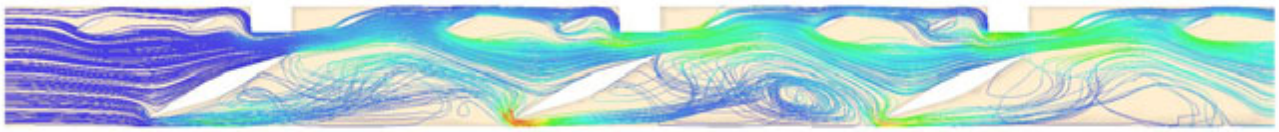
BIPV

The problem of building integrated photovoltaics (BIPV) is taken as a motivating factor in choosing a systems approach to the design of the roof cross section. Solar panel energy conversion efficiency decreases as temperatures rise, requiring photovoltaic arrays to be cooled if they are to be truly integrated into the building. To resolve this issue, the team has designed a thermal plenum located above the ceiling and below the roof of the proposed design. Fitted with solar powered fans and passive turbulence generators that direct turbulent airflow to the underside of the panel, the plenum is designed to manage heat storage and keep the panel at effective operating temperatures. To further increase energy conversion efficiency, the interior surface of the plenum is mirrored, reflecting light back to the underside of the translucent panel. The plenum will serve as a passive solar pre-heat cavity on sunny and cool desert mornings and once interior climate specifications have been met, excess heat from the plenum will be exhausted to the exterior. An 8kw photovoltaic array will support all the electrical need for

the home while in Washington, D.C. Upon return to Tucson, AZ, the array size will be reduced to 2kw.



The thermal plenum actively cools the underside of the PV panels. Fans drive air past turbulence generators to provide cooling for the solar panels.



Computational fluid dynamic simulation of the effects of the turbulence generators. The solar panels form the upper portion of the plenum.

Modularity and Systems Core

The core contains four components: (1) the power management and distribution system, (2) the communications and monitoring system, (3) heating and cooling equipment, including ductwork and hot water storage, and (4) all kitchen appliances and fixtures. The module is prefabricated and designed to be adapted to a number of different floor plan layouts and home sizes. Real-time data for the operational efficiency of the home will be broadcast to the inhabitants, informing them of the environmental effects of their living choices. The systems will measure data, tabulate this data, and archive it in order to display trends over time. This data may also be used to prove the environmental benefit of living in energy-efficient, environmentally responsive homes.

Integrated Greenhouse Module

Greenhouse integration provides three major functions that add to the sustainable nature and livability of the home: (1) air quality control, (2) food production, and (3) gray water filtration. The greenhouse filters the air, providing increased O^2, filters water, regulates humidity, and provides thermal storage—all of which reduce the SEED[pod]'s overall energy footprint.

Adaptive Envelope and Control

Active means of modulating light, ventilation and heat gain are integral to the home to maintain internal stability in response to fluctuating environmental conditions. The control and programming of the automated systems are web-based and can be monitored and adjusted on or off-site. The team has worked to develop an interface for controlling the SEED[pod] via a smart phone device such as an iphone.

The control systems are programmable for diurnal and annual schedules and can hit humidity, temperature and air quality targets in response to the localized climatic data for both the arid Sonoran region and the more temperate climate of Washington, D.C. The greenhouse preconditioning module and the conditioned interior space of the SEED[pod] will be monitored for temperature, humidity, day lighting, and O^2 and CO^2 levels. As the environment fluctuates over the course of the day the control system operates the porosity of the exterior envelope layer, fans, vents, shades and the mechanical heating and cooling equipment and also balances energy loads. A self-shading building envelope is a viable technology in the Tucson region as shading the building surface produces a surface temperature difference of up to 7ºC, thus reducing summer cooling loads. The self-shading mechanisms are triggered via shape memory alloys that serve as non-mechanical actuators driven thermally by the sun.

Trombe Wall Research

The trombe wall system has been custom designed and fabricated as part of a student thesis project. PET plastic was chosen as a material for its low cost and high recyclability index. Our intention is to further expedite the use of post-consumer material into the building industry. In this innovative system, building mass is combined with the optical qualities of shaped, water-filled PET panels, giving the interior a luminous and watery effect—something we cherish during the desert summer day.

Conclusion

The work engages experts from the disciplines of civil engineering, electrical engineering, materials science, mechanical engineering, optical science, and plant science, together with architects, in order to develop design strategies that positively impact the construction industry. Our goal is to broaden our sense of design responsibility by using materials and construction technology to reestablish our relationship with our local environment conditions. It is the position of the team that an intelligent, systems-approach to redefining the construction industry is imminent and we plan to contribute with research of alternative housing strategies that consume less energy to fabricate and have net-zero operational costs. The future is powered by the sun.

Market Viability Justification

In identifying the target market for the SEED[pod] we recognized two categories of the population that would serve as viable markets. The first category identified as a potential target market is young couples, aged 27-32, that are considering their first home purchase. This market is eco-conscious and recognizes the need to embrace newer building and design technologies. They are recent college grads, and new members of the work force. Young in their careers and marriage, they are looking to enter into the housing market. The SEED[pod] represents a good housing option for these couples as it provides them the flexibility of expanding as their family unit grows. However, further marketing research into this market has suggested that the high cost of the SEED[pod], as built for the Solar Decathlon Competition, would price this market out.

The second category of individuals identified as a potential target market for the SEED[pod] is the empty-nester market. These individuals, ranging in age from 55-60 years, are currently living in the large three to four bedroom homes that they raised their families in. As the kids have recently left the house, these individuals are beginning to look for smaller homes. The appeal of the SEED[pod] to these individuals is the small size, and minimal maintenance required. In addition, this generation has expressed deep concerns over environmental issues such as global climate change. Their high level of eco-consciousness is reflected in their high percentage of hybrid purchases. For the UASDT's house to be entered in the 2009 Solar Decathlon Competition, it is this market that will serve as the target market.

This market represents a large portion of the population in Southwest Arizona. As couples near the retirement age they begin to look for good retirement communities. With its abundance of good weather, golf courses, and resort style atmosphere, the southwest region of Arizona has experienced high levels of senior immigration. This market represents a great opportunity for a self sustaining solar house with small square footage to thrive.

Market I.D. Parameter	SEED[pod]
Location of Permanent Site	Tucson, AZ
Housing Type	Single Family
# of Occupants	2
Occupant Demographic	Baby boomers, empty-nesters
Occupant Annual Income	$60,000 - $80,000+
# of Bedrooms	1
# of Bathrooms	1
Square Footage	800
Starting Price	$425,000

Lighting Design Narrative

The main goal in the design of the electrical lighting system of the seed pod is to achieve the highest efficiency and flexibility. To obtain the highest efficiency two main strategies are utilized. Firstly the house is treated as a light box and the reflectivity values of the interior surfaces play an utmost role in intensifying the lighting quality. Secondly the selection of the light fixtures has been an asset to get the highest energy efficiency. To achieve this purpose, linear fluorescents are chosen for general lighting and LEDs are selected for task and aesthetical lighting. The smart control system of the house which is Lutron Radio-RA control system, with the RadioRA dimmers and Master Controls, gives the users convenient, one-touch control of all the home lighting. It also enables them to create relaxed and flexible lighting scenes in any area of the house for specific activities.

The second goal of the electrical lighting design is to provide human comfort and help in improving human health. The human comfort is mainly achieved by eliminating glare in placing the fixtures and simplicity in the lighting control system. Human health is improves by using LowBluelight bulbs specifically in the bedroom. These special light bulbs help the user reduce their evening exposure to blue light, which suppresses the body's ability to produce melatonin, a necessary sleep hormone.

APPENDICES