



U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON 2011

TEAM FLORIDA
FLEX HOUSE

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Florida State University & the
University of Central Florida

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SUMMARY OF CHANGES

Significant changes to the project manual that have occurred between submissions have been outlined below. The Construction Drawings should also be reviewed for relevant revisions.

3-22-2011 REVISION

REVISIONS:

- Changed structural system from a steel frame structure to wood frame due to value engineering. Final structural calculations and their compliance with wind speed Exposure Category C requirements are included in Appendix A.
- Included an "Assembly Sequence" set of plans (G-301-304). We are going to lift in place the house; pending are crane selection and other transportation requirements that depend on hoisting and rigging plan under development.
- Modified HVAC system. Equipment specifications have been included.
- Modified PV array and components. Equipment specifications have been included.
- Updated water budget.
- Updated liquid desiccant system.

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RULES COMPLIANCE CHECKLIST

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Rule	Rule Description	Location Description	Location
Rule 4-2	Construction Equipment	Drawing(s) showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site	Plan G-301 to G-304
Rule 4-2	Construction Equipment	Specifications for heavy machinery	App. G
Rule 4-3	Ground Penetration	Drawing(s) showing the locations and depths of all ground penetrations on the competition site	C-101, S-002.1
Rule 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	C-102, S-101
Rule 4-5	Generators	Specifications for generators	APP. D ; HASP/NOISE EXPOSURE
Rule 4-6	Spill Containment	Drawing(s) showing the locations of all equipment, containers, and pipes that will contain liquids at any point during the event	G-102
Rule 4-6	Spill Containment	Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event	APP. I: HASP APP. "H"
Rule 4-7	Lot Conditions	Calculations showing that the structural design remains compliant even if 18 in. (45.7 cm) of vertical elevation change exists	Apendix "A"
Rule 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-002.1
Rule 5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	Report sec _. Envelope exemption sheet
Rule 6-1	Structural Design Approval	List of, or marking on, all drawing and project manual sheets that have been or will be stamped by the qualified, licensed design professional in the stamped structural submission; the stamped submission shall consist entirely of sheets that also appear in the drawings and project manual	Report - Section 3/ APP. A Report sec, 9 (structural drawings list)
Rule 6-2	Finished Square Footage	Drawing(s) showing all information needed by the rules officials to measure the finished square footage electronically	G-102

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Rule	Rule Description	Location Description	Location
Rule 6-2	Finished Square Footage	Drawing(s) showing all movable components that may increase the finished square footage if operated during contest week	N/A
Rule 6-3	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	G-102
Rule 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
Rule 7-2	Watering Restrictions	Drawing(s) showing the layout and operation of greywater irrigation systems	N/A
Rule 8-1	PV Technology Limitations	Specifications for photovoltaic components	E-102, Report section 9
Rule 8-3	Batteries	Drawing(s) showing the location(s) and quantity of all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-3	Batteries	Specifications for all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-4	Desiccant Systems	Drawing(s) describing the operation of the desiccant system	APP. C
Rule 8-4	Desiccant Systems	Specifications for desiccant system components	APP. C
Rule 8-5	Village Grid	Completed interconnection application form.	PM
Rule 8-5	Village Grid	Drawing(s) showing the locations of the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	E-102
Rule 8-5	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	E-102, E-101
Rule 8-5	Village Grid	One-line electrical diagram	E-102, E-101
Rule 8-5	Village Grid	Calculation of service/feeder net computed load per NEC 220	E-101
Rule 8-5	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	G-102
Rule 8-5	Village Grid	Elevation(s) showing the meter housing, main utility disconnect, and other service equipment	“for CD”

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Rule	Rule Description	Location Description	Location
Rule 9-1	Container Locations	Drawing(s) showing the location of all liquid containers relative to the finished square footage	G102, P-101
Rule 9-1	Container Locations	Drawing(s) demonstrating that the primary supply water tank(s) is fully shaded from direct solar radiation between 9 a.m. and 5 p.m. EDT or between 8 a.m. and 4 p.m. solar time on October 1	G-307
Rule 9-2	Team-Provided Liquids	Quantity, specifications , and delivery date(s) of all team-provided liquids for irrigation, thermal mass, hydronic system pressure testing, and thermodynamic system operation	N/A
Rule 9-3	Greywater Reuse	Drawing(s) showing the layout and operation of greywater reuse systems	N/A
Rule 9-4	Rainwater Collection	Drawing(s) showing the layout and operation of rainwater collection systems	N/A
Rule 9-6	Thermal Mass	Drawing(s) showing the locations of liquid-based thermal mass systems	N/A
Rule 9-6	Thermal Mass	Specifications for components of liquid-based thermal mass systems	N/A
Rule 9-7	Greywater Heat Recovery	Drawing(s) showing the layout and operation of greywater heat recovery systems	N/A
Rule 9-8	Water Delivery	Drawing(s) showing the complete sequence of water delivery and distribution events	G-307, Report section 6
Rule 9-8	Water Delivery	Specifications for the containers to which water will be delivered	Specifications, Division 22
Rule 9-9	Water Removal	Drawing(s) showing the complete sequence of water consolidation and removal events	G-307. Report section 6
Rule 9-9	Water Removal	Specifications for the containers from which water will be removed	Specifications' Division 22
Rule 11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	G-102

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FLEX HOUSE DESIGN APPROACH

OVERVIEW:

The FLeX House is a flexible, modular building system that can adapt easily to different site situations and plan configurations. The main body of the house can be shipped on one truck [to minimize shipping costs] and quickly deployed on the site. Sliding modules contract into the main body during shipping and roll out at the site to maximize the floor area. The Flex house is designed for a young couple living in Central Florida on a moderate income. The key factor shaping the design approach is central Florida's hot humid climate and intense solar radiation. Our proposal will combine the wisdom of vernacular Florida houses and our team's years of experience in ZEH technologies to make a state of the art zero energy home.

A contemporary ZEH in central Florida must take advantage of passive cooling and heating in the mild months and utilize highly efficient mechanical cooling during the months when temperatures are too high for passive cooling strategies. This hybrid open and closed building type will be reflected in the design of the landscape, floor plan, building section, and building envelope and will dictate the choice of building materials and mechanical systems. The following is a summary of the Flex House design approach:

SITE PLAN:

FLeX House is oriented on an east west axis, sits on the southern half of the site and frames a courtyard on its cooler north side. A pedestrian spine along the west edge of the site will connect the house's main entry to Decathlete Way to the North. The building is designed so that all features fall within the specified setbacks and solar envelope.

PREFABRICATION:

To be implemented on a large scale ZEH must be affordable for people earning a moderate income. Although individual materials and technologies affect the cost of home construction the building process itself is a more significant factor. Site built construction is time consuming and wasteful and results in higher costs. Building homes in the controlled environment of a factory can reduce material waste, and construction costs while increasing quality control, efficiency and safety during the construction process. Pre-fabricating the house will also minimize preparation time, waste and safety concerns during the setup for the exhibition on the Mall. The single unit home concept will emphasize the viability of relocation, expandability, flexibility and recyclability to keep pace with the evolving American housing market.

BUILDING ENVELOPE:

Designing an envelope that works equally well throughout the year combining an optimum level of insulation for temperature extremes, resistance to air infiltration, transparency for daylight, and flexibility, is a challenge in central Florida. Team Florida will work with industry partners to design an affordable building envelope that meets these criteria. Variations of SIP and stick built configurations were analyzed to find the best balance of efficiency, sustainability and economics. In this case stick built construction was chosen but in different circumstances SIP construction may prove to be more desirable. Florida enjoys a relatively low temperature differential throughout the year so insulation values can be lower than in more extreme climates, walls can be thinner and well shaded glass can be abundant. Corrugated Metal was chosen as the exterior finish material due to its durability, low thermal mass, reflectivity and cost.

NATURAL VENTILATION:

Passive solar design is the most economical approach to affordable zero energy home design as it is virtually free to implement. Passive cooling through ventilation must start with the site plan and vegetation. Vegetation creates shade and cools the air before entering the house. The FLeX House will have a strong connection between indoors and outdoors with carefully placed fenestration and or movable wall systems that will allow the house to transform from a more closed system,

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during periods of extreme temperature, to a more open system that invites natural ventilation during the milder, dryer months. Raising the building off of the ground and ventilating the crawlspace will help to mitigate the negative effects of ground moisture, humidity and radon on the building and its interior air quality. The house has high ceilings that allow warmer air and cooler air to stratify and ceiling fans will maintain constant air movement improving the comfort level on hot days when the house is open.

ZONES:

Movable interior partitions between the sleeping/office area and the living area will allow the entire wall to be opened or closed allowing for thermal zones in support of the flexible, hybrid design approach. The HVAC system will conserve energy by responding to individual zones and seasonal temperature and relative humidity fluctuations.

MECHANICAL EQUIPMENT MODULE:

Mechanical systems are all located in a mechanical equipment module that is accessible from the exterior of the house for ease of access, replacement and maintenance. Access to mechanical systems from the exterior of the house gives the residents more privacy during routine service calls and replacement of equipment.

PARASOL:

Throughout the year the majority of heat gain in central Florida happens through the roof where attic spaces can reach temperatures exceeding 140°. The Florida Cracker house, homes designed by Paul Rudolph, and FSEC research all demonstrate that shading is a critical strategy for reducing heat gain in Florida houses. The Flex House will incorporate a parasol-like outer structure composed of wooden louvers that will shade the roof and walls minimizing heat gain through the building envelope. The open space between the parasol and the building envelope will ventilate freely and prevent the build-up of hot air typically found in attic spaces. To ease the impact of perennial water shortages in central Florida the roof will feed rainwater to a water feature and cistern where it will be stored for site irrigation. Efficient, safe and economical upgrade and maintenance of the PV array and solar thermal systems will be facilitated by their attachment to the parasol framework rather than to the roof of the building envelope.

LIGHTING DESIGN:

The Team Florida Flex House incorporates passive and active lighting strategies to create visual comfort for its occupants, promote energy efficiency, and creates an aesthetic atmosphere. Passive design applications are elements that are integrated into the building's site, exterior shell, and the interior spaces. Passive design relies on the architecture of the building to provide aid to conditional variables such light, heat, or ventilation. Active lighting design utilizes electrical controls and devices to help control the desired level of illumination within the occupied space.

In the Flex House, the overhead louvers act as a passive application that aids in blocking and filtering the sun's bright light helping to control illumination and heat gain. Glazing on the south wall is minimized to help reduce the amount of heat gain from continuous southern exposure from the sun. The northern wall consists primarily of glazing to maximize the benefits of the soft diffuse indirect sunlight. The house is designed so that daylighting is the primary source of illumination. However, at night and during the summer thunderstorms, the occupants will rely on energy efficient artificial lighting to maintain proper illumination.

The active lighting design applications include interior window coverings, occupancy and daylighting sensors, light emitting diode (LED) and fluorescent artificial lighting. The primary design focus of selecting the luminaires and devices for the Flex House is to promote energy efficiency. Visual comfort for the occupants is achieved by providing warm white overhead lighting and additional task lighting to assist with higher cognitive tasks. The recessed luminaires create a spacious atmosphere and the decorative sconces, pendants, and floor lamps add a luxurious appeal to the aesthetic design.

Upon entering the Flex House, glazing along the south wall and a light from a window at floor level illuminate the entry module. A small single pendant luminaire is suspended just above the

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entry casework in order to create a simplistic and lightly illuminated space. At night, this single pendant will create a welcoming focal point for guests.

Immediately upon moving through the entry space, the general ambient illumination bathes the the entire living, dining, and kitchen space. The overhead recessed LED luminaires are dimmable which allows the occupants to create various ambient conditions. The ceiling luminaires are placed on a symmetrical grid that emphasizes the two major axes of the Flex House.

A single rectilinear pendant suspended over the dining table provides a focal point that draws guests to the kitchen. The shade of the master crafted dining pendant consists of tightly spaced cords around a diffuse acrylic panel which reflects the repetitive theme of corrugated materiality found throughout the exterior and interior of the house. The acrylic panel allows the tubular fluorescent lamp to shine through as an ambient diffused light. When not acting as focal point, the pendant also functions as task lighting for the multi-purpose table it is suspended over.

The kitchen is illuminated by the overhead LED grid and integrated recessed LED luminaires that are mounted under the upper cabinets. Additional elements that actively contribute to the energy efficiency of the Flex House include daylight and occupancy sensors and a ceiling fan which are all aligned within the overhead grid.

The overhead LED grid continues through the main space of the home which leads into the bed, bath, and study area. The recessed luminaires and an LED desk lamp are the primary light sources for the study area. In the bedroom module, the illumination is mainly provided by glazing along the north wall. At night, the bedroom module is moderately illuminated by integrated LED luminaires in the bedroom casework. Decorative accent illumination is created by table and floor lamps. In the bathroom, two slender vertical fluorescent luminaires are mounted on either side of the large mirror. The delicate elements blend with the surrounding bath fixtures and provides the best facial illumination for the occupants. Overhead recessed lighting adds additional illumination for the shower and water closet area.

The overall concept of the lighting design is to promote energy efficiency, visual comfort for the occupants, and aesthetics. The energy used by the luminaires in the the Flex House is allowable to maintain an zero-energy home. The total cost for the selected luminaires is approximately 2% of the overall budget. The recessed LEDs and decorative lighting provide proper illumination as required by the IESNA. Finally, simplistic design of the luminaires complements the overall palette, materiality, and textures related to the Flex House.

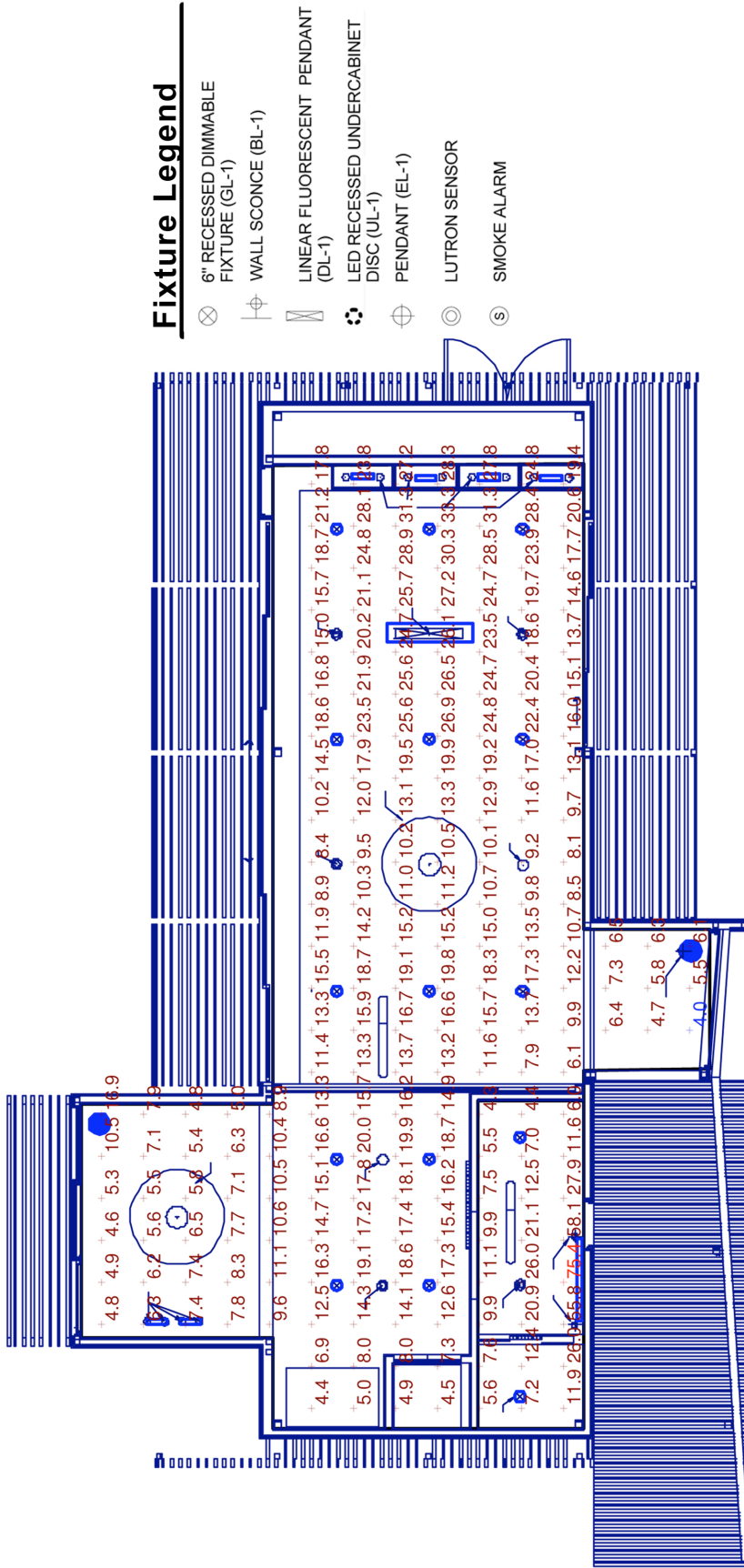
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FLEX HOUSE LIGHT ZONE CALCULATIONS



Fixture Legend

- ⊗ 6" RECESSED DIMMABLE FIXTURE (GL-1)
- ⊕ WALL SCONCE (BL-1)
- ⊞ LINEAR FLUORESCENT PENDANT (DL-1)
- ⊙ LED RECESSED UNDERCABINET DISC (UL-1)
- ⊕ PENDANT (EL-1)
- ⊙ LUTRON SENSOR
- ⊙ SMOKE ALARM

Plan View

Scale 1" = 8'



STRUCTURAL CALCULATIONS

List of drawings and calculations to be stamped by licensed structural design professional

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S-001 Structural notes and symbols

S-101 Foundation plan

S-102 Floor framing plan

S-103 Floor framing trailer

S-104 Roof framing plan

S-105 Umbrella structural plan

S-201 Building envelope elevations

S-202 Building envelope elevations

S-601 Typical details and schedules

The Calculations have been attached in Appendix A.

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DETAILED WATER BUDGET

Function	Water Use (Gallons)	Calculations		Notes
		Gal	Events	
Hot Water Draws	240	15	16	
Water Vaporization	4	1	4	
Dishwasher	31	6.2	5	
Clothes Washer	40	5	8	
Fire Protection	235	235	1	
Testing	50	50	1	
Solar Thermal Collectors	400	400	1	
Safety Factor	100			
Water Required	1100	Gallons		

WATER DELIVERY SEQUENCE:

- A group consisting of 6 team members will carry the organizer provided hose from the adjacent lot to the east side of our lot. Two more team members will be on standby to gather any extra length of hose necessary to reach the south side of our lot. (See diagram for dimensions).
- One team member will be responsible for removing the cover from the tank shading structure as well as the lid from the tank itself, while the remainder two members accommodate the hose for proper water delivery.
- Once the hose has been securely placed, the truck will pump the required amount of water as specified on the water budget section of this document.
- Repeat two previous steps per remaining two tanks until the balance of the water budget requirements have been fulfilled.
- Three team members will finally remove the organizer hose and aid the following team in carrying the hose to their adjacent lot.

WATER REMOVAL SEQUENCE:

- A group consisting of 6 team members will carry the organizer provided hose from the adjacent lot to the east side of our lot. Two more team members will be on standby to gather any extra length of hose necessary to reach the south side of our lot. (See diagram for dimensions).
- Two team members will take charge to connect the organizer provided hose to the end of a drain pipe located on the lower portion east side of the tank shading structure.
- Two additional team members will monitor the drain valves from each of the three tanks while water is being removed.
- Three team members will finally remove the organizer hose and aid the following team in carrying the hose to their adjacent lot.

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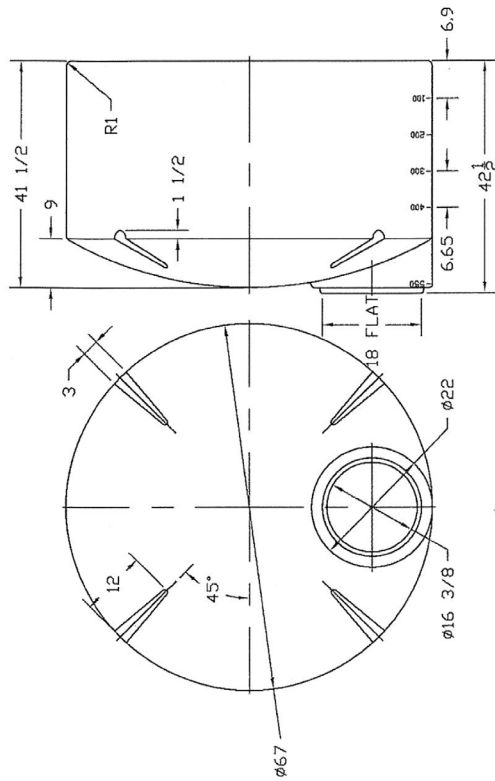
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FLeX House Project Manual

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CHEMICAL CONTAINERS, INC. 800-346-7867

550 GAL. VERTICAL

SCALE NS T1068N

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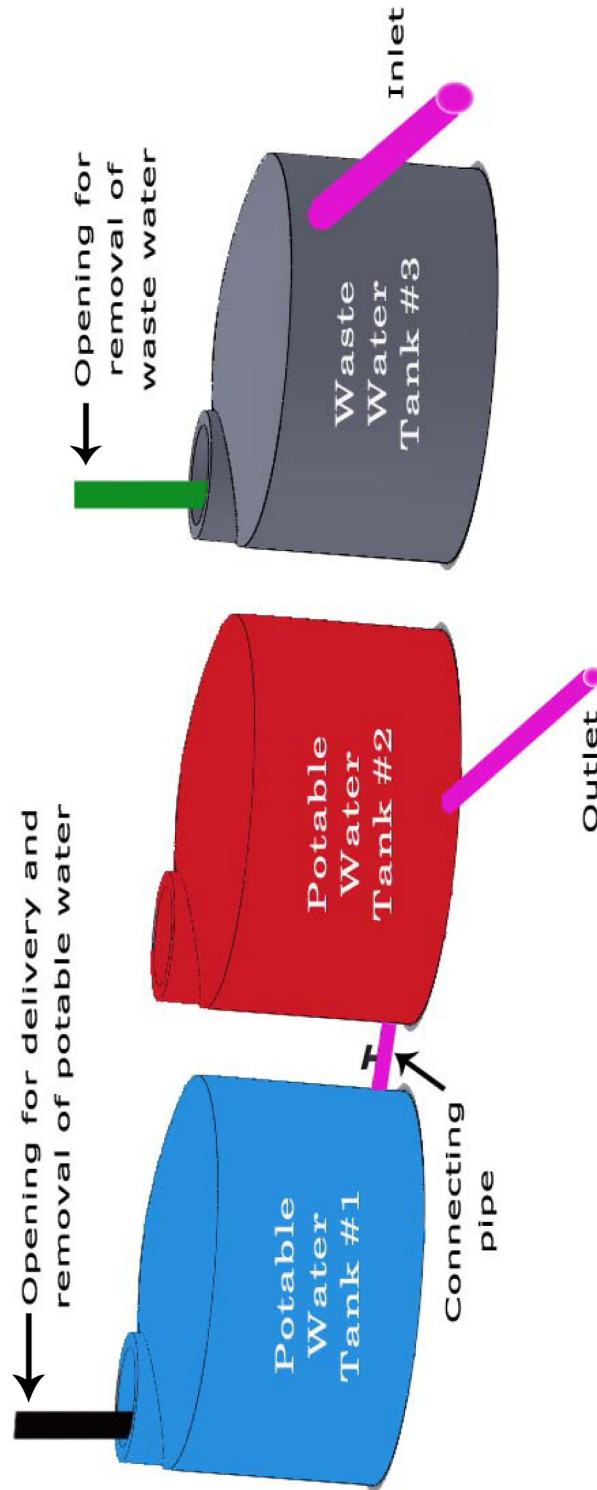
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Note:

1. Each Tank can hold 550 Gallons
2. 1100 Gallons is to be delivered into tank #1
3. The opening diameter is a minimum of 4 inches
4. Please see the section views for additional clarification.

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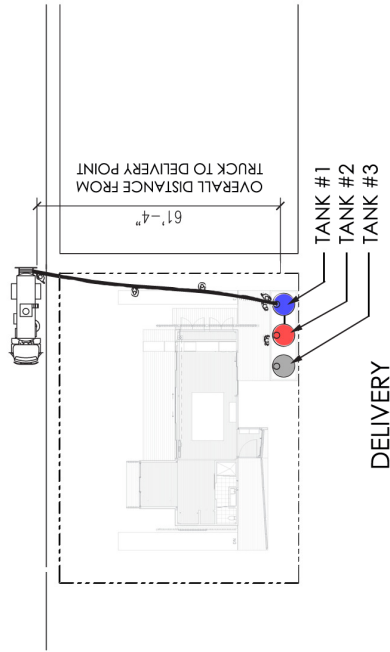
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Delivery:

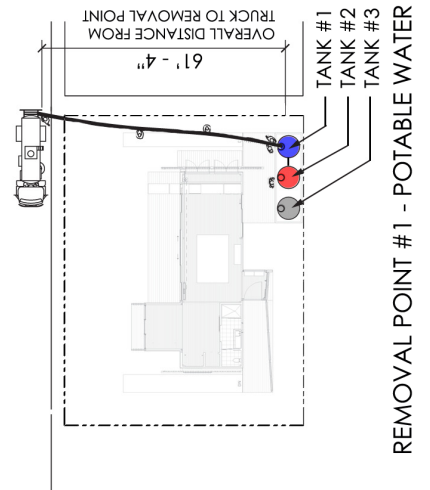
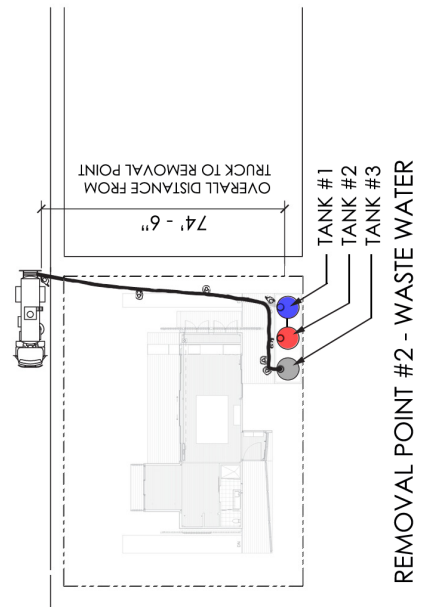
6 team members will help move the water delivery hose to the delivery point on the potable water tank #1. Water flows into potable water tank# 2 through a connector pipe with a shut off valve. Each tank holds 550 gal. The total delivery will be 1100 gal.



- TANK #1 - POTABLE WATER
- TANK #2 - POTABLE WATER
- TANK #3 - WASTE WATER

Removal:

6 team members will help move the water removal hose to the 2 removal points. The first removal point is for potable water from tank #1. The second removal point is for waste water from tank #3



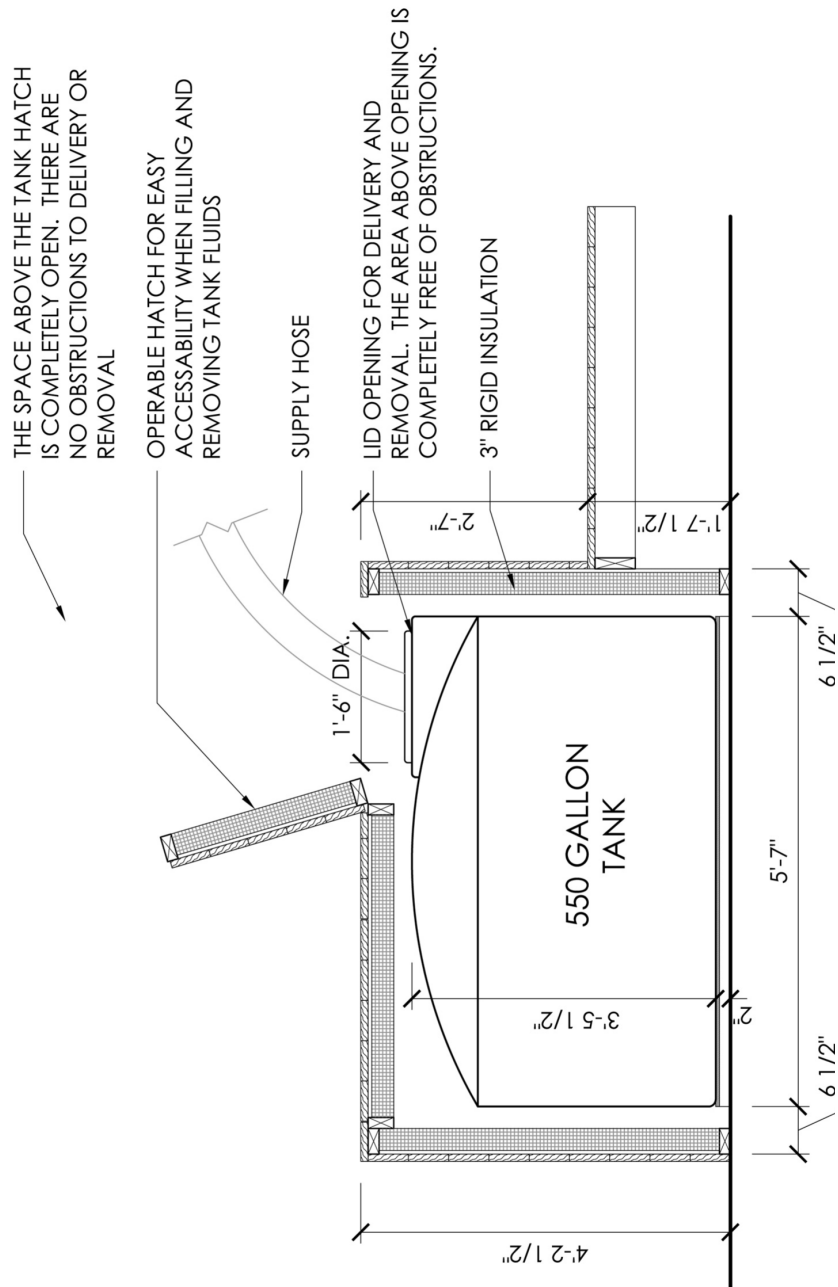
REMOVAL POINT #1 - POTABLE WATER

REMOVAL POINT #2 - WASTE WATER

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SUMMARY OF UNLISTED ELECTRICAL COMPONENTS

Team florida will not be using any unlisted electrical components.

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SUMMARY OF RECONFIGURABLE FEATURES

Flex House will be shipped to the National Mall as a single unit that contains smaller deployable modules for the bedroom and entry. After the main unit is taken off of the trailer and set onto the foundation pads, the bedroom and entry way will be deployed on a bearing and guide beam system [A-501] [see detailed explanation in Project Manual “outside logistics” section]. Once the deployable modules are set they will be considered permanent and will not be moved again during the competition or jury walkthroughs.

Flex House includes a Murphy bed that folds into the west wall of the bedroom [I-501]. The Murphy bed will be folded down in its bed position and never moved during the public exhibition. The Murphy bed will be folded into the wall as a demonstration during the jury walkthroughs.

Flex House is fully shaded by an “umbrella” structure. The umbrella is composed of stationary and operable wood louvers. The wood louvers on the west elevation [A-202] are operable but will remain in a fixed position during the public exhibition. The operable louvers will be demonstrated during the jury walkthroughs.

Flex House employs a retractable shading device that can be lowered or raised. The retractable shading device will be connected to the umbrella on the south elevation [A-202]. The retractable shading device will remain stationary during the public exhibition but will be demonstrated during Jury walkthroughs.

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INTERCONNECTION APPLICATION FORM

TEAM FLORIDA # 110

PV SYSTEMS

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
SolarWorld	1 row of 12 and 1 row of 10 panels arranged parallel to the south, tilted 28-39 degrees	5060 W

Total DC power of all arrays is 4.4kW (in tenths)

INVERTERS

Inverter Manufacturer	Model Number	Voltage	Rating (kVA or KW)	Quantity
Enphase	D380	56	230 W	11

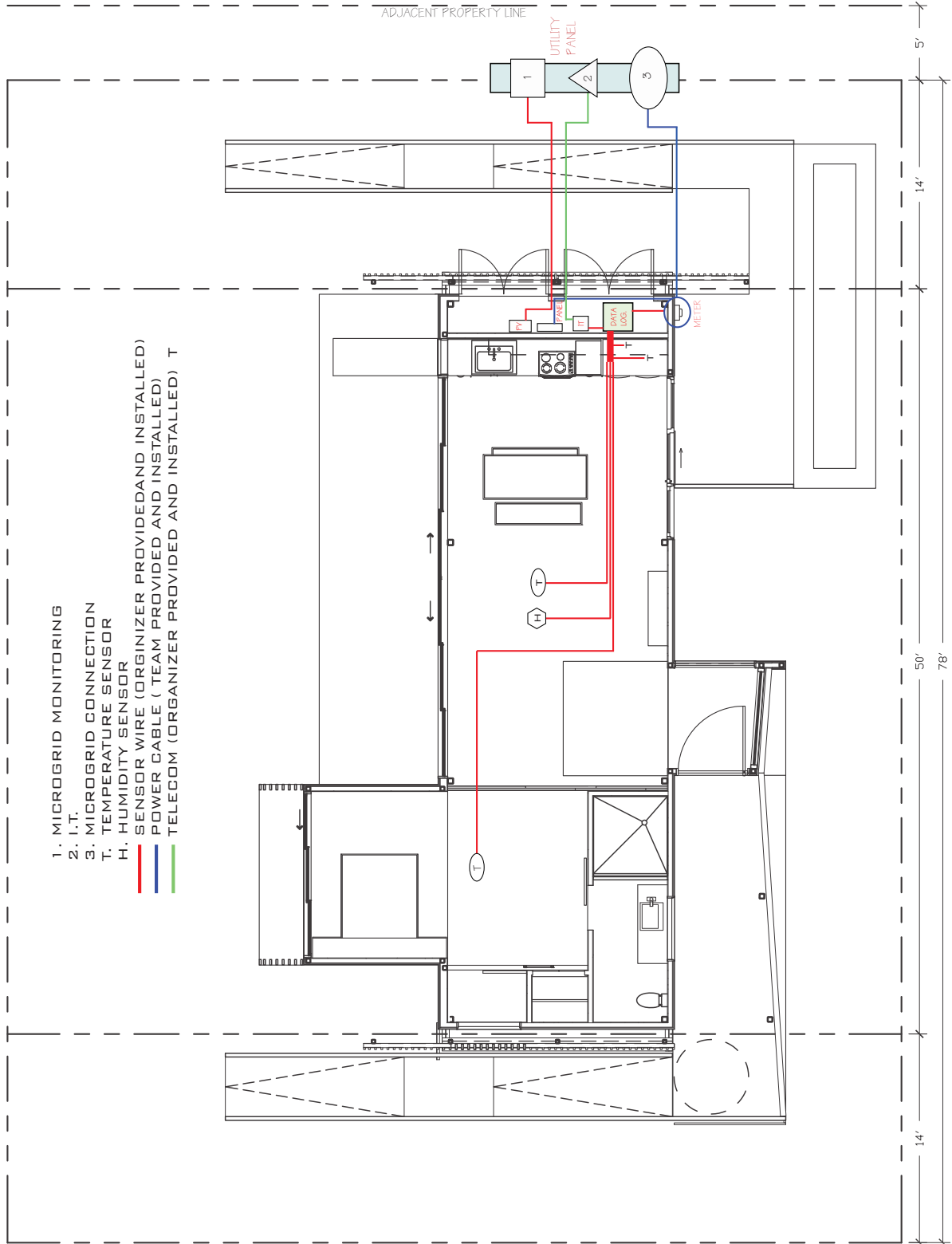
Total AC power of all inverters is 4kVA or kW (in whole numbers)

1. One-Line Electrical schematic. (See diagram on the next page) (E101)
2. Calculations of service/feeder net computer load and neutral load (NCE 220) (E-101)
3. Plan view of the lot showing the house, decks, ramps, tour paths, the service point and the distribution panel or load center. [G-102]

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ENERGY ANALYSIS RESULTS AND DISCUSSION

5210 S. University Dr. Suite 105 – Davie, FL 33328
Tel.: 954 680 2690 – Fax: 954 414 9393

www.rcieng.com

November 23, 2010
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

Re: Solar Decathlon – Energy Model for Team Florida

To Whom It May Concern:

This narrative describes the results of the energy model for Team Florida’s building in the 2011 Solar Decathlon. In addition to the overall results, there is a brief discussion of noteworthy elements of the building construction and an explanation of Florida’s statewide energy code.

OVERALL ENERGY MODEL RESULTS

The energy model shows that Team Florida’s building consumes an estimated 11,287 kWh of electricity annually, which is 32.5% less energy than a baseline model created in accordance with ASHRAE 90.1-2007. The energy consumption is itemized by the various end uses in the following table:

Building End Use	Proposed	Baseline
Interior Lighting	\$54 (3.6 MBtu)	\$133 (9.1 MBtu)
Heat Rejection	\$30 (2.0 MBtu)	\$0 (0.0 MBtu)
Miscellaneous Equipment	\$101 (6.8 MBtu)	\$100 (6.8 MBtu)
Pumps & Miscellaneous	\$13 (0.9 MBtu)	\$4 (0.3 MBtu)
Space Cooling	\$272 (18.4 MBtu)	\$411 (28.2 MBtu)
Space Heating	\$7 (0.5 MBtu)	\$5 (0.4 MBtu)
Ventilation Fans	\$92 (6.2 MBtu)	\$176 (12.1 MBtu)
Total	\$569 (38.4 MBtu)	\$830 (56.9 MBtu)

Iterations are still being performed by the design team to optimize energy performance. Additionally, several default values from Florida’s building code have been incorporated into the model as a safety factor and to ensure compliance with the State building code. The final model will override the more stringent defaults to represent all components of the proposed building.

BUILDING CONSTRUCTION

The proposed building is insulated with R-21 batt insulation at the walls and floors. The ceiling has tapered insulation for an average of R-35 batt. The real benefits of the building construction, however, are the exterior elements. The exterior walls and roof have a relatively high reflectivity to

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serve as a radiation barrier. Further, there are louvered perimeter shading walls that allow indirect light for daylighting but are angled to prevent direct solar radiation from reaching many of the walls; this essentially offers the thermal benefits of northern facing walls, which is an assumption in the building model. These two elements have been combined with overhangs and a ‘solar umbrella’ consisting of photovoltaic panels and solar thermal panels covering the bulk of the roof deck. These panels absorb much of the solar radiation and convert it to usable energy, with about a 12” air gap between the panels and the roof. In conclusion, most solar radiation does not reach the building envelope; and what does still must penetrate the low-e exterior and the insulation.

The HVAC system consists of a small air-cooled chiller serving two interior fan coils. This system was selected for two main reasons. First, it allows simple integration of solar thermal to satisfy the heating demand of the building. The same coil is used for heating and cooling, with a valve and control system determining whether to circulate chilled or hot water. Second, the chiller uses a variation on standard thermal storage to improve overall system performance. The chiller is able to chill the water in the storage tank in the early hours of the morning, running more efficiently because of lower ambient temperatures. Then, the temperature in the tank is permitted to rise with a varying deadband controlled by current and predictive weather conditions. For example, during parts of the Spring and Fall the chiller may initially cool the water to 42oF, then allow the tank to creep up to 60oF, then turn on and cool back to 42oF. This reduces chiller cycling and allows the chiller to remain off as long as possible during periods of peak electrical demand and higher ambient temperatures.

The ERV is a critical component in Florida courtesy of our relatively high heat and humidity. The ERV combined with the liquid desiccant system allow the fan coil temperatures to exceed the dewpoint (i.e., the fan coils will be removing less humidity than normal) while still maintaining good indoor air quality. Further, by pretreating the outside air, the chilled water system runs more efficiently, determined in accordance with ARI Guideline V.

FLORIDA’S ENERGY CODE

The State of Florida has its own statewide uniform standard for energy efficiency, which is Chapter 13 of the Florida Building Code (FBC). The first table below shows the sections in ASHRAE 90.1-2007 with the corresponding sections from FBC Chapter 13.

Most of the language is identical between these two standards. The most significant difference is that Florida’s code requires buildings to exceed ASHRAE 90.1 by at least 15%. The Building Energy Codes Program – under the direction of the U.S. Department of Energy – has determined that FBC Chapter 13 is more stringent than ASHRAE 90.1-2007; see http://www.energycodes.gov/states/state_info.php?stateAB=FL. Recently the State has moved to use IECC 2009 as the foundation of its code rather than the current ASHRAE 90.1-2004; however, this has not yet been incorporated in the text of the code.

Category	ASHRAE 90.1	FBC Chapter 13
Building Envelope	Section 5	13-401 to 13-406
HVAC	Section 6	13-407 to 13-411
Service Water Heating	Section 7	13-412
Power	Section 8	13-413
Lighting	Section 9	13-415
Other Equipment	Section 10	13-414
Energy Cost Budget	Section 11	13-400

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FBC Chapter 13 requires all commercial projects to be modeled with the Energy Gauge FLA/COM 2007 software (www.energygauge.com). This software performs an annual hourly building energy simulation and satisfies the requirements in ASHRAE 90.1 for modeling capabilities; in addition, the software is accepted for modeling for tax deductions under IRC 179D and LEED certification by the USGBC. This software has an option to calculate compliance with the State energy efficiency code, which includes default data for occupancy, schedules and other similar data, and also requires 15% improved performance over ASHRAE 90.1. Alternatively, an option is provided to override defaults. Currently this model uses the State default values for schedules, but these values will be modified for the final energy model as the control algorithm and overall design are finalized.

If there are any questions or comments regarding the energy model or the assumptions used in creating the model, please contact our office.

Sincerely,

Brian Coldwell, P.E.

Principal

A detailed energy analysis is provided in Appendix F of this document.

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CONSTRUCTION SPECIFICATIONS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 10 00 SUMMARY

PART 1–GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Phased construction.
 - 4. Work by Owner.
 - 5. Work under separate contracts.
 - 6. Future work.
 - 7. Purchase contracts.
 - 8. Owner-furnished products.
 - 9. Contractor-furnished, Owner-installed products.
 - 10. Access to site.
 - 11. Coordination with occupants.
 - 12. Work restrictions.
 - 13. Specification and drawing conventions.
- B. Related Section:
 - 1. Division 01 Section “Temporary Facilities and Controls” for limitations and procedures governing temporary use of Owner’s facilities.



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1.03 PROJECT INFORMATION

- A. Project Identification: Solar Decathlon 2011 Team Florida Project Flex House.
1. Project Location: This project includes an initial “Build Location,” a “Competition Location,” and final “Permanent Location.”.
 2. Build Location: The house will be constructed in the factory of housing manufacturer Palm Harbor homes in Plant City Florida and shipped to Washington DC for deployment on the Mall. Some components will be subsequently detached from the house to enable shipment to Washington, DC. The building will be trucked to the competition site for installation in September 2011.
 3. Competition Location: The house will be reassembled at the competition site #110 Decathlete Way, National Mall, Washington, DC, in September 2011.
 4. Permanent Location: After the competition the house will be partially disassembled and shipped to its permanent location on the University of South Florida’s Tampa campus. The house will be reassembled on its permanent site and used as a zero energy house learning center for the University and the community.
- B. Owner: University of South Florida, 4202 East Fowler Ave., Tampa Fl. 33620
1. Owner’s Representative: Stanley Russell, Assistant Professor, University of South Florida School of Architecture and Community Design, 4202 East Fowler. Tel: 813-746-6724, E-mail: russell@arch.usf.edu
- C. Architect: Owner to serve as architect assisted by Stanley Russell Registered Architect, University of South Florida School of Architecture and Community Design 4202 East Fowler. Tel: 813-746-6724, E-mail: russell@arch.usf.edu
- D. Other Owner Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Structural Engineer: Hees and Associates Structural Engineers, 1381 Fifth Street, Sarasota, Florida 34236 Tel: 941-955-4555, E-mail: karl@heesassociates.com
 2. Electrical Engineer: Brian Coldwell, P.E., LEED AP bcoldwell@rcieng.com / RCI Engineering, Inc. 5210 S. University Dr. Suite 105, Davie, FL 33328 P: 954.680.2690 - F: 954.680.2691
 3. Mechanical and Plumbing Engineers: Brian Coldwell, P.E., LEED AP bcoldwell@rcieng.com / RCI Engineering, Inc. 5210 S. University Dr. Suite 105, Davie, FL 33328 P: 954.680.2690 - F: 954.680.2691
 4. Photovoltaic Systems:
 5. Steel Shop Drawings and Fabrication: Palm Harbor Homes, 605 S Frontage Rd, Ste. C Plant City, FL 33563, Tel: (800) 622-2832
- E. Contractor: Owner to serve as General Contractor
- F. Project Coordinator for Multiple Contracts: Stanley Russell, Assistant Professor, University of South Florida School of Architecture and Community Design, 4202 East Fowler. Tel: 813-746-6724, E-mail: russell@arch.usf.edu
- G. Project Web Site: A Project Web site administered by the Owner will be used for purposes of managing communication and documents during the construction stage.
1. See Division 01 Section “Project Management and Coordination” for Contractor’s requirements for utilizing the Project Web site.



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1.04 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and consists of the following:
1. This project consists of a prototype single-family dwelling for competition in the 2011 Solar Decathlon, an international student-led design/build competition. The project is characterized by one central space with two slide-out modules. One slide-out module is the entry area and the second slide-out module is the sleeping area. All occupied spaces with the exception of a loft are on one floor level.
 2. The project is designed as a hybrid structure including lightweight hot-rolled steel sections and structural insulating panels (SIP's). It includes an overhead canopy of photovoltaic panels and sun shading louvers. Operable louvers shade the east and west walls. The structure is protected by a sprinkler system.
 3. The project includes construction of a steel-framed deck, wood walkways and ramps, and landscape materials within the limitations of the prescribed solar envelope.
 4. This project will be constructed, partially disassembled, and reassembled on multiple sites, including an initial Build Location in Florida, and Competition Locations in Washington, DC, and a final Permanent Location in Florida.
 5. The work is designed as a series of modular components that can be relocated and/or reconfigured through multiple moves and to accommodate multiple site conditions. All systems are designed to support this adaptability and changeability.
- B. Type of Contract
1. Project will be constructed under coordinated, concurrent multiple contracts. See Division 01 Section "Multiple Contract Summary" for a description of work included under each of the multiple contracts and for the responsibilities of the Project coordinator.

1.05 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.06 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
- B. Owner-Furnished Products:
1. Refer to Construction Documents.

1.07 CONTRACTOR-FURNISHED, OWNER-INSTALLED PRODUCTS

- A. Contractor shall furnish products indicated. The Work includes unloading, handling, storing, and protecting Contractor-furnished products as directed and turning over to Owner at Project closeout.
- B. Contractor-Furnished, Owner-Installed Products:
1. Refer to Construction Documents.

1.08 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

-
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and 25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
 2. Driveways, Walkways and Entrances: Keep driveways, parking areas, loading/unloading 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.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.09 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 2. Notify the Owner not less than 72 hours in advance of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
 2. Refer to City of Gainesville, Code of Ordinances, Chapter 15 "Noise" for special criteria pertaining to noise generated by/during construction.

-
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8:00 a.m. to 10:00 p.m., Monday through Friday, except as otherwise indicated.
 - 1. Weekend Hours: 8:00 a.m. to 10:00 p.m.
 - 2. Hours for Core Drilling or Other Noisy Activity: As permitted by local ordinances.
 - C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
 - D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
 - E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes.
 - F. Controlled Substances: Consumption of alcohol, use of tobacco products, and/or use of other controlled substances on the Project site is not permitted.
 - G. Employee Identification: Owner will provide identification tags for Contractor personnel working on the Project site. Require personnel to utilize identification tags at all times.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

END OF SECTION 01 10 00

SECTION 01 12 00 MULTIPLE CONTRACT SUMMARY

PART 1–GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.
- B. Specific requirements for work of each contract are also indicated in individual Specification Sections and on Drawings.
- C. Related Sections:
 - 1. Division 01 Section “Summary” for the Work covered by the Contract Documents, restrictions on use of the Project site, coordination with occupants, and work restrictions.
 - 2. Division 01 Section “Project Management and Coordination” for general coordination requirements.

1.03 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

1.01 PROJECT COORDINATOR

- A. Project coordinator shall be responsible for coordination between the General Construction Contracts, Plumbing Contract, HVAC Contract, Electrical Contract, and any other specialty contracts required.
- B. Mechanical/electrical coordinator, who shall be under the direction of the Project coordinator, shall be responsible for coordination between the Plumbing Contract, HVAC Contract, Electrical Contract, and any other specialty contracts required.
 - 1. Electrical Contractor shall act as mechanical/electrical coordinator. Mechanical/electrical coordinator shall be licensed to practice as a professional engineer in location of Project.

1.05 COORDINATION ACTIVITIES

- A. Coordination activities of Project coordinator include, but are not limited to, the following:
 - 1. Provide overall coordination of the Work.
 - 2. Coordinate shared access to workspaces.
 - 3. Coordinate product selections for compatibility.
 - 4. Provide overall coordination of temporary facilities and controls.
 - 5. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.

6. Coordinate construction and operations of the Work with work performed by each Contract, separate contracts, and Owner's construction forces.
 7. Prepare coordination drawings in collaboration with each contractor to coordinate work by more than one contract.
 8. Coordinate sequencing and scheduling of the Work. Include the following:
 - a. Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.
 - b. Prepare a combined Contractors' construction schedule for entire Project. Base schedule on preliminary construction schedule. Secure time commitments for performing critical construction activities from contractors. Show activities of each contract on a separate sheet. Prepare a simplified summary sheet indicating combined construction activities of contracts.
 - 1) Submit schedules for approval.
 - 2) Distribute copies of approved schedules to contractors.
 9. Provide photographic documentation.
 10. Provide quality-assurance and quality-control services specified in Division 01 Section "Quality Requirements."
 11. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.
 12. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
 13. Locate existing permanent benchmarks, control points, and similar reference points, and establish permanent benchmarks on Project site.
 14. Provide field surveys of in-progress construction and site work and final property survey.
 15. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.
 16. Coordinate cutting and patching.
 17. Coordinate protection of the Work.
 18. Coordinate firestopping.
 19. Coordinate completion of interrelated punch list items.
 20. Coordinate preparation of Project record documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
 21. Print and submit record documents if installations by more than one contractor are indicated on the same contract drawing or shop drawing.
 22. Collect record Specification Sections from contractors, collate Sections into numeric order, and submit complete set.
 23. Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
- B. Responsibilities of Project coordinator for temporary facilities and controls include, but are not limited to, the following:

1. Provide common-use field office for use by all personnel engaged in construction activities.
2. Provide telephone and internet service for common-use facilities.

1.06 GENERAL REQUIREMENTS OF CONTRACTS

- A. Extent of Contract: Unless the Agreement contains a more specific description of the work, requirements indicated on Drawings and in Specification Sections determine which contract includes a specific element of Project.
1. Unless otherwise indicated, the work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.
 2. Trenches and other excavation for the work of each contract shall be the work of the General Construction Contract.
 3. Blocking, backing panels, sleeves, and metal fabrication supports for the work of each contract shall be the work of the General Construction Contract.
 4. Furnishing of access panels for the work of each contract shall be the work of each contract for its own work. Installation of access panels shall be the work of the General Construction Contract.
 5. Equipment pads for the work of each contract shall be the work of the General Construction Contract.
 6. Roof-mounted equipment curbs for the work of each contract shall be the work of the General Construction Contract.
 7. Painting for the work of each contract shall be the work of the General Construction Contract.
 8. Cutting and Patching: Provided by the General Construction Contract.
 9. Through-penetration firestopping for the work of each contract shall be provided by each contract for its own work.
 10. Contractors' Preliminary Construction Schedule: Within five working days after preliminary horizontal bar-chart-type construction schedule submittal has been received from Project coordinator, submit a matching preliminary horizontal bar-chart schedule showing construction operations sequenced and coordinated with overall construction.
- B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the work.
1. Project coordinator shall coordinate substitutions.
- C. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Division 01 Section "Temporary Facilities and Controls," each contractor is responsible for the following:
1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.
 2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 3. Its own storage and fabrication sheds.
 4. Temporary enclosures for its own construction activities.
 5. Staging and scaffolding for its own construction activities.



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6. General hoisting facilities for its own construction activities, up to 2 tons (2000 kg).
 7. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
 8. Progress cleaning of work areas affected by its operations on a daily basis.
 9. Secure lockup of its own tools, materials, and equipment.
 10. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
- D. Temporary Heating, Cooling, and Ventilation: Project coordinator is responsible for temporary heating, cooling, and ventilation before weathertight enclosure of building is complete. Project coordinator is responsible for temporary heating, cooling, and ventilation after permanent enclosure of building is complete and Owner will pay utility-use charges.
- E. Use Charges: Comply with the following:
1. Sewer Service: Include the cost for sewer service use by all parties engaged in construction activities at Project site in the General Construction Contract.
 2. Water Service: Include the cost for water service, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site in the General Construction Contract.
 3. Electric Power Service: Include the cost for electric power service, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site in the General Construction Contract.

1.07 GENERAL CONSTRUCTION CONTRACT

- A. Work in the General Construction Contract includes, but is not limited to, the following:
1. Remaining work not identified as work under other contracts.
 2. Site preparation, including clearing, building demolition and relocations, and earthwork.
 3. Site improvements, including roadways, parking lots, pedestrian paving, site development furnishings and equipment, and landscaping.
 4. Tunnels for site utilities.
 5. Selective demolition.
 6. Foundations, including footings, foundation walls, and piles.
 7. Slabs-on-grade, including earthwork, subdrainage systems, and insulation.
 8. Below-grade building construction, including excavation, backfill, and thermal and moisture protection.
 9. Superstructure, including floor and roof construction.
 10. Exterior closure, including walls, parapets, doors, windows, and screens.
 11. Roofing, including coverings, flashings, and roof specialties.
 12. Interior construction, including partitions, doors, and fittings.
 13. Fire-protection specialties.
 14. Stairs, including railings and finishes.



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15. Interior finishes, finish carpentry, architectural woodwork, and built-in casework.
 16. Miscellaneous items, including concrete equipment bases and painting of mechanical and electrical work.
 17. Equipment, including the following:
 - a. Residential appliances.
 - b. Solar thermal and photovoltaic systems.
 18. Furnishings, including casework, window treatments, floor grilles and mats, and furniture.
- B. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:
1. Temporary facilities and controls that are not otherwise specifically assigned to the Plumbing Contract, HVAC Contract, or Electrical Contract.
 2. Sediment and erosion control.
 3. Unpiped sewers and drainage, including drainage ditches, dry wells, stabilization ponds, and containers.
 4. Stormwater control.
 5. Unpiped temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
 6. Temporary enclosure for building exterior, except as indicated.
 7. Temporary roads and paved areas.
 8. Dewatering facilities and drains.
 9. Excavation support and protection, unless required solely for the Work of another contract.
 10. Special or unusual hoisting requirements for construction activities, including hoisting loads in excess of 2 tons (2000 kg), hoisting material or equipment into spaces below grade, and hoisting requirements outside building enclosure.
 11. Project identification and temporary signs.
 12. General waste disposal facilities.
 13. Pest control.
 14. Temporary stairs.
 15. Temporary fire-protection facilities.
 16. Barricades, warning signs, and lights.
 17. Site enclosure fence.
 18. Covered walkways.
 19. Security enclosure and lockup.
 20. Environmental protection.
 21. Restoration of Owner's existing facilities used as temporary facilities.

1.08 PLUMBING CONTRACT

A. Work in the Plumbing Contract includes, but is not limited to, the following:

1. Site water supply and distribution.
2. Site sanitary sewerage.
3. Site storm drainage.
4. Site special plumbing systems.
5. Plumbing fixtures.
6. Domestic water distribution.
7. Sanitary waste.
8. Stormwater drainage.
9. Special plumbing systems, including the following:
 - a. Pools and fountains.
 - b. Grey water collection system and storage tanks.
 - c. Solar thermal hot-water collection and distribution systems.
10. Fire-suppression systems.
11. Plumbing connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC Contract, and Electrical Contract.

B. Temporary facilities and controls in the Plumbing Contract include, but are not limited to, the following:

1. Piped sewerage and drainage.
2. Piped gas service.
3. Piped water service.
4. Piped temporary toilet fixtures, wash facilities, and drinking water facilities.
5. Plumbing connections to existing systems and temporary facilities and controls furnished by the General Construction Contract, Plumbing Contract, HVAC Contract, and Electrical Contract.

1.09 HVAC CONTRACT

A. Work in the HVAC Contract includes, but is not limited to, the following:

1. Site hydronic distribution.
2. HVAC systems and equipment.
3. HVAC instrumentation and controls.
4. HVAC testing, adjusting, and balancing.



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5. Building automation system.
6. Mechanical connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC Contract, and Electrical Contract.

1.10 ELECTRICAL CONTRACT

A. Work in the Electrical Contract includes, but is not limited to, the following:

1. Site electrical distribution.
2. Site lighting.
3. Site communications and security.
4. Electrical service and distribution.
5. Exterior and interior lighting and light pole bases.
6. Communication and security.
7. Special electrical systems, including the following:
 8. Uninterruptible power supply systems.
 9. Packaged engine generator systems.
 10. Battery power systems.
 11. Cathodic protection.
 12. Electromagnetic shielding systems.
 13. Lightning protection systems.
 14. Unit power conditioners.
 15. Power generation systems.
16. Electrical connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC Contract, and Electrical Contract.

B. Temporary facilities and controls in the Electrical Contract include, but are not limited to, the following:

1. Electric power service and distribution.
2. Lighting, including site lighting.
3. Electrical connections to existing systems and temporary facilities and controls furnished by the General Construction Contract, Plumbing Contract, HVAC Contract, and Electrical Contract.

END OF SECTION 01 12 00



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SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Administrative and supervisory personnel.
 - 3. Coordination drawings.
 - 4. Requests for Information (RFIs).
 - 5. Project Web site.
 - 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Sections:
 - 1. Division 01 Section “Multiple Contract Summary” for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
 - 2. Division 01 Section “Construction Progress Documentation” for preparing and submitting Contractor’s construction schedule.
 - 3. Division 01 Section “Execution” for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 4. Division 01 Section “Closeout Procedures” for coordinating closeout of the Contract.
 - 5. Division 01 Section “General Commissioning Requirements” for coordinating the Work with Owner’s commissioning authority.

1.03 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.04 COORDINATION

- A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.05 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

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- d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Fire Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the

coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.

- C. Coordination Digital Data Files: Prepare coordination digital data files in accordance with the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as the original Drawings.
 2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and in Portable Data File (PDF) format.
 3. Architect will furnish Contractor one set of digital data files of the Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to the Drawings.
 - b. Digital Data Software Program: The Drawings are available in AutoCAD 2007 format.
 - c. Contractor shall execute a data licensing agreement in the form of AIA Document C106 or an Agreement form acceptable to the Owner and Architect.

1.06 KEY PERSONNEL

- A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.01 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.

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6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or software-generated form with substantially the same content, acceptable to Architect.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B. or software log with not less than the following:
1. Project name.
 2. Name and address of Contractor.

3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.08 PROJECT WEB SITE

- A. Use Owner's Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:
 1. Project directory.
 2. Project correspondence.
 3. Meeting minutes.
 4. Contract modifications forms and logs.
 5. RFI forms and logs.
 6. Task and issue management.
 7. Photo documentation.
 8. Schedule and calendar management.
 9. Submittals forms and logs.
 10. Payment application forms.
 11. Drawing and specification document hosting, viewing, and updating.
 12. Online document collaboration.
 13. Reminder and tracking functions.
 14. Archiving functions.
- B. Provide up to seven Project Web site user licenses for use of the Owner, Owner's Commissioning Authority, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for Project Web site users.
- C. Upon completion of Project, provide two complete archive copies of Project Web site files to Owner and to Architect in a digital storage format acceptable to the Architect.
- D. Provide one of the following Project Web site software packages under their current published licensing agreements:
 1. Autodesk, Buzzsaw.
 2. Autodesk, Constructware.
 3. Meridian Systems, Prolog and ProjectTalk.

- E. Contractor, subcontractors, and other parties granted access by the Contractor to project Web site shall execute a data licensing agreement in the form of AIA Document C106 or another form of Agreement acceptable to the Owner and Architect.

1.09 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Sustainable design requirements.
 - m. Preparation of record documents.
 - n. Use of the premises and existing building.
 - o. Work restrictions.

- p. Working hours.
 - q. Owner's occupancy requirements.
 - r. Responsibility for temporary facilities and controls.
 - s. Procedures for moisture and mold control.
 - t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. First aid.
 - z. Security.
 - aa. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority, of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.

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- n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing sustainable design documentation.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.

- i. Submittal procedures.
 - j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.

- 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings at monthly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.



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- 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

END OF SECTION 01 31 00

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Start-up construction schedule.
 2. Contractor's construction schedule.
 3. Daily construction reports.
 4. Material location reports.
 5. Field condition reports.
 6. Special reports.
- B. Related Sections:
1. Division 01 Section "Multiple Contract Summary" for preparing a combined Contractor's Construction Schedule.
 2. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
 3. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.03 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 2. Predecessor Activity: An activity that precedes another activity in the network.
 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.

- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.04 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Three paper copies and an electronic file in PDF format.
- B. Start-up construction schedule.
 - 1. Approval of cost-loaded start-up construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Start-up Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Material Location Reports: Submit at monthly intervals.
- H. Field Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.

1.05 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
1. Review software limitations and content and format for reports.
 2. Verify availability of qualified personnel needed to develop and update schedule.
 3. Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial Owner occupancy.
 4. Review delivery dates for Owner-furnished products.
 5. Review schedule for work of Owner's separate contracts.
 6. Review time required for review of submittals and resubmittals.
 7. Review requirements for tests and inspections by independent testing and inspecting agencies.
 8. Review time required for completion and startup procedures.
 9. Review and finalize list of construction activities to be included in schedule.
 10. Review submittal requirements and procedures.
 11. Review procedures for updating schedule.

1.06 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from entities involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2-PRODUCTS**2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL**

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 10 days, unless specifically allowed by Architect.
 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

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3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section “Submittal Procedures” in schedule. Coordinate submittal review times in Contractor’s construction schedule with submittal schedule.
 4. Startup and Testing Time: Include not less than 15 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect’s administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section “Summary.” Delivery dates indicated stipulate the earliest possible delivery date.
 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section “Summary.” Delivery dates indicated stipulate the earliest possible delivery date.
 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.

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- h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Completion of solar panel installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered RFIs.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.02 START-UP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit start-up horizontal bar-chart-type construction schedule within seven 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. Outline significant construction activities for first 20 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.03 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's construction schedule within 10 days of date established for commencement of the Work. Base schedule on the start-up construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.04 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Start-up Network Diagram: Submit diagram within 10 days of date established for commencement of the Work. Outline significant construction activities for the first 20 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 20 days after date established for commencement of the Work.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to correlate with Contract Time. Contract Time is defined as calendar days.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the start-up network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.

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- h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, LEED documentation, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
 - E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
 - F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Principal events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).

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- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.05 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (refer to special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.

13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.06 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3—EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.



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- C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - a. Post copies in Project meeting rooms and temporary field offices.
 - b. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections:
 - 1. Division 01 Section “Payment Procedures” for submitting Applications for Payment and the schedule of values.
 - 2. Division 01 Section “Construction Progress Documentation” for submitting schedules and reports, including Contractor’s construction schedule.
 - 3. Division 01 Section “Operation and Maintenance Data” for submitting operation and maintenance manuals.
 - 4. Division 01 Section “Project Record Documents” for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Division 01 Section “Demonstration and Training” for submitting video recordings of demonstration of equipment and training of Owner’s personnel.

1.03 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect’s responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect’s responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.04 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor’s construction schedule.

2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action, informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled dates for installation.
 - i. Activity or event number.

1.05 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD 2007.
 - c. Contractor shall execute a data licensing agreement in the form of AIA Document C106 or an Agreement form acceptable to the Owner and Architect.
 - d. The following plot files will be furnished for each appropriate discipline:
 - 1) Floor plans.
 - 2) Reflected ceiling plans.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

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3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. 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.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 20 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.

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- k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Include the following information on an inserted cover sheet:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Related physical samples submitted directly.
 - m. Other necessary identification.
 5. Include the following information as keywords in the electronic file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- F. Options: Identify options requiring selection by the Architect.
- G. Deviations: Identify deviations from the Contract Documents on submittals.
- H. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

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- I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
1. Transmittal Form: Use AIA Document G810 or alternate format acceptable to Architect. Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Specification Section number and title.
 - i. Indication of full or partial submittal.
 - j. Drawing number and detail references, as appropriate.
 - k. Transmittal number, numbered consecutively.
 - l. Submittal and transmittal distribution record.
 - m. Remarks.
 - n. Signature of transmitter.
 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- L. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2–PRODUCTS

2.01 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files. If PDF files exceed 5 MB and/or are not able to be transmitted via email, post electronic submittal files directly to Project Web site and/or Architect's FTP site specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Action Submittals: Submit two paper copies of each submittal, unless otherwise indicated. Architect will return one copy.
 3. Informational Submittals: Submit two paper copies of each submittal, unless otherwise indicated. Architect will not return copies.
 4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
 5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
 6. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.

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- c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. Two paper copies of Product Data, unless otherwise indicated. Architect will return one copy.
- C. 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, unless submittal based upon Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (750 by 1067 mm).
 3. Submit Shop Drawings in the following format:
 - a. Two opaque (bond) copies of each submittal. Architect will return one copy.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

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- b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
 - E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file and two paper copies of product schedule or list, unless otherwise indicated. Architect will return one copy.
 - F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
 - G. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
 - H. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
 - I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.

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3. Drawing number and detail references, as appropriate, covered by subcontract.
 4. Submit subcontract list in the following format:
 - a. PDF electronic file.
 - b. Number of Copies: Two paper copies of subcontractor list, unless otherwise indicated. Architect will return one copy.
 - J. Coordination Drawings: Comply with requirements specified in Division 01 Section “Project Management and Coordination.”
 - K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
 - L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.
 - M. Installer Certificates: Submit written statements on manufacturer’s letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - N. Manufacturer Certificates: Submit written statements on manufacturer’s letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - O. Product Certificates: Submit written statements on manufacturer’s letterhead certifying that product complies with requirements in the Contract Documents.
 - P. Material Certificates: Submit written statements on manufacturer’s letterhead certifying that material complies with requirements in the Contract Documents.
 - Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency’s standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - R. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
 - S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers’ names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
 - T. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section “Quality Requirements.”

- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.02 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 Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, 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.

PART 3—EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: 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. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.



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- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. 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. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections:
 - 1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 2. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.
- C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size, physical assemblies constructed at testing facility to verify performance characteristics.
 - 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on the project site, consisting of multiple products, assemblies and subassemblies.

- D. **Preconstruction Testing:** Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. **Product Testing:** Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. **Source Quality-Control Testing:** Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. **Field Quality-Control Testing:** Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. **Testing Agency:** An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. **Installer/Applicator/Erector:** Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.
- J. **Experienced:** When used with an entity or individual, “experienced” means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 CONFLICTING REQUIREMENTS

- A. **Referenced Standards:** If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.05 ACTION SUBMITTALS

- A. **Shop Drawings:** For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.06 INFORMATIONAL SUBMITTALS

- A. **Contractor’s Quality-Control Plan:** For quality-assurance and quality-control activities and responsibilities.
- B. **Contractor’s Quality-Control Manager Qualifications:** For supervisory personnel.
- C. **Contractor’s Statement of Responsibility:** When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.

1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.
 2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.
- D. Testing Agency Qualifications: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
 2. Entity responsible for performing tests and inspections.
 3. Description of test and inspection.
 4. Identification of applicable standards.
 5. Identification of test and inspection methods.
 6. Number of tests and inspections required.
 7. Time schedule or time span for tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.

1.07 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the “Statement of Special Inspections.”
 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective

actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

- F. **Monitoring and Documentation:** Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.08 REPORTS AND DOCUMENTS

- A. **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. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. **Manufacturer's Technical Representative's Field Reports:** Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.

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- C. **Factory-Authorized Service Representative's Reports:** Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. **Permits, Licenses, and Certificates:** For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.09 QUALITY ASSURANCE

- A. **General:** Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. **Specialists:** Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. **Testing Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. **NRTL:** A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. **NVLAP:** A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

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- I. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
 - J. **Preconstruction Testing:** Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.
 - 2. **Testing Agency Responsibilities:** Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - K. **Mockups:** Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed, unless otherwise indicated.
 - L. **Integrated Exterior Mockups:** Construct integrated exterior mockup in accordance with approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual specification sections, along with supporting materials.
 - M. **Laboratory Mockups:** Comply with requirements of preconstruction testing and those specified in individual Specification Sections in Divisions 02 through 49.

1.10 QUALITY CONTROL

- A. **Owner Responsibilities:** Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.



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1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. 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.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. 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. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. 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.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency and/or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected work.



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PART 2–PRODUCTS (NOT USED)

PART 3–EXECUTION

3.01 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00
REFERENCES**PART 1—GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. “Approved”: When used to convey Architect’s action on Contractor’s submittals, applications, and requests, “approved” is limited to Architect’s duties and responsibilities as stated in the Conditions of the Contract.
- C. “Directed”: A command or instruction by Architect. Other terms including “requested,” “authorized,” “selected,” “required,” and “permitted” have the same meaning as “directed.”
- D. “Indicated”: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including “shown,” “noted,” “scheduled,” and “specified” have the same meaning as “indicated.”
- E. “Regulations”: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. “Furnish”: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. “Install”: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. “Provide”: Furnish and install, complete and ready for the intended use.
- I. “Project Site”: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aEIC.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955

AHRI	Air-Conditioning, Heating, and Refrigeration Institute	(703) 524-8800
	www.ahrinet.org	
AI	Asphalt Institute	(859) 288-4960
	www.asphaltinstitute.org	
AIA	American Institute of Architects (The)	(800) 242-3837
	www.aia.org	(202) 626-7300
AISC	American Institute of Steel Construction	(800) 644-2400
	www.aisc.org	(312) 670-2400
AISI	American Iron and Steel Institute	(202) 452-7100
	www.steel.org	
AITC	American Institute of Timber Construction	(303) 792-9559
	www.aitc-glulam.org	
ALSC	American Lumber Standard Committee, Incorporated	(301) 972-1700
	www.alsc.org	
AMCA	Air Movement and Control Association International, Inc.	(847) 394-0150
	www.amca.org	
ANSI	American National Standards Institute	(202) 293-8020
	www.ansi.org	
AOSA	Association of Official Seed Analysts, Inc.	(405) 780-7372
	www.aosaseed.com	
APA	Architectural Precast Association	(239) 454-6989
	www.archprecast.org	
APA	APA - The Engineered Wood Association	(253) 565-6600
	www.apawood.org	
API	American Petroleum Institute	(202) 682-8000
	www.api.org	
ARI	Air-Conditioning & Refrigeration Institute (Now AHRI)	
ARMA	Asphalt Roofing Manufacturers Association	(202) 207-0917
	www.asphaltroofing.org	



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ASCE	American Society of Civil Engineers	(800) 548-2723
	www.asce.org	(703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	(800) 527-4723
	www.ashrae.org	(404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International)	(800) 843-2763 (973) 882-1170
	www.asme.org	
ASSE	American Society of Safety Engineers	(847) 699-2929
	www.asse.org	
ASSE	American Society of Sanitary Engineering	(440) 835-3040
	www.asse-plumbing.org	
ASTM	ASTM International (American Society for Testing and Materials International)	(610) 832-9500
	www.astm.org	
ATIS	Alliance for Telecommunications Industry Solutions	(202) 628-6380
	www.atis.org	
AWCI	Association of the Wall and Ceiling Industry	(703) 534-8300
	www.awci.org	
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWI	Architectural Woodwork Institute	(571) 323-3636
	www.awinet.org	
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association)	(205) 733-4077
	www.awpa.com	
AWS	American Welding Society	(800) 443-9353 (305) 443-9353
	www.aws.org	
AWWA	American Water Works Association	(800) 926-7337
	www.awwa.org	(303) 794-7711



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BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer’s Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation) www.internationalbadminton.org	6-03-9283 7155
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919

CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(703) 724-1128
CPPA	Corrugated Polyethylene Pipe Association www.plasticpipe.org	(800) 510-2772 (202) 462-9607
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010



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ECA	Electronic Components Association	(703) 907-8024
	www.ec-central.org	
EIA	Electronic Industries Alliance	(703) 907-7500
	www.eia.org	
EIMA	EIFS Industry Members Association	(800) 294-3462
	www.eima.com	(770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee	(703) 295-5000
	www.ejdc.org	
EJMA	Expansion Joint Manufacturers Association, Inc.	(914) 332-0040
	www.ejma.org	
ESD	ESD Association	(315) 339-6937
	(Electrostatic Discharge Association)	
	www.esda.org	
ETL SEMCO	Intertek ETL SEMCO	(800) 967-5352
	(Formerly: ITS - Intertek Testing Service NA)	
	www.intertek-etlsemko.com	
FIBA	Federation Internationale de Basketball	41 22 545 00 00
	(The International Basketball Federation)	
	www.fiba.com	
FIVB	Federation Internationale de Volleyball	41 21 345 35 35
	(The International Volleyball Federation)	
	www.fivb.org	
FM Approvals	FM Approvals LLC	(781) 762-4300
	www.fmglobal.com	
FM Global	FM Global	(401) 275-3000
	(Formerly: FMG - FM Global)	
	www.fmglobal.com	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.	(407) 671-3772
	www.floridarroof.com	
FSA	Fluid Sealing Association	(610) 971-4850
	www.fluidsealing.com	



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FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation (Now BWF)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830

IEC	International Electrotechnical Commission	41 22 919 02 11
	www.iec.ch	
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)	(212) 419-7900
	www.ieee.org	
IES	Illuminating Engineering Society	(212) 248-5000
	www.ies.org	
IESNA	Illuminating Engineering Society of North America (Now IES)	
IEST	Institute of Environmental Sciences and Technology	(847) 981-0100
	www.iest.org	
IGCC	Insulating Glass Certification Council	(315) 646-2234
	www.igcc.org	
IGMA	Insulating Glass Manufacturers Alliance	(613) 233-1510
	www.igmaonline.org	
ILI	Indiana Limestone Institute of America, Inc.	(812) 275-4426
	www.iliai.com	
ISO	International Organization for Standardization	41 22 749 01 11
	www.iso.ch	
	Available from ANSI	(202) 293-8020
	www.ansi.org	
ISSFA	International Solid Surface Fabricators Association	(877) 464-7732
	www.issfa.net	(702) 567-8150
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union	41 22 730 51 11
	www.itu.int/home	
KCMA	Kitchen Cabinet Manufacturers Association	(703) 264-1690
	www.kcma.org	
LPI	Lightning Protection Institute	(800) 488-6864
	www.lightning.org	

MBMA	Metal Building Manufacturers Association	(216) 241-7333
	www.mbma.com	
MFMA	Maple Flooring Manufacturers Association, Inc.	(888) 480-9138
	www.maplefloor.org	
MFMA	Metal Framing Manufacturers Association, Inc.	(312) 644-6610
	www.metalframingmfg.org	
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America	(800) 345-1815
	www.mhia.org	(704) 676-1190
MIA	Marble Institute of America	(440) 250-9222
	www.marble-institute.com	
MPI	Master Painters Institute	(888) 674-8937
	www.paintinfo.com	(604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.	(703) 281-6613
	www.mss-hq.com	
NAAMM	National Association of Architectural Metal Manufacturers	(630) 942-6591
	www.naamm.org	
NACE	NACE International (National Association of Corrosion Engineers International)	(800) 797-6623 (281) 228-6200
	www.nace.org	
NADCA	National Air Duct Cleaners Association	(202) 737-2926
	www.nadca.com	
NAGWS	National Association for Girls and Women in Sport	(800) 213-7193, ext. 453
	www.aahperd.org/nagws/	(703) 476-3400
NAIMA	North American Insulation Manufacturers Association	(703) 684-0084
	www.naima.org	
NBGQA	National Building Granite Quarries Association, Inc.	(800) 557-2848
	www.nbgqa.com	



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NCAA	National Collegiate Athletic Association (The)	(317) 917-6222
	www.ncaa.org	
NCMA	National Concrete Masonry Association	(703) 713-1900
	www.ncma.org	
NCPI	National Clay Pipe Institute	(262) 248-9094
	www.ncpi.org	
NCTA	National Cable & Telecommunications Association	(202) 775-2300
	www.ncta.com	
NEBB	National Environmental Balancing Bureau	(301) 977-3698
	www.nebb.org	
NECA	National Electrical Contractors Association	(301) 657-3110
	www.necanet.org	
NeLMA	Northeastern Lumber Manufacturers' Association	(207) 829-6901
	www.nelma.org	
NEMA	National Electrical Manufacturers Association	(703) 841-3200
	www.nema.org	
NETA	InterNational Electrical Testing Association	(888) 300-6382
	www.netaworld.org	(269) 488-6382
NFHS	National Federation of State High School Associations	(317) 972-6900
	www.nfhs.org	
NFPA	NFPA	(800) 344-3555
	(National Fire Protection Association)	(617) 770-3000
	www.nfpa.org	
NFRC	National Fenestration Rating Council	(301) 589-1776
	www.nfrc.org	
NGA	National Glass Association	(866) 342-5642
	www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association	(800) 933-0318
	www.natlhardwood.org	(901) 377-1818
NLGA	National Lumber Grades Authority	(604) 524-2393
	www.nlga.org	



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NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWFA	National Wood Flooring Association www.woodfloors.org	(800) 422-4556 (636) 519-9663
NWWDA	National Wood Window and Door Association (Now WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.cee.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network www.landcarenetwork.org	(800) 395-2522 (703) 736-9666

PTI	Post-Tensioning Institute	(602) 870-7540
	www.post-tensioning.org	
RCSC	Research Council on Structural Connections	
	www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute	(301) 340-8580
	www.rfci.com	
RIS	Redwood Inspection Service	(925) 935-1499
	www.redwoodinspection.com	
SAE	SAE International	(877) 606-7323
	www.sae.org	(724) 776-4841
SCTE	Society of Cable Telecommunications Engineers	(800) 542-5040
	www.scte.org	(610) 363-6888
SDI	Steel Deck Institute	(847) 458-4647
	www.sdi.org	
SDI	Steel Door Institute	(440) 899-0010
	www.steeldoor.org	
SEFA	Scientific Equipment and Furniture Association	(877) 294-5424
	www.sefalabs.com	(516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council	(315) 646-2234
	www.sgcc.org	
SIA	Security Industry Association	(866) 817-8888
	www.siaonline.org	(703) 683-2075
SJI	Steel Joist Institute	(843) 626-1995
	www.steeljoist.org	
SMA	Screen Manufacturers Association	(561) 533-0991
	www.smainfo.org	
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association	(703) 803-2980
	www.smacna.org	

SMPTE	Society of Motion Picture and Television Engineers	(914) 761-1100
	www.smpte.org	
SPFA	Spray Polyurethane Foam Alliance	(800) 523-6154
	www.sprayfoam.org	
SPIB	Southern Pine Inspection Bureau	(850) 434-2611
	www.spib.org	
SPRI	Single Ply Roofing Industry	(781) 647-7026
	www.spri.org	
SSINA	Specialty Steel Industry of North America	(800) 982-0355
	www.ssina.com	(202) 342-8630
SSPC	SSPC: The Society for Protective Coatings	(877) 281-7772
	www.sspc.org	(412) 281-2331
STI	Steel Tank Institute	(847) 438-8265
	www.steeltank.com	
SWI	Steel Window Institute	(216) 241-7333
	www.steelwindows.com	
SWRI	Sealant, Waterproofing, & Restoration Institute	(816) 472-7974
	www.swrionline.org	
TCNA	Tile Council of North America, Inc.	(864) 646-8453
	www.tileusa.com	
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance	(703) 907-7700
	www.tiaonline.org	
TMS	The Masonry Society	(303) 939-9700
	www.masonrysociety.org	
TPI	Truss Plate Institute, Inc.	(703) 683-1010
	www.tpinst.org	
TPI	Turfgrass Producers International	(800) 405-8873
	www.turfgrassod.org	(847) 649-5555
TRI	Tile Roofing Institute	(312) 670-4177
	www.tilerroofing.org	



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UL	Underwriters Laboratories Inc.	(877) 854-3577
	www.ul.com	(847) 272-8800
UNI	Uni-Bell PVC Pipe Association	(972) 243-3902
	www.uni-bell.org	
USAV	USA Volleyball	(888) 786-5539
	www.usavolleyball.org	(719) 228-6800
USGBC	U.S. Green Building Council	(800) 795-1747
	www.usgbc.org	
USITT	United States Institute for Theatre Technology, Inc.	(800) 938-7488
	www.usitt.org	(315) 463-6463
WASTEC	Waste Equipment Technology Association	(800) 424-2869
	www.wastec.org	(202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau	(800) 283-1486
	www.wclib.org	(503) 639-0651
WCMA	Window Covering Manufacturers Association	(212) 297-2122
	www.wcmanet.org	
WCSC	Window Covering Safety Council	(800) 506-4636
	www.windowcoverings.org	(212) 297-2109
WDMA	Window & Door Manufacturers Association	(800) 223-2301
	www.wdma.com	(847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)	(916) 372-9943
	www.wicnet.org	
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association	(800) 550-7889
	www.wmmpa.com	(530) 661-9591
WSRCA	Western States Roofing Contractors Association	(800) 725-0333
	www.wsrca.com	(650) 570-5441
WWPA	Western Wood Products Association	(503) 224-3930
	www.wwpa.org	

- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DIN	Deutsches Institut für Normung e.V. www.din.de	49 30 2601-0
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
UBC	Uniform Building Code (See ICC)	

- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322

FCC	Federal Communications Commission	(888) 225-5322
	www.fcc.gov	
FDA	Food and Drug Administration	(888) 463-6332
	www.fda.gov	
GSA	General Services Administration	(800) 488-3111
	www.gsa.gov	
HUD	Department of Housing and Urban Development	(202) 708-1112
	www.hud.gov	
LBL	Lawrence Berkeley National Laboratory	(510) 486-4000
	www.lbl.gov	
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology	(301) 975-6478
	www.nist.gov	
OSHA	Occupational Safety & Health Administration	(800) 321-6742
	www.osha.gov	(202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science	(202) 690-7694
	www.hhs.gov/ophs	
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department	(202) 647-4000
	www.state.gov	
TRB	Transportation Research Board	(202) 334-2934
	http://gulliver.trb.org	
USDA	Department of Agriculture	(202) 720-2791
	www.usda.gov	
USPS	Postal Service	(202) 268-2000
	www.usps.com	

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
	Architectural Barriers Act (ABA)	(202) 272-0080
	Accessibility Guidelines for Buildings and Facilities	
	Available from U.S. Access Board	
	www.access-board.gov	
CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	
DOD	Department of Defense Military Specifications and Standards	(215) 697-2664
	Available from Department of Defense Single Stock Point	
	http://dodssp.daps.dla.mil	
DSCC	Defense Supply Center Columbus	
	(See FS)	
FED-STD	Federal Standard	
	(See FS)	
FS	Federal Specification	(215) 697-2664
	Available from Department of Defense Single Stock Point	
	http://dodssp.daps.dla.mil	
	Available from Defense Standardization Program	
	www.dps.dla.mil	
	Available from General Services Administration	(202) 619-8925
	www.gsa.gov	
	Available from National Institute of Building Sciences	(202) 289-7800
	www.wbdg.org/ccb	
FTMS	Federal Test Method Standard	
	(See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	

MILSPEC	Military Specification and Standards	(215) 697-2664
	Available from Department of Defense Single Stock Point	
	http://dodssp.daps.dla.mil	
UFAS	Uniform Federal Accessibility Standards	(800) 872-2253
	Available from Access Board	(202) 272-0080
	www.access-board.gov	

- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation	(800) 952-5210
	www.dca.ca.gov/bhfti	(916) 574-2041
CCR	California Code of Regulations	(916) 323-6815
	www.calregs.com	
CDHS	California Department of Health Services	
	(See CDPH)	
CDPH	California Department of Public Health, Indoor Air Quality Section	(510) 620-2802
	www.cal-iaq.org	
CPUC	California Public Utilities Commission	(415) 703-2782
	www.cpuc.ca.gov	
TFS	Texas Forest Service	(979) 458-6650
	Forest Resource Development	
	http://txforestservation.tamu.edu	

END OF SECTION 01 42 00

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Sections:
 - 1. Division 01 Section “Summary” for work restrictions and limitations on utility interruptions.
 - 2. Division 31 Section “Dewatering” for disposal of ground water at Project site.
 - 3. Division 32 Section “Concrete Paving” for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.03 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner’s construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner’s existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner’s existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.04 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.
 - 1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

D. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of the work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air filtration system discharge.
4. Other dust-control measures.
5. Waste management plan.

1.05 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.06 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2-PRODUCTS

2.01 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.
- B. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

2.02 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
 3. Drinking water and private toilet.
 4. Coffee machine and supplies.

5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
 6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
- D. Store combustible materials apart from building.

2.03 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures."

PART 3—EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

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- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Generators are permitted to power tools and construction lights during stand-alone assembly and stand-alone disassembly. Engine generators shall meet the National Park Service (NPS) noise regulation stated in 36CFR2.12. This regulation allows a maximum 60 dB (A) at 50 ft (15 m) under full load.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Install lighting for Project identification sign.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Processor: Intel Pentium D or Intel CoreDuo, 1.8 GHz processing speed.

2. Memory: 2 gigabyte.
3. Disk storage: 80 gigabyte hard disk drive and combination DVD-RW/CD-RW drive.
4. Display: 19-inch (480-mm) LCD monitor with 128 Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet.
7. Operating System: Microsoft Windows XP Professional or Microsoft Windows Vista Business.
8. Productivity Software:
 - a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.
 - b. Adobe Reader 7.0 or higher.
 - c. WinZip 7.0 or higher.
9. Printer: “All-in-one” unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these 3 functions.
10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing and spam protection in a combined application.
12. Backup: External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

3.03 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Use designated areas of Owner’s existing parking areas for construction personnel.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

3.03 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 1. Comply with work restrictions specified in Division 01 Section "Summary."
- B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.05 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.

- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.06 OPERATION, TERMINATION, AND REMOVAL

- A. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- B. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.



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2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Sections:
 - 1. Division 01 Section "Substitution Procedures" for requests for substitutions.
 - 2. Division 01 Section "References" for applicable industry standards for products specified.

1.03 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.04 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or

rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval: As specified in Division 01 Section “Submittal Procedures.”
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section “Submittal Procedures.” Show compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer’s written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer’s original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 5. Comply with product manufacturer’s written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 6. Protect stored products from damage and liquids from freezing.

7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.07 PRODUCT WARRANTIES

- A. 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.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2—PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. **Manufacturer/Source:** Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. **Products:**
 - a. **Restricted List:** 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, unless otherwise indicated.
 - b. **Nonrestricted List:** 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 in "Comparable Products" Article for consideration of an unnamed product.
 4. **Manufacturers:**
 - a. **Restricted List:** 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, unless otherwise indicated.
 - b. **Nonrestricted List:** 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 in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. **Basis-of-Design Product:** Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. **Visual Matching Specification:** 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.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.
- D. **Visual Selection Specification:** Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

- A. **Conditions for Consideration:** Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.



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3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

END OF SECTION 01 60 00

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Substantial Completion procedures.
 2. Final completion procedures.
 3. Warranties.
 4. Final cleaning.
- B. Related Sections:
1. Division 01 Section “Execution” for progress cleaning of Project site.
 2. Division 01 Section “Operation and Maintenance Data” for operation and maintenance manual requirements.
 3. Division 01 Section “Project Record Documents” for submitting Record Drawings, Record Specifications, and Record Product Data.
 4. Division 01 Section “Demonstration and Training” for requirements for instructing Owner’s personnel.
 5. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Advise Owner of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer’s name and model number where applicable.

7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 8. Complete startup testing of systems.
 9. Submit test/adjust/balance records.
 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 11. Advise Owner of changeover in heat and other utilities.
 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 13. Complete final cleaning requirements, including touchup painting.
 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.04 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format:
 - a. PDF electronic file.

1.06 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title “WARRANTIES,” Project name, and name of Contractor.
 4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2–PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.



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PART 3–EXECUTION

3.01 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.



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- q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
 - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."

END OF SECTION 01 77 00

SECTION 01 78 23 OPERATION AND MAINTENANCE DATA

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
1. Operation and maintenance documentation directory.
 2. Emergency manuals.
 3. Operation manuals for systems, subsystems, and equipment.
 4. Product maintenance manuals.
 5. Systems and equipment maintenance manuals.
- B. Related Sections:
1. Division 01 Section “Multiple Contract Summary” for coordinating operation and maintenance manuals covering the Work of multiple contracts.
 2. Division 01 Section “Submittal Procedures” for submitting copies of submittals for operation and maintenance manuals.
 3. Division 01 Section “General Commissioning Requirements” for verification and compilation of data into operation and maintenance manuals.
 4. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.03 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Architect.

-
- a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Initial Manual Submittal: Submit draft copy of each manual at least **20** days before commencing demonstration and training. Architect and Commissioning Agent will comment on whether general scope and content of manual are acceptable.
 - D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Agent will return copy with comments.
 1. Correct or modify each manual to comply with Architect's and Commissioning Agent's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Agent's comments and prior to commencing demonstration and training.

PART 2–PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.

-
- B. Title Page: Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Agent.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.03 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.04 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.05 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of

Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- F. **Spare Parts List and Source Information:** Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
- H. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3-EXECUTION

33.01 MANUAL PREPARATION

- A. **Operation and Maintenance Documentation Directory:** Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. **Emergency Manual:** Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.



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- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
- G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 PROJECT RECORD DOCUMENTS

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- B. Section includes administrative and procedural requirements for project record documents, including the following:
1. Record Drawings.
 2. Record Specifications.
 3. Record Product Data.
 4. Miscellaneous record submittals.
- C. Related Sections:
1. Division 01 Section “Multiple Contract Summary” for coordinating project record documents covering the Work of multiple contracts.
 2. Division 01 Section “Execution” for final property survey.
 3. Division 01 Section “Closeout Procedures” for general closeout procedures.
 4. Division 01 Section “Operation and Maintenance Data” for operation and maintenance manual requirements.
 5. Divisions 02 through 49 Sections for specific requirements for project record documents of the Work in those Sections.

1.03 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
1. Number of Copies: Submit one set of marked-up record prints.
- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project’s Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.
1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated in Project record documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2—PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

-
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings, and as annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. Refer to Division 01 Section “Submittal Procedures” for requirements related to use of Architect’s digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation “PROJECT RECORD DRAWING” in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation “PROJECT RECORD DRAWINGS.”
 - d. Name of Architect.
 - e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.
1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART-3 EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

PART 1—GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. OPR and BoD documentation are included by reference for information only.

1.02 SUMMARY

- A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.
- B. Related Sections:
 - 1. Division 01 Section “Facilities Exterior Enclosure Commissioning” for commissioning process activities for building exterior enclosure, roof, and foundation systems, assemblies, equipment, and components.
 - 2. Division 01 Section “Interiors Commissioning” for commissioning process activities for building interiors construction, stairways, and finish systems and assemblies.
 - 3. Division 14 Section “Commissioning of Conveying Equipment” for commissioning process activities for conveying systems, assemblies, equipment, and components.
 - 4. Division 21 Section “Commissioning of Fire Suppression” for commissioning process activities for fire-suppression systems, assemblies, equipment, and components.
 - 5. Division 22 Section “Commissioning of Plumbing” for commissioning process activities for plumbing systems, assemblies, equipment, and components.
 - 6. Division 23 Section “Commissioning of HVAC” for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.
 - 7. Division 25 Section “Commissioning of Integrated Automation” for commissioning process activities for integrated automation systems, assemblies, equipment, and components.
 - 8. Division 26 Section “Commissioning of Electrical Systems” for commissioning process activities for electrical systems, assemblies, equipment, and components.
 - 9. Division 27 Section “Commissioning of Communications” for commissioning process activities for communications systems, assemblies, equipment, and components.
 - 10. Division 28 Section “Commissioning of Electronic Safety and Security” for commissioning process activities for electronic safety and security systems, assemblies, equipment, and components.

1.03 DEFINITIONS

- A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.



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- B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- C. CxA: Commissioning Authority.
- D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.04 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- B. Members Appointed by Owner:
 - 1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
 - 2. Representatives of the facility user and operation and maintenance personnel.
 - 3. Architect and engineering design professionals.

1.05 OWNER'S RESPONSIBILITIES

- A. Provide the OPR documentation to the CxA and each Contractor for information and use.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
- C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
 - 1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 - 2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
 - 3. Attend commissioning team meetings held on a monthly basis.
 - 4. Integrate and coordinate commissioning process activities with construction schedule.
 - 5. Review and accept construction checklists provided by the CxA.
 - 6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.

7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.07 CxA'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Provide commissioning plan.
- C. Convene commissioning team meetings.
- D. Provide Project-specific construction checklists and commissioning process test procedures.
- E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
- F. Prepare and maintain the Issues Log.
- G. Prepare and maintain completed construction checklist log.
- H. Witness systems, assemblies, equipment, and component startup.
- I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

END OF SECTION 01 91 13



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DIVISION 02 – EXISTING CONDITIONS

DIVISION 03 – CONCRETE

DIVISION 04 – MASONRY

DIVISION 05 – METALS

SECTION 05 12 00 STRUCTURAL STEEL

PART 1–GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, Welding Procedure Specifications (WPSs), and mill test reports.
- 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

2.01 STRUCTURAL STEEL

- A. W-Shapes: ASTM A 992/A 992M, Grade 50.
- B. Channels, Angles: ASTM A 36/A 36M, Grade 36.
- C. Plate and Bar: ASTM A 36/A 36M, Grade 36.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

2.02 ACCESSORIES

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325N, Type 1, heavy-hex steel structural bolts.
- B. Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436, Type 1, hardened carbon steel.

- C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
- D. Grout: ASTM C 1107, nonmetallic, shrinkage resistant, factory packaged.

2.03 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 and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
- C. Shop Priming: Prepare surfaces according to SSPC-SP 2, "Hand Tool Cleaning"; or SSPC-SP 3, "Power Tool Cleaning." Shop prime steel to a dry film thickness of at least 1.5 mils. Do not prime surfaces to be embedded in concrete or mortar or to be field welded.

PART 3-EXECUTION

3.01 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.
- C. 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.
- D. Do not use thermal cutting during erection.
- E. 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.
- F. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

END OF SECTION 051200

SECTION 05 50 00
METAL FABRICATIONS**PART 1–GENERAL****1.01 SECTION REQUIREMENTS**

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

PART 2–PRODUCTS**2.01 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. Steel Tubing: ASTM A 500.
- E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.
- F. Cast Iron: ASTM A 48/A 48M or ASTM A 47/A 47M.
- G. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- H. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- I. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.02 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

2.03 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. Fabricate steel pipe columns with 1/2-inch steel base plates and 1/4-inch steel top plates welded to pipe with continuous fillet weld same size as pipe wall thickness. Drill top plates for connection bolts and base plates for 5/8-inch anchor bolts.
- E. Fabricate loose lintels from steel angles and shapes. Size to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches.

2.04 STEEL AND IRON FINISHES

- A. Hot-dip galvanize steel fabrications at exterior locations.



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- B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

PART 3-EXECUTION

3.01 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.
- C. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

END OF SECTION 055000



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DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

SECTION 06 10 00 ROUGH CARPENTRY

PART 1–GENERAL

1.01 SECTION REQUIREMENTS

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

PART 2–PRODUCTS

2.01 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.

2.02 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.
- C. Fire-Retardant-Treated Materials: Comply with performance requirements in AWPA C20.
 - 1. Use Exterior type for exterior locations and where indicated.
 - 2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 - 3. Use Interior Type A unless otherwise indicated.
 - 4. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Provide fire-retardant treated materials for items indicated on Drawings.

2.03 LUMBER

- A. Dimension Lumber:
 - 1. Maximum Moisture Content: 19 percent

2. Non-Load-Bearing Interior Partitions: Construction or No. 2 SPF
 3. Framing Other Than Non-Load-Bearing Interior Partitions: Spruce-pine-fir (south):
- B. Miscellaneous Lumber: Construction, or No. 2 grade with 19 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

2.04 ENGINEERED WOOD PRODUCTS

- A. Engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

2.05 PLYWOOD BACKING PANELS

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

2.06 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; with ASTM A 563 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 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.

PART 3—EXECUTION

3.01 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. in ICC's International Residential Code for One- and Two-Family Dwellings.

END OF SECTION 061000

SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY

PART 1–GENERAL**1.01 SECTION REQUIREMENTS**

- A. Submittals: ICC-ES evaluation reports for treated wood.

PART 2–PRODUCTS**2.01 WOOD PRODUCTS, GENERAL**

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

2.02 TREATED MATERIALS

- A. Preservative-Treated Materials: AWPAC2, except that lumber not in ground contact and not exposed to the weather may be treated according to AWPAC31 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. Wood framing members that are less than 18 inches (460 mm) above the ground. Where wood joists or the bottom of a wood structural floor without joists are closer than 18 inches (457 mm), or wood girders are closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation
- C. Fire-Retardant-Treated Materials: Comply with performance requirements in AWPAC20.
1. Use Exterior type for exterior locations and where indicated.
 2. Use Interior Type A, High Temperature (HT) where indicated.
 3. Use Interior Type A unless otherwise indicated.
 4. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Provide fire-retardant treated materials for items indicated on Drawings.

2.03 LUMBER

- A. Dimension Lumber:
1. Maximum Moisture Content: 19 percent
 2. Interior Partition Framing: Spruce-pine-fir (south):
 3. Other Framing: Spruce-pine-fir (south):
- B. Concealed Boards: 19 percent maximum moisture content. Spruce-pine-fir (south):



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- C. Miscellaneous Lumber: Construction, or No. 2, 19 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

2.04 FASTENERS

- 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.

PART 3-EXECUTION

3.01 INSTALLATION

- A. Set miscellaneous 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 miscellaneous rough carpentry to substrates, complying with the following:
 - 1. CABO NER-272 for power-driven fasteners.
 - 2. ICC's International Residential Code for One- and Two-Family Dwellings.

END OF SECTION 06 10 53



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SECTION 06 10 63 EXTERIOR ROUGH CARPENTRY

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: ICC-ES evaluation reports for wood-preserved treated wood, metal framing anchors and decking fasteners.

PART 2—PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

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

2.02 TREATED MATERIALS

- A. Preservative-Treated Boards and Dimension Lumber: AWPAC2.
 - 1. Use treatment containing no arsenic or chromium.
- B. Preservative-Treated Timber: AWPAC15, waterborne preservative.
 - 1. Use treatment containing no arsenic or chromium.
 - 2. Treatment with CCA shall include post-treatment fixation process.
- C. Preservative-Treated Poles: AWPAC4, waterborne preservative.
 - 1. Use treatment containing no arsenic or chromium.
 - 2. Treatment with CCA shall include post-treatment fixation process.
- D. After treatment, redry boards and dimension lumber to 19 percent maximum moisture content.
- E. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
- F. Provide preservative-treated materials for all exterior rough carpentry and the following:
 - 1. Framing members less than 18 inches (460 mm) above grade.
 - 2. Sills and ledgers.
 - 3. Posts.
 - 4. Decking.

2.03 LUMBER

- A. Dimension Lumber:
 - 1. Maximum Moisture Content: 19 percent
 - 2. Deck Framing: Spruce-pine-fir (south)
 - 3. Dimension Lumber Posts: No. 2 Spruce-pine-fir (south):

4. Dimension Lumber Decking: #2 Cypress

B. Boards:

1. Maximum Moisture Content: 19 percent.
2. Board Decking: 1inch- thick, radius-edged decking of #2 Cypress

2.04 MISCELLANEOUS PRODUCTS

- A. Fasteners: Use fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or ASTM F 2329 unless otherwise indicated.
1. Provide nails or screws, in sufficient length, to penetrate not less recommended by the manufacturer
 2. Power-Driven Fasteners: CABO NER-272.
 3. Carbon-Steel Bolts: ASTM A 307 with ASTM A 563 hex nuts and, where indicated, flat washers all hot-dip zinc coated.
- B. Postinstalled Anchors: Stainless-steel, anchors with capability to sustain, without failure, a load equal to six times the load imposed as determined by testing per ASTM E 488.
- C. Deck Tracks: Formed metal strips designed to be fastened to deck framing and to secure decking material from underside with screws. Made from , hot-dip galvanized
- D. Flexible Flashing: UV-resistant, self-adhesive, elastomeric thermoplastic flashing material with an overall thickness of not less than 0.040 inch (1.0 mm).

PART 3–EXECUTION

3.01 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. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction" unless otherwise indicated.
- C. Securely attach rough carpentry to substrates, complying with the following:
1. CABO NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- D. Secure decking to framing with concealed decking fasteners.
- E. Railing Installation: Countersink fastener heads, fill flush, and sand filler.
1. Fit balusters to railings, glue, and screw in place.
 2. Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts and glue.

END OF SECTION 06 10 63

**SECTION 06 16 00
SHEATHING****PART 1—GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals:

PART 2—PRODUCTS**2.01 WOOD PANEL PRODUCTS, GENERAL**

- A. Oriented Strand Board: DOC PS 2.

2.02 WALL SHEATHING

- A. ½" Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

2.03 ROOF SHEATHING

- A. 5/8" Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.

2.04 SUBFLOORING AND UNDERLAYMENT

- A. Combination Subfloor-Underlayment:

1. ¾" Oriented-Strand-Board tongue and groove Combination Subfloor-Underlayment: Exposure 1 single-floor panels.

2.02 MISCELLANEOUS 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. Sheathing Joint-and-Penetration Treatment Materials:

1. Sealant for Fiber Cement Sheathing: Joint sealant recommended by sheathing manufacturer for application indicated.
2. Sheathing Tape for Fiber Cement Sheathing: Self-adhering, glass-fiber tape recommended by sheathing and tape manufacturers for application indicated.

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

PART 3—EXECUTION**3.01 INSTALLATION**

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

1. CABO NER-272 for power-driven fasteners.
2. ICC's International Residential Code for One- and Two-Family Dwelling.



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B. Fastening Methods:

1. Combination Subfloor-Underlayment:

- a. Nail to wood framing.
- b. Screw to cold-formed metal framing.

2. Subflooring:

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

3. Wall and Roof Sheathing:

- a. Nail to wood framing.

C. Fiber Cement Sheathing Joint-and-Penetration Treatment: Seal sheathing joints and penetrations according to sheathing manufacturer's written instructions.

END OF SECTION 06 16 00



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SECTION 06 17 53 PREFABRICATED STRUCTURAL WOOD

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Parallel strand lumber (PSL).
- B. Prefabricated wood joists (I-Joists).

1.2 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry.
- B. Section 07 26 00 - Vapor Retarders.

1.3 REFERENCES

- A. International Code Council (ICC-ES):
 - 1. PSL Report Number: ESR-1387
 - 2. I-Joist Report Number: ESR-1130.
 - 3. I-Joist Report Number: ESR-1305.
 - 4. I-Joist APA Product Report Number: PR-L238
- B. Canadian Construction Materials Centre (CCMC):
 - 1. PSL Report Number: 11161-R.
 - 2. I-Joist Report Number: 11094-R.
 - 3. I-Joist Report Number: 12412-R.
 - 4. Rim Board Report Number: 13204-R.
- C. American Society for Testing and Materials International (ASTM):
 - 1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Provide engineered wood products and installed systems which have been engineered, manufactured, fabricated and installed to meet the specified performance requirements.
 - 2. Regulatory Requirements and Approvals: Provide engineered wood products meeting the requirements of the referenced building code compliance reports.

B. Performance Requirements:**1. Deflection Requirements:**

- a. Live load deflection limit of no more than 1/360 of span or a maximum of [Specify deflection.] inches of deflection.
 - b. Total load deflection limit of no more than 1/360 of span or a maximum of [Specify deflection.] inches of deflection.
2. Assembly Fire Resistance Rating (ASTM E119): Members and connections required of this section are an integral part of required fire resistance assemblies indicated or required by the design.
 - a. Provide members and connections to comply with fire rated assembly indicated of 1 hour.
 - b. Provide members and connections to comply with fire rated assembly indicated of 2 hours.
 - c. Provide members and connections to comply with fire rated assembly scheduled.
 3. Assembly Sound Transmission Class (STC) (ASTM E90): Members and connections required of this section are an integral part of required sound privacy assemblies indicated or required by the design.
 - a. Provide members, connections and details to comply with sound privacy indicated of [Specify required STC.].
 4. Assembly Impact Isolation Criteria (IIC) (ASTM E90): Members and connections required of this section are an integral part of required sound privacy assemblies indicated or required by the design.
 - a. Provide members, connections and details to comply with sound privacy indicated of [Specify required IIC.].

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Design Data: Submit design calculations signed and sealed by a professional engineer registered in the state of the Project location.
- D. Test Reports: Upon request provide current structural, fire and sound test reports from recognized testing laboratories.
- E. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
- F. Shop Drawings: Provide drawings indicating member type by manufacturer's series, size, location and connection details.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 1. Having a minimum 5 years experience manufacturing components comparable to or exceeding requirements of project.
 2. Having sufficient capacity to produce and deliver required materials without causing delay in the Work.



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- B. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity.
- C. Mock-Up: Provide a mock-up for evaluation of visually critical members and connections surface preparation techniques and application workmanship.
 - 1. Finish areas and connection details designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, connection details, and finish are approved by Architect.
 - 3. Correct mock-up as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
 - 1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - 2. Keep materials dry and store on a hard, dry, level surface not in contact with the ground.
 - 3. Store materials in wrapped and strapped bundles stacked no more than 10 feet (3 m) high.
 - 4. Support bundles to prevent excessive bowing. Support and separate bundles with dimension lumber spaced no more than 10 feet (3 m) apart. Keep supports in line vertically.
 - 5. Handle individual pieces in a manner to prevent physical damage during measuring, cutting and erection.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

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

1.9 WARRANTY

- A. Manufacturer shall provide material warranty:
 - 1. Warranty Period: Lifetime Limited Warranty beginning with date of substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
 - 1. Trus joist TJI 230 or similar
 - 2. Ilevel by Weyerhaeuser or similar.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PARALLEL STRAND LUMBER (PSL)

- A. Product: 2.0E Parallam PSL by Weyerhaeuser Products, or similar.
 - 1. Member: PSL.
 - a. Thickness: 3-1/2 inches
 - b. Thickness: 5-1/4 inches
 - c. Depth: 11-7/8 inches

2.3 WOOD JOISTS

- A. Product: Trus joist I-Joists by Weyerhaeuser Products or similar.
 - 1. Member: TJI 230. Solid sawn lumber top and bottom chords permanently attached to oriented strand board webs.
 - a. Flange Width: 2-1/16 inches.
 - b. Flange Material: Solid Sawn.
 - c. Depth: 11-7/8 inches (302 mm).

2.4 ACCESSORIES

- A. Provide engineered connectors specifically designed for connection type and application. Refer to drawings and schedules.
- B. Provide nail and fastener types and sizes per member manufacturer's details and recommendations.

PART 3 EXECUTION**3.1 EXAMINATION**

- A. Do not begin installation until supporting work has been properly prepared.
- B. If supporting work is the responsibility of another installer, notify Architect of unsatisfactory work before proceeding.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the installation under the project conditions.

3.3 GENERAL INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install engineered wood products in compliance with approved shop drawings.
- C. Conditions and Practices Not Permitted:
 - 1. Do not place holes closer to supports than recommended by manufacturer.
 - 2. Do not over cut holes and damage flanges.
 - 3. Do not make holes with hammer unless a knockout is provided for this purpose.
 - 4. Do not hammer on flange and damage joist.
 - 5. Do not cut, notch or drill flange.

6. Do not use 16d or larger nails in flange.
7. Do not bevel cut joist ends inside edge of bearing.
8. Do not support joist on web.
9. Do not install visibly damaged joists.

3.4 JOISTS INSTALLATION

- A. Accurately fit, align, securely fasten and install free from distortion or defects.
- B. Conditions and Practices Required:
 1. Carefully unload joists by lifting, using forklifts or cranes to avoid damage.
 2. Keep joists stored in wrapped and strapped bundles stacked no more than 10 feet (3 m) high.
 3. Support bundles to prevent excessive bowing. Support and separate bundles with dimension lumber spaced no more than 10 feet (3 m) apart. Keep supports in line vertically.
 4. Handle individual joists in a manner to prevent physical damage during measuring, cutting and erection.
 5. Handle joists vertically, not horizontally (flat).
 6. Use at least 1 by 4 temporary bracing members nailed to each joist with two 8d common nails. Keep rows of bracing parallel at no more than 8 feet (2.5 m) apart.
 7. Use long pieces for bracing, not short blocks. Lap ends to form a continuous line of bracing.
 8. Anchor bracing at ends and at 25 feet (7.5 m) intervals into a stable end wall or an area braced by sheathing or diagonal bracing.
 9. Exercise caution when removing temporary bracing when applying sheathing. Remove bracing as sheathing is attached.
 10. All rim joists, blocking, connections and temporary bracing shall be installed before erectors are allowed on the structure.
 11. Impose no loads other than the weight of the erectors on the structure before it is permanently sheathed.
 12. After sheathing, do not exceed design loads on joists with construction materials.
 13. Support joists laterally at end bearings and cantilevers.
 14. Joists shall have a minimum end bearing length of 1-1/2 inches
 15. Refer to drawings and member schedule for end bearing and interior bearing stiffener requirements.

3.5 PARALLEL STRAND LUMBER INSTALLATION

- A. Install parallel strand lumber plumb and level.
- B. Accurately fit, align, securely fasten and install free from distortion or defects.
- C. Temporary Bracing:
 1. Securely brace LSL during construction by anchoring to the ground, foundation, a braced wall or other completed, stable section of the structure.

2. Support members laterally at end bearings and cantilevers.
3. Install all rim joists, blocking, connections and temporary bracing before erectors are allowed on the structure.
4. Impose no loads other than the weight of the erectors on the structure before it is permanently sheathed.
5. Exercise caution when removing temporary bracing to apply sheathing.
6. After sheathing, do not exceed design loads on members with construction materials.
7. All conditions calling for notched or drilled beams must be reviewed and approved by a licensed professional engineer.

3.6 PROTECTION

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

END OF SECTION 061753

**SECTION 06 20 00
FINISH CARPENTRY****PART 1–GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals: Samples of materials

PART 2–PRODUCTS**2.01 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. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.

2.02 EXTERIOR FINISH CARPENTRY

- A. Exterior Lumber Trim: Smooth textured cypress
 - 1. Maximum Moisture Content: 19 percent.
- B. Lumber Siding: Kiln-dried ¾" ship lap cypress

2.03 INTERIOR STANDING AND RUNNING TRIM

- A. Interior Softwood Lumber Trim: Cypress
 - 1. Maximum Moisture Content: 19 percent.

2.04 SHELVING AND CLOTHES RODS

- A. Shelving: ¾-inch (19-mm) particleboard with radiused and filled front edge ¾-inch (19-mm) finish boards as specified for interior softwood lumber trim.
- B. Clothes Rods: 1-1/2-inch- (38-mm-) diameter, clear, kiln-dried hardwood clear, kiln-dried softwood; either Douglas fir or southern pine.
- C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

2.05 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.



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PART 3—EXECUTION

3.01 INSTALLATION

- A. Condition finish carpentry in installation areas for 24 hours before installing.
- B. Prime and backprime lumber for painted finish exposed on the exterior.
- C. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.
- D. 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.
- E. Nail siding at each stud. Do not allow nails to penetrate more than one thickness of siding, unless otherwise recommended by siding manufacturer. Seal joints at inside and outside corners and at trim locations.

END OF SECTION 062000

SECTION 06 40 13
EXTERIOR ARCHITECTURAL WOODWORK

PART 1–GENERAL**1.01 SECTION REQUIREMENTS**

- A. Submittals: Shop Drawings.

PART 2–PRODUCTS**2.01 MATERIALS**

- A. Cypress.
- B. Preservative Treatment: Comply with WDMA I.S.4 for items indicated to receive water-repellent preservative treatment.
- C. Fasteners for Exterior Woodwork:
1. Nails: stainless steel.
 2. Screws: stainless steel.

2.02 EXTERIOR WOODWORK

- A. Wood Moisture Content: Maximum 19 percent.
- B. 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.
- C. 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.
- D. Exterior Standing and Running Trim: Custom grade, made from No. 2 cypress.
- E. Shop seal woodwork for transparent finish with stain (if required), other required pretreatments, and first coat of specified finish.

PART 3–EXECUTION**3.01 INSTALLATION**

- A. Install woodwork to comply with referenced quality standard for grade specified.
- B. Install woodwork true and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- D. 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 for exposed nailing, countersunk and filled flush with woodwork.
- E. 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.

END OF SECTION 06 40 13

SECTION 06 40 23
INTERIOR ARCHITECTURAL WOODWORK

PART 1—GENERAL**1.01 SECTION REQUIREMENTS**

- A. Submittals: Shop Drawings and Samples showing the full range of colors, textures, and patterns available for each type of finish.
- B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is completed, and HVAC system is operating.

PART 2—PRODUCTS**2.01 MATERIALS**

- A. Hardboard: AHA A135.4.
- B. Particleboard: ANSI A208.1, Grade M-2
- C. Softwood Plywood: DOC PS 1.
- D. Hardwood Plywood and Face Veneers: HPVA HP-1 made with adhesive containing no urea formaldehyde.
- E. High-Pressure Decorative Laminate: NEMA LD 3.
 - 1. Products:
 - a. Advanced Technology Inc; Nu Metal corrugated mill aluminum.

2.02 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. Butt Hinges: 2-3/4-inch (70-mm), 5-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
 - 1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
 - 2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Catches: Magnetic catches, BHMA A156.9, B03141
- D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests
- E. Drawer Slides: BHMA A156.9, B05091.
 - 1. Box Drawer Slides: Grade 1
- F. Exposed Hardware Finishes: Comply with BHMA A156.18 for BHMA code number indicated.
- G. Furring, Blocking, Shims, and Hanging Strips: Soft and hardwood lumber, kiln dried to 19 percent moisture content.

2.03 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. Interior Standing and Running Trim for Transparent Finish: Custom grade, made from cypress
- D. Interior Standing and Running Trim for Opaque Finish: SPF
- E. Wood Cabinets for Transparent Finish: Custom grade.
 - 1. AWI Type of Cabinet Construction: Flush overlay
 - 2. WI Construction Style: Style Frameless
 - 3. WI Door and Drawer Front Style: Flush overlay
 - 4. Wood Species and Cut for Exposed Surfaces: cypress plainsawn
- F. Retain one of three options in first subparagraph below for Premium-grade cabinets.
 - 1. Semiexposed Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces
 - 2. Drawer Sides and Backs: Thermoset decorative panels.
 - 3. Drawer Bottoms: Hardwood plywood

2.04 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.
- C. Transparent Finish: Penetrating oil

PART 3—EXECUTION

3.01 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.



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- H. Cabinets: Install so doors and drawers are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
- I. Revise requirements in subparagraph below as necessary for seismic restraint of cabinets. Delete if hanging cleats are used and are detailed on Drawings.
 - 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.
- J. Anchor countertops securely to base units. Seal space between backsplash and wall.

END OF SECTION 06 40 23

SECTION 06 65 10
SOLID SURFACE FABRICATIONS

PART 1 — GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following horizontal and trim solid surface product types:
1. Countertops with sinks
 2. Lavatory tops with undermount bowls
 3. Vanity tops
 4. Tabletops
- B. Related Sections include the following:
1. Division 1 Section "LEED Requirements" for additional LEED requirements.
 2. Division 6 Section "Rough Carpentry" for Blocking.
 3. Division 9 Section "Wall Cladding."
 4. Division 15 Section "Plumbing Fixtures."
 5. Division 16 Section "Wiring Devices."
- C. Alternates:
1. Refer to Division 1 Section "Alternates" for description of work in this Section affected by alternates.

1.03 DEFINITION

- A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.04 SUBMITTALS

- A. Product data:
1. For each type of product indicated.
- B. Shop drawings:
1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
 - a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
 - b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.

-
- c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.
- C. Product data:
1. Indicate product description, fabrication information and compliance with specified performance requirements.
- D. LEED submittals:
1. Credit EQ 4.1:
 - a. Manufacturer's product data for installation adhesives, including printed statement of VOC content and material safety data sheets.
 2. Credits MR 5.1:
 - a. Product data indicating that materials are regionally manufactured and within 500 miles of the project site.
- E. Product certificates:
1. For each type of product, signed by product manufacturer.
- F. Fabricator/installer qualifications:
1. Provide copy of certification number.
- G. Manufacturer certificates:
1. Signed by manufacturers certifying that they comply with requirements.
- H. NSF/ANSI standards:
1. Refer to www.nsf.org for the latest compliance to NSF/ANSI Standard 51 for food zone — all food types.
- I. Maintenance data:
1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
 - a. Maintenance kit for finishes shall be submitted.
 2. Include in project closeout documents.

1.05 QUALITY ASSURANCE

- A. Qualifications:
1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
- B. Fabricator/installer qualifications:
1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.
- C. Applicable standards:
1. Standards of the following, as referenced herein:
 - a. American National Standards Institute (ANSI)
 - b. American Society for Testing and Materials (ASTM)

-
- c. National Electrical Manufacturers Association (NEMA)
 - d. NSF International
 2. Fire test response characteristics:
 - a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1) Flame Spread Index: 25 or less.
 - 2) Smoke Developed Index: 450 or less.
 - D. Coordination drawings:
 1. Shall be prepared indicating:
 - a. Plumbing work.
 - b. Electrical work.
 - c. Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.
 2. Content:
 - a. Project-specific information, drawn accurately to scale.
 - b. Do not base coordination drawings on reproductions of the contract documents or standard printed data.
 - c. Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
 - d. Provide alternate sketches to designer for resolution of such conflicts.
 - 1) Minor dimension changes and difficult installations will not be considered changes to the contract.
 - E. Drawings shall:
 1. Be produced in 1/2-inch scale for all fabricated items.
 - F. Drawings must be complete and submitted to the architect within 60 days after award of contract for record only.
 1. No review or approval will be forthcoming.
 2. Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.
 - G. Job mock-up:
 1. Prior to fabrication of architectural millwork, erect sample unit to further verify selections made under sample submittals and to demonstrate the quality of materials and execution.
 2. Mock-up shall be 6 in x 6 in
 3. Build the mock-up to comply with the contract documents and install in a location as directed by the architect.
 4. Notify the architect two weeks in advance of the date of when the mock-up will be delivered.
 5. Should mock-up not be approved, re-fabricate and reinstall until approval is secured.
 - a. Remove rejected units from project site.

6. After approval, the mock-up may become a part of the project.
7. This mock-up, once approved, shall serve as a standard for judging quality of all completed units of work.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.
 1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.07 WARRANTY

- A. Provide manufacturer's warranty against defects in materials.
 1. Warranty shall provide material and labor to repair or replace defective materials.
 2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
 3. Warranty shall be transferable to subsequent owner for remainder of warranty period.
- B. Optional Installed Warranty:
 1. To qualify for the optional Installed Warranty, fabrication and installation must be performed by a DuPont Certified Fabrication/Installation source who will provide a brand plate for the application.
 2. This warranty covers all fabrication and installation performed by the certified/approved source subject to the specific wording contained in the Installed Warranty Card.
- C. Manufacturer's warranty period:
 1. Ten years from date of substantial completion.

1.08 MAINTENANCE

- A. Provide maintenance requirements as specified by the manufacturer.

PART 2 – PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers:
 1. Subject to compliance with requirements, provide products by one of the following:
 - a. Corian® surfaces from the DuPont company (basis of design).

2.02 MATERIALS

- A. Solid polymer components
 1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
 2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.
- B. Thickness:
 1. 1/2 inch

C. Performance characteristics:

PROPERTY	TYPICAL RESULT	TEST
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5 x 10 ⁶ psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2 x 10 ⁶ psi	ASTM D 790
Hardness	>85	Rockwell “M” Scale
	56	ASTM D 785 Barcol Impressor ASTM D 2583
Thermal Expansion	3.02 x 10 ⁻⁵ in./in./°C (1.80 x 10 ⁻⁵ in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000 Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
Izod Impact (Notched Specimen)	0.28 ft.-lbs./in. of notch	ASTM D 256 (Method A)
Ball Impact Resistance: Sheets	No fracture—1/2 lb. ball: 1/4” slab—36” drop 1/2” slab—144” drop	NEMA LD 3-2000 Method 3.8
Weatherability	ΔE*94<5 in 1,000 hrs.	ASTM G 155
Specific Gravity †	1.7	

PROPERTY	TYPICAL RESULT	TEST
Water Absorption	Long-term 0.4% (3/4") 0.6% (1/2") 0.8% (1/4")	ASTM D 570
Toxicity	99 (solid colors) 66 (patterned colors)	Pittsburgh Protocol Test ("LC50" Test)
Flammability	All colors (Class I and Class A)	ASTM E 84, NFPA 255 & UL 723
Flame Spread Index	<25	
Smoke Developed Index	<25	

† Approximate weight per square foot: 1/4" (6 mm) 2.2 lbs., 1/2" (12.3 mm) 4.4 lbs.

Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories.

NEMA results based on the NEMA LD 3-2000

2.03 ACCESSORIES

A. Joint adhesive:

1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

B. Sealant:

1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

C. Sink/lavatory mounting hardware:

1. Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.

D. Conductive tape:

1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

E. Insulating felt tape:

1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.04 FACTORY FABRICATION

A. Shop assembly

1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.

2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
 - a. Reinforce with strip of solid polymer material, 2" wide.
 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
 4. Rout and finish component edges with clean, sharp returns.
 - a. Rout cutouts, radii and contours to template.
 - b. Smooth edges.
 - c. Repair or reject defective and inaccurate work.
- B. Thermoforming:
1. Comply with manufacturer's data.
 2. Heat entire component.
 - a. Material shall be uniform, between 275 and 325 degrees Fahrenheit during forming.
 3. Form pieces to shape prior to seaming and joining.
 4. Cut pieces to finished dimensions.
 5. Sand edges and remove nicks and scratches.

2.05 FINISHES

- A. Select from the manufacturer's standard color chart.
1. Color:
 - a. clamshell
- B. Finish:
1. Provide surfaces with a uniform finish.
 - a. Semigloss; gloss range of 20–50.
 - 1) Clamshell

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
1. Provide product in the largest pieces available.



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- 2. Form field joints using manufacturer’s recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams shall not be allowed.
 - 3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
 - 4. Cut and finish component edges with clean, sharp returns.
 - 5. Rout radii and contours to template.
 - 6. Anchor securely to base cabinets or other supports.
 - 7. Align adjacent countertops and form seams to comply with manufacturer’s written recommendations using adhesive in color to match countertop.
 - 8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - 9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.
- B. Integral sinks/vanities:
- 1. Provide solid surface materials bowls and/or lavatories sinks with overflows in locations shown on the drawings.
 - 2. Secure sinks and lavatory bowls to tops using manufacturer’s recommended sealant, adhesive and mounting hardware to maintain warranty.

3.03 REPAIR

- A. Repair or replace damaged work which cannot be repaired to architect’s satisfaction.

3.04 CLEANING AND PROTECTION

- A. Keep components clean during installation.
- B. Remove adhesives, sealants and other stains.

3.05 SCHEDULE

- A. Countertops:
 - 1. Surfaces of material adhesively joined with inconspicuous seams.

	Color	
a. Vertical Thickness _____	_____	_____
b. Horizontal Thickness _____	_____	_____
c. Edge Details _____	_____	_____
d. Finish _____	_____	_____



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B. Countertops with traditional undermount lavatories:

1. Surfaces of material adhesively joined with silicone sealant.

- | | Color |
|-------------------------------|-------|
| a. Vertical Thickness _____ | _____ |
| b. Horizontal Thickness _____ | _____ |
| c. Edge Details _____ | _____ |
| d. Finish _____ | _____ |
| e. Sink _____ | _____ |

END OF SECTION 06 65 10

SECTION 06 17 60
METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1–GENERAL**1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data, Shop Drawings, structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, “National Design Standard for Metal Plate Connected Wood Truss Construction.”
 - 2. TPI DSB, “Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses.”
 - 3. TPI BCSI, “Guide to Good Practice for Handling, Installing, Restraining & Bracing Metal Plate Connected Wood Trusses.”
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA’s “National Design Specifications for Wood Construction” and its “Supplement.”

PART 2–PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads indicated without exceeding TPI 1 deflection limits.

2.02 MATERIALS

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review, any species, graded visually or mechanically.
 - 1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Connector Plates: TPI 1, fabricated from hot-dip galvanized-steel sheet complying with ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.
- C. Fasteners: Where trusses are exposed to weather or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- D. Metal Framing Anchors: Provide framing anchors made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

2.03 FABRICATION

- A. Assemble trusses using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted. Fabricate wood trusses within manufacturing tolerances in TPI 1.



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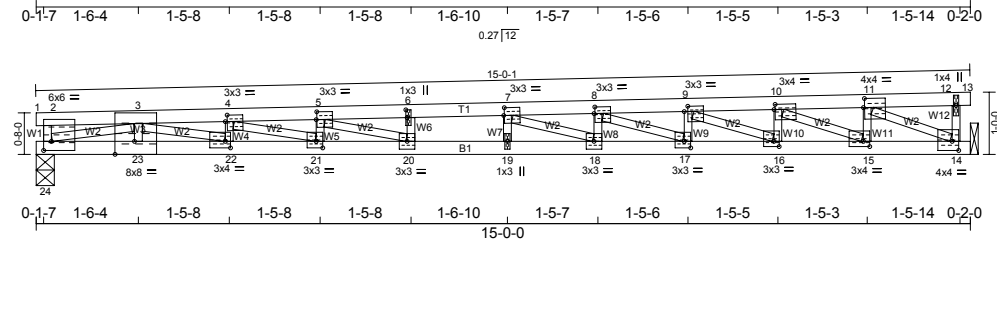

PART 3—EXECUTION

3.01 INSTALLATION

- A. Install and brace trusses according to TPI recommendations and as indicated. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- B. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor.
- C. Securely connect each truss ply required for forming built-up girder trusses. Anchor trusses to girder trusses.
- D. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with [Division 6 Section “Rough Carpentry”].
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- E. Install wood trusses within installation tolerances in TPI 1.
- F. Do not cut or remove truss members.
- G. Remove wood trusses that are damaged or do not meet requirements and replace with trusses that do meet requirements.

FIGURES:

FIGURE 06176.1 TRUSS SPECS

Job 57272	Truss M630101	Truss Type MONO TRUSS	Qty 1	Ply 1	University of Soth Florida 216 FL 101810-USF Ref. #2161755		
Universal Forest Products Inc., Grand Rapids, MI 49525, Weston Gorbly 7.240 e Jun 18 2010 MiTek Industries, Inc. Wed Oct 20 08:06:39 2010 Page 1 of 2							
							
Plate Offsets (X,Y): [2:0-1-8,0-1-12], [4:0-0-6,0-1-4], [5:0-0-2,0-1-8], [6:0-1-8,0-0-4], [7:0-0-3,0-1-8], [8:0-0-3,0-1-4], [9:0-0-11,0-1-0], [10:0-0-4,0-1-0], [11:0-0-4,0-1-12], [14:0-1-4,0-1-12], [15:0-1-4,0-1-0], [16:0-1-0,0-1-0], [17:0-1-4,0-1-4], [21:0-1-4,0-1-4], [22:0-1-0,0-1-4], [23:0-3-12,Edge]							
LOADING (psf) TCLL 20.0 (Ground Snow=20.0) TCDD 7.0 BCDD 0.0 BCDL 7.0		SPACING 2-0-0 Plates Increase 1.15 Lumber Increase 1.15 Rep Stress Incr YES Code IBC2006/TPI2002		CSI TC 0.94 BC 0.78 WB 0.99 (Matrix)		DEFL in (loc) l/defl L/d Vert(LL) 0.73 19-20 >242 240 Vert(TL) -0.64 19-20 >276 180 Horz(TL) -0.08 14 n/a n/a PLATES GRIP MT20 197/144 Weight: 36 lb FT = 0%	
LUMBER TOP CHORD 2 X 3 SPF No.2 BOT CHORD 2 X 3 SYP No.1 WEBS 2 X 2 SPF Stud *Except* W1: 2 X 2 SPF No.2			BRACING TOP CHORD Structural wood sheathing directly applied or 2-2-0 oc purlins, except end verticals. BOT CHORD Rigid ceiling directly applied or 2-10-1 oc bracing.				
REACTIONS (lb/size) 24=433/0-3-8 (min. 0-1-8), 14=434/Mechanical Max Horz 24=30(LC 7) Max Uplift 24=548(LC 7), 14=552(LC 7) Max Grav 24=544(LC 13), 14=545(LC 13)							
FORCES (lb) - Maximum Compression/Maximum Tension TOP CHORD 1-2=0/0, 2-3=-224/253, 3-4=-2295/2579, 4-5=-2844/3197, 5-6=-3070/3449, 6-7=-3070/3454, 7-8=-2790/3136, 8-9=-2340/2630, 9-10=-1723/1937, 10-11=-949/1065, 11-12=-58/64, 12-13=0/0, 12-14=-77/93, 2-24=-135/153 BOT CHORD 23-24=-1557/1359, 22-23=-1556/1358, 21-22=-2615/2301, 20-21=-3227/2848, 19-20=-3470/3069, 18-19=-3470/3069, 17-18=-3145/2783, 16-17=-2631/2329, 15-16=-1929/1708, 14-15=-1051/930 WEBS 3-23=-31/75, 4-22=-297/367, 5-21=-176/232, 6-20=-78/123, 5-20=-259/236, 4-21=-645/577, 3-22=-1108/988, 3-24=-1196/1340, 11-14=-977/1103, 11-15=-403/392, 10-15=-855/967, 10-16=-330/321, 9-16=-675/764, 9-17=-221/226, 8-17=-490/556, 8-18=-122/137, 7-18=-305/350, 7-19=0/58							
NOTES 1) Wind: ASCE 7-05; 130mph; TCDD=4.2psf; BCDL=4.2psf; h=30ft; Cat. II; Exp C; enclosed; MWFRS (low-rise) gable end zone and C-C Exterior(2) zone;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60 2) TCDD: ASCE 7-05; Pg=20.0 psf (ground snow); Ps=20.0 psf (roof snow); Category II; Exp C; Partially Exp.; Ct=1.1; IBC 1607.11.2 minimum roof live load applied where required.; IBC 1608.3 minimum flat roof snow load governs. 3) Roof design snow load has been reduced to account for slope. 4) Unbalanced snow loads have been considered for this design. 5) This truss has been designed for basic load combinations, which include cases with reductions for multiple concurrent live loads. 6) This truss has been designed for a 10.0 psf bottom chord live load nonconcurrent with any other live loads. 7) * This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-6-0 tall by 2-0-0 wide will fit between the bottom chord and any other members. 8) Provide mechanical connection (by others) of truss to bearing plate capable of withstanding 548 lb uplift at joint 24 and 552 lb uplift at joint 14. 9) This truss has been designed in accordance with the 2006 IBC Sec 2303.4.2, 2006 IRC Sec 802.10.2							
WARNING - Verify design parameters and READ NOTES							
This building component has only been designed for the loads noted on this drawing. Construction and lifting forces have not been considered. The builder is responsible for lifting methods and system design. Builder responsibilities are defined under TPI1. This design is based only upon parameters shown, and is for an individual building component to be installed and loaded vertically. Applicability of design parameters and proper incorporation of component is responsibility of building designer - not truss designer. Bracing shown is for lateral support of individual web members only. Additional temporary bracing to insure stability during construction is the responsibility of the erector. Additional permanent bracing of the overall structure is the responsibility of the building designer. For general guidance regarding fabrication, quality control, storage, delivery, erection and bracing, consult BCSI 1-06 from the Wood Truss Council of America and Truss Plate Institute Recommendation available from WTCA, 6300 Enterprise LN, Madison, WI 53719 J:\support\Mitek\Suppl\templates\ufp.tpe© copyright 2010 by: Universal Forest Products, Inc.							
				Universal Forest Products, Inc. 2801 EAST BELTLINE RD, NE GRAND RAPIDS, MI 49525 PHONE (616)-364-6161 FAX (616)-365-0060			
							

END OF SECTION 06176

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1–GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2–PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Guardian Building Products Inc. (Guardian Fiberglass)
Guardian Building Products Inc.
979 Batesville Rd. Greer, SC 29651
1-800-569-4262

Plants in Albion, MI, Mineral Wells, MS, Inwood, WV, Kingman, AZ, Winnsboro, SC, Moses Lake, WA.

- B. Or Manufacturer with similar product

2.02 INSULATION PRODUCTS

- A. Exterior Stud Walls- Thermal Batt Insulation
 - 1. Thickness: 3 ½ inches
 - 2. R-Value: 11
 - 3. Vapor retarder: Kraft facing
- B. Attic- Thermal Blowing Insulation
 - 1. Thickness: 8.37 inches
 - 2. R-value: 22
 - 3. Vapor Retarder: NA
- C. Module Roof- high Density Thermal Insulation
 - 1. Thickness: 3 5/8 inches
 - 2. R-value: 15
 - 3. Vapor Retarder: NA

D. Floor- Thermal Batt Insulation

1. Thickness: 3 5/8 inches
2. R-value: 13
3. Vapor retarder: Kraft facing

2.03 ACCESSORIES

A. Vapor Retarder:

1. ASTM C 665 Type II, Class C, Category 1, faced on one side with Kraft paper providing a vapor barrier of 1.0 or less.

PART 3—EXECUTION

3.01 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. Except for loose-fill insulation and insulation that is friction fitted in stud cavities, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- C. Place loose-fill insulation to comply with ASTM C 1015.
 1. Comply with the CIMA's Special Report #3, "Standard Practice for Installing Cellulose Insulation."
- D. 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 07 21 00

**SECTION 07 25 00
WEATHER BARRIERS****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Weather barrier membrane (DuPont™ Tyvek® HomeWrap®)
- B. Seam Tape (DuPont™ Tyvek® Tape)
- C. Flashing (DuPont™ FlexWrap™, DuPont™ StraightFlash™ and/or DuPont™ StraightFlash™ VF)
- D. Fasteners (DuPont™ Tyvek® Wrap Caps)

1.02 REFERENCES

- A. ASTM International
 - 1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM C1193; Standard Guide for Use of Joint Sealants
 - 3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
 - 4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
 - 5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E96; Test Method for Water Vapor Transmission of Materials
 - 7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
 - 8. ASTM E2178; Test Method for Air Permeance of Building Materials
- B. AATCC – American Association of Textile Chemists and Colorists
 - 1. Test Method 127 Water Resistance: Hydrostatic Pressure Test
- C. TAPPI
 - 1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
 - 2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer current technical literature for each component.
- B. Samples: Weather Barrier membrane, minimum 8-1/2 inches by 11 inch.
- C. Quality Assurance Submittals
 - 1. Manufacturer Instructions: Provide manufacturer's written installation instructions.

1.04 QUALITY ASSURANCE

- A. Qualifications
 - 1. Installer shall have experience with installation of similar weather barrier assemblies under similar conditions.

2. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01 60 00 Product Requirements.
- B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store weather barrier materials as recommended by system manufacturer.

1.06 SCHEDULING

- A. Install DuPont™ Tyvek® HomeWrap® prior to the installation of windows and doors.

PART 2 – PRODUCTS**2.01 MANUFACTURER**

- A. DuPont Building Innovations; 4417 Lancaster Pike, Chestnut Run Plaza 721, Wilmington, DE 19805; 1-800-44-TYVEK (8-9835); <http://construction.TYVEK.com>

2.02 MATERIALS

- A. Basis of Design: spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont™ Tyvek® HomeWrap® and related assembly components.
- B. Performance Characteristics:
 1. Air Penetration: <.004 cfm/ft2 at 1.57 psf, when tested in accordance with ASTM E2178. Type I per ASTM E1677.
 2. Water Vapor Transmission: 56 perms, when tested in accordance with ASTM E96-05, Method A.
 3. Water Penetration Resistance: 250 cm when tested in accordance with AATCC Test Method 127.
 4. Basis Weight: 1.8 oz/yd2, when tested in accordance with TAPPI Test Method T-410.
 5. Air Resistance: 1200 seconds, when tested in accordance with TAPPI Test Method T-460.
 6. Tensile Strength: 30/30 lbs/in., when tested in accordance with ASTM D882.
 7. Tear Resistance: 8/6 lbs, when tested in accordance with ASTM D1117.
 8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 15, Smoke Developed: 15

2.03 ACCESSORIES

- A. Seam Tape: [2] [or] [3] inch wide, DuPont™ Tyvek® Tape as manufactured by DuPont Building Innovations.
- B. Fasteners:
 1. DuPont™ Tyvek® Wrap Cap staples as manufactured by DuPont Building Innovations. (Cap staples are only recommended for residential construction).

-
- C. Sealants
 - 1. Products:
 - a. Sealants recommended by the weather barrier manufacturer.
 - D. Adhesive:
 - 1. Provide adhesive recommended by weather barrier manufacturer.
 - E. Primer:
 - 1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
 - F. Flashing
 - 1. DuPont™ FlexWrap™, as manufactured by DuPont Building Innovations: flexible membrane flashing materials for window openings and penetrations.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.02 INSTALLATION – WEATHER BARRIER

- A. Install weather barrier over exterior face of exterior wall substrate before installation of windows and doors in accordance with manufacturer recommendations.
- B. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.
- C. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface. Maintain weather barrier plumb and level.
- D. Extend bottom roll edge over sill plate interface 2” to 3” minimum. Seal weather barrier with sealant or tape. Shingle weather barrier over back edge of thru-wall flashings and seal weather barrier with sealant or tape. Ensure weeps are not blocked.
- E. Subsequent layers shall overlap lower layers a minimum of 6 inches horizontally in a shingling manner.
- F. Window and Door Openings: Extend weather barrier completely over openings
- G. Weather Barrier Attachment:
 - 1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, spaced 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

3.03 SEAMING

- A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.
- B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.04 OPENING PREPARATION (for use with flanged windows)

- A. Cut weather barrier membrane in a modified “I-cut” pattern.
 - 1. Cut weather barrier horizontally along the bottom of the header.
 - 2. Cut weather barrier vertically 2/3 of the way down from top center of window opening.
 - 3. Cut weather barrier diagonally from bottom of center vertical cut to the left and right corners of the opening.
 - 4. Fold side and bottom weather barrier flaps into window opening and fasten.
- B. Cut a head flap at 45-degree angle in the weather barrier membrane at window head to expose 8 inches of sheathing. Temporarily secure weather barrier membrane flap away from sheathing with tape.

3.05 FLASHING

- A. Cut 7-inch [2x4 framing] or 9-inch [2x6 framing] wide DuPont™ FlexWrap™ a minimum of 12 inches longer than width of sill rough opening. Apply primer as recommended by the manufacturer.
- B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.
- C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.
- D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.
- E. Install window according to manufacturer’s instructions.
- F. Apply 4-inch wide strips of DuPont™ StraightFlash™ at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.
- G. Apply 4-inch wide strip of DuPont™ StraightFlash™ as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.
- H. Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont™ StraightFlash™ over the 45-degree seams.
- I. Tape head flap in accordance with manufacturer recommendations.
- J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer’s instructions and ASTM C1193.

3.06 PROTECTION

- A. Protect installed weather barrier from damage.

END OF SECTION 07 25 00

SECTION 07 40 00
ROOFING AND SIDING PANELS

PART 1—GENERAL**1.01 SECTION INCLUDES**

- A. 07 42 13 Metal Wall Panels - Through-fastened metal wall Panels.

1.02 RELATED SECTIONS

- A. Section 051200 - Structural Steel Framing: Secondary wind load resisting girts and subgirts for exterior wall framing.
- B. Section 061000 - Rough Carpentry: Blocking and miscellaneous framing.
- C. Section 061500 - Wood Decking: Wood deck material and installation.
- D. Section 072100 – Thermal Insulation: Fiberglass Rolled Metal Building Insulation with VRR+ backer or semi-rigid unfaced fiberglass batt insulation at insulated walls and roof decks.
- E. Section 076200 - Sheet Metal Flashing and Trim: Flashing and trim.
- F. Section 077100 – Roof Specialties: Roof edge coordination and attachment provisions.
- G. Section 07920 - Joint Sealants: Installation requirements.

1.03 REFERENCES

- A. Building Design Codes: International Building Code (IBC) with revisions for Local Codes
- B. American Iron and Steel Institute (AISI): North American Specification for the Design of Cold-Formed Steel Structural Members.
- C. American Institute of Steel Construction (AISC): Manual of Steel Construction.
- D. ASTM International (ASTM):
1. ASTM D 659: Method of Evaluating Degree of Chalking of Exterior Paints.
 2. ASTM D 822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 3. ASTM D 3361 - Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 4. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
 5. ASTM D 4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
 6. ASTM G 23 - Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.

1.04 PERFORMANCE REQUIREMENTS FOR WALL SYSTEMS

- A. Design Requirements for Wall Systems:
1. System Design: Metal wall system as designed by the manufacturer shall be a complete system. All components of the system shall be supplied by the same manufacturer.

2. Wall Panels: Steel panels shall be designed in accordance with the AISI Cold-Formed Steel Design Manual.
3. Design Loads: Design load application shall be in accordance with local building code.
4. Wind Loads: The design wind loads shall be based on the wind criteria in accordance with local building code.
5. Deflection: Deflection requirements shall be in accordance with the applicable building code, or as a minimum, $L/180$ for wind load (but not less than 10 psf (49 kg/sq m).
6. Accessories and Fasteners: Accessories and fasteners shall be capable of resisting the specified design wind suction forces in accordance with local building code.

B. Framing Members Supporting the Metal Panel System:

1. Additions/revisions to framing members supporting the metal panel system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility, and shall be submitted for review and approval by the Engineer of Record.
2. Framing members and their connections shall be designed in accordance with AISC, AISI, and LGSI design specifications as applicable. Deflection requirements shall be in accordance with the applicable building code, or as a minimum, the provisions of the AISC Steel Design Guide Series 3 - Serviceability Design Considerations for Low-Rise-Buildings.

1.05 SUBMITTALS

A. Submit under provisions of Section 013000.

1. Product Data: Manufacturer's data sheets on each product to be used.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings:

1. Show methods of erection, elevations, and plans of roof panels, sections and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with all materials not supplied and proposed identification of component parts and their finishes.
2. Submit complete shop drawings and erection details to Architect for review. Do not proceed with manufacture prior to review of shop drawings and approval of shop drawings. Do not use drawings prepared by Architect for shop or erection drawings.

C. Selection Samples: For each finish product specified, color charts representing manufacturer's full range of standard colors and patterns. For non standard colors or finishes color samples must be submitted to manufacturer for matching if quantity of custom materials is sufficient.

D. Verification Samples: For each product specified, two samples, minimum size 12 inches (305 mm) x full panel width, representing actual product configuration.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Panels specified in this section shall be produced in a permanent factory environment with fixed-base roll-forming equipment. Standing seam roofing may be roll formed at the jobsite if the design lengths of the panels are longer

than shipping capabilities. Roll forming of the profiled panels, curving of all panels, factory mitering of corners, and fabricating of all curved flashings shall be performed by the manufacturer.

2. Manufacturer shall submit names and addresses of five previous projects of equal size and scope at the request of the Architect.
 3. Specified system shall have been in use in the United States for a minimum of ten years.
 4. Manufacturer with a minimum of five years experience in manufacturing panels of this nature in a permanent, stationary, indoor production facility utilizing industrial equipment.
- B. Installer Qualifications:
1. Installer shall have completed five projects of similar scope and magnitude that have been in service for a minimum of five years with satisfactory performance of the panel system.
 2. Installer shall submit names and addresses of five previous projects of equal size and scope at the request of the Architect.
 3. Installer's foreman shall be trained in the proper installation of the specified system, and present at all times when material is being installed.
- C. Regulatory Requirements: Comply with specified performance and local building code requirements. In the event of conflict, comply with the higher performing or more restrictive requirement.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panels to job site properly packaged to provide protection against transportation damage.
- B. Exercise extreme care in unloading, storing, and erecting panels to prevent bending, warping, twisting, end and surface damage.
- C. Store all material and accessories above ground on well skidded platforms.
- D. Store inside or under breathable waterproof covering. Provide proper ventilation to panels to prevent condensation buildup between each panel. Elevate one end of bundles while being stored.
- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 WARRANTY

- A. Finish Warranty: Manufacturer warrants that under normal atmospheric conditions the metal panels will meet the following requirements after shipment from manufacturer's mill:
 1. FLEXSHIELD (Vinyl Plastisol): 4 mils thick good both sides of the metal, for sidewalls.
 - a. The paint will not crack, check or peel for a period of 20 years.
 - b. The paint will not chalk in excess of number 6 rating for a period of 20 years.
 - c. The paint will not change color more than 6 NBS units for a period of 20 years.



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PART 2—PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Flexospan, Inc; 253 Railroad St., Sandy Lake, PA 16145. Toll Free Tel: (800) 245-0396. Tel: (724) 376-7221. Fax: (724) 376-3864. Email: sales@flexospan.com. Web: <http://www.flexospan.com>.
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 THROUGH-FASTENED METAL WALL PANELS

- A. Metal Wall Panels: 1/2" Corrugated Metal Wall Panel as manufactured by Flexospan Inc. 2.67 inches (68 mm) rib spacing by 1/2 inch (13 mm) deep. Overall panel width of 41.25 inches (1048 mm) with a wall coverage of 40 inches (1016 mm).
 - 1. Material:
 - a. Painted Steel with G-90 Galvanizing or Galvalume coated.
 - 1) Steel Thickness:
 - (a) 18 gauge.
 - 2) Finish:
 - (a) Vinyl Plastisol (FLEXSHIELD):
 - (1) Volatile Organic Content: 0 percent.
 - (2) Top Side Finish: Primer, dry = 0.15 mil to 0.25 mil; Top coat, dry = 4.0 mil, minimum.
 - (3) Reverse Side Finish: Primer, dry = 0.15 to 0.25 mil; top coat, dry = 4.0 mil, minimum.
 - (4) Accelerated Weathering: Per ASTM D 4587, no cracking, peeling, crazing or adhesion loss of external coating system after 2000 hours accelerated weathering; no chalking greater than #6 rating on walls and #4 rating on roof per ASTM D 4214.
 - 3) Color:
 - (a) Flexospan Standard Color.
 - 2. Accessories:
 - a. Metal Components:
 - 1) Provide accessories and other items essential to a complete roof panel installation including trim, flashing, fascia, metal closures, caps, gutters, downspouts, soffits and similar metal components.
 - 2) Metal components to be fabricated from same gauge and finish as metal panels, unless otherwise noted.
 - b. Flashing:
 - 1) Flashing shall have the same gauge and finish as the exterior panel, unless otherwise noted.
 - c. Fasteners:
 - 1) Exposed fasteners shall be hex head self-drilling screws with bonded washers and color finished to match panels. Screws may be either plated carbon steel or stainless steel as noted on the drawings.
 - 2) Exposed stainless steel rivets shall match color finish of panel.

-
- d. Closure Strips:
 - 1) Polyethylene to match configuration of the covering.
 - e. Sealants:
 - 1) Exposed Sealants: Shall be one component silicone based as recommended by panel manufacturer: field applied.
 - 2) Concealed Sealants: Non-curing, non-skinning butyl, polyisobutylene or polybutane tape as recommended by panel manufacturer; field applied.
 3. Fabrication:
 - a. Form and fabricate components of the system to the profiles and patterns as determined by Architect.
 - b. Metal panels shall be factory formed on a stationary industrial type rolling mill.
 - c. Panel Orientation: Panels with custom metallic finishes are directional and shall be erected so as to produce a consistent visual effect.
 4. Length:
 - a. Unless otherwise shown on Drawings or specified herein, panels shall be full length. Fabricate flashings in 10 ft (3 m) lengths.
 - b. Panel Length: Factory formed standard lengths to 40 feet (12 m).
 - c. Panel Length: Factory formed custom lengths of 40 feet to 60 feet (12 m to 18 m) with special packaging and shipping.
 5. Insulation: Use insulation designed to be installed with through fastened metal wall panel.

PART 3-EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Tolerance Requirements: No panels shall be erected if the structural steel does not meet the tolerances of the AISC Code, Section 7. It is the responsibility of the Contractor to examine this alignment before the panels are erected. The Contractor is responsible for properly installing the roof system and ensuring that all purlins or sub-framing members are properly installed.
- C. If structural steel erection is the responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.

3.02 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.

3.03 INSTALLATION - METAL PANELS

- A. Install in accordance with manufacturer's instructions.
- B. Fastening of Exterior Wall Panels:



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1. Exposed fastener profiles shall be attached with No. 14, self-tapping screws when attached to a sub-girt with a No. 14 by 3/4 inch (19 mm) sheet metal screw, or 12/14 by 1 inch (25 mm) self-drilling screws with sealing washers. When used with color-coated exterior panels, fastener heads shall be the same color as the panel. Fasteners used for attaching aluminum, stainless steel, or Galvalume/Acrylume, shall be of an approved type.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Remove strippable film immediately upon erection of panels or flashings.

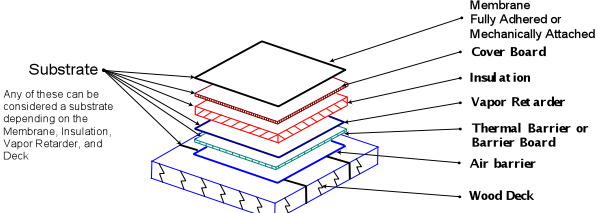
END OF SECTION 07 40 00

**SECTION 07 54 00
 TPO ROOF MEMBRANE**



Wood Deck Specifications
 Adhered / Ballasted ⁽⁶⁾ / Mechanically Attached UltraPly TPO

Sample Assembly



Consult the Firestone Technical Database for specific installation and warranty requirements

	Insulation Attachment	Membrane
<p>30 YEAR</p> <ul style="list-style-type: none"> <input type="checkbox"/> I.S.O. 95+ GL <input type="checkbox"/> Tapered I.S.O. 95+ GL <input type="checkbox"/> Dens Deck ⁽⁴⁾ <input type="checkbox"/> Dens Deck Prime ⁽⁴⁾ <input type="checkbox"/> HailGard ⁽⁶⁾ 	<p>30 YEAR</p> <ul style="list-style-type: none"> <input type="checkbox"/> Heavy Duty Fasteners <input type="checkbox"/> HailGard Fasteners <input type="checkbox"/> Firestone ISO Twin Pack ⁽²⁾ <input type="checkbox"/> Firestone ISO Spray Adhesive ⁽²⁾ <input type="checkbox"/> Firestone ISO-FIX Adhesive ^(2,3) 	<p>30 YEAR</p> <ul style="list-style-type: none"> <input type="checkbox"/> UltraPly Platinum TPO .080 <input type="checkbox"/> ReflexEON Platinum TPO .080
<p>20 YEAR</p> <ul style="list-style-type: none"> <input type="checkbox"/> I.S.O. 95+ GL <input type="checkbox"/> Tapered I.S.O. 95+ GL <input type="checkbox"/> Dens Deck ^(4,5) <input type="checkbox"/> Dens Deck Prime ^(4,5) <input type="checkbox"/> HailGard ^(6,8) 	<p>20 YEAR</p> <ul style="list-style-type: none"> <input type="checkbox"/> Heavy Duty Fasteners <input type="checkbox"/> HailGard Fasteners <input type="checkbox"/> Firestone ISO Twin Pack ⁽²⁾ <input type="checkbox"/> Firestone ISO Spray Adhesive ⁽²⁾ <input type="checkbox"/> Firestone ISO-FIX Adhesive ^(2,3) <input type="checkbox"/> Loose Laid ⁽⁷⁾ 	<p>20 YEAR</p> <ul style="list-style-type: none"> <input type="checkbox"/> UltraPly Platinum TPO .080 ⁽¹⁾ <input checked="" type="checkbox"/> UltraPly TPO .060 ⁽¹⁾ <input type="checkbox"/> UltraPly TPO XR 115 ⁽¹⁾ <input type="checkbox"/> ReflexEON Platinum TPO .080 ⁽¹⁾ <input type="checkbox"/> ReflexEON .060 or .080 ⁽¹⁾
<p>15 YEAR AND LESS</p> <ul style="list-style-type: none"> <input type="checkbox"/> I.S.O. 95+ GL <input type="checkbox"/> Tapered I.S.O. 95+ GL <input type="checkbox"/> Dens Deck ^(4,5) <input type="checkbox"/> Dens Deck Prime ^(4,5) <input type="checkbox"/> FiberTop Woodfiber <input type="checkbox"/> FiberTop Woodfiber Composite <input type="checkbox"/> HailGard ^(6,8) 	<p>15 YEAR RECOVER</p> <ul style="list-style-type: none"> <input type="checkbox"/> Heavy Duty Fasteners <input type="checkbox"/> HailGard Fasteners <input type="checkbox"/> Firestone ISO Twin Pack ⁽²⁾ <input type="checkbox"/> Firestone ISO Spray Adhesive ⁽²⁾ <input type="checkbox"/> Firestone ISO-FIX Adhesive ^(2,3) <input type="checkbox"/> Loose Laid ⁽⁷⁾ <p>15 YEAR AND LESS</p> <ul style="list-style-type: none"> <input type="checkbox"/> All Purpose Fasteners <input type="checkbox"/> Heavy Duty Fasteners <input type="checkbox"/> HailGard Fasteners <input type="checkbox"/> Firestone ISO Twin Pack ⁽²⁾ <input type="checkbox"/> Firestone ISO Spray Adhesive ⁽²⁾ <input type="checkbox"/> Firestone ISO-FIX Adhesive ^(2,3) <input type="checkbox"/> Loose Laid ⁽⁷⁾ 	<p>15 YEAR AND LESS</p> <ul style="list-style-type: none"> <input type="checkbox"/> UltraPly Platinum TPO .080 ⁽¹⁾ <input type="checkbox"/> UltraPly TPO .045 or .060 ⁽¹⁾ <input type="checkbox"/> UltraPly TPO XR 110 or 115 ⁽¹⁾ <input type="checkbox"/> ReflexEON Platinum TPO .080 ⁽¹⁾ <input type="checkbox"/> ReflexEON TPO.060 or .080 ⁽¹⁾

Notes:

Footnotes:

1. The new roof membrane can be directly adhered to a Structural Concrete deck, New Cover Board, new insulation, or a combination of the above. See the Firestone Technical Database for specific installation requirements.
2. Max Size Insulation Board 4'x4'
3. Full Test required on deck if ISO-FIX Adhesive is used to attach Insulation to deck.
4. Acceptable for use in 4'x8' attachment with Twin Pack Adhesive
5. Not acceptable for top layer of insulation in Ballasted assembly.
6. Ballasted Systems are not acceptable for 30 year warranties.
7. Loose laid insulation is only acceptable in Ballasted Assemblies.
8. HailGard Insulation can only be attached using approved Firestone Fasteners.

Building Height Limitations:
 Refer to the Firestone Technical Database for Building Height limitations for Firestone Adhered and Mechanically Attached Systems

Base Tie-Ins:
 Must be constructed using the QuickSeam RPF Strip.

Slope Requirements:

- Minimum 1/8" slope recommended to promote positive drainage. Firestone Recommends a minimum of 1/4" slope.

Use of Air Barrier:

- An air barrier is required for projects with large openings that are greater than 10% of the total wall area that can be left open in a storm. Criteria to be determined based upon Firestone's Review.

Seam Construction:

- Side Laps and End Laps: Minimum 3" QuickSeam Splice Tape with QuickSeam Joint Covers at all "T" joints and wall intersections.

Sheet Metal:

- Firestone Metal Edge System
- Shop Fabricated pre-finished G-90 Galvanized Steel, Stainless Steel, Anodized or Extruded Aluminum.

Other Requirements:

- As-Built projects not permitted. Firestone requires a Pre-Installation Notice 14 days prior to project installation.
- System installation per Firestone Technical Database.

The Firestone Warranty does not cover products not supplied by Firestone Building Products

Products or problems associated with the use of non-Firestone supplied products are not covered under the Firestone Warranty

FIRESTONE BUILDING PRODUCTS COMPANY
 310 East 96th Street • Indianapolis, IN 46240
 Technical Hotline 1-800-428-4511 • Technical Facsimile: 1-800-242-0504
 Sales 1-800-428-4442 • Web Site: www.firestonebpc.com

END OF SECTION 07 54 00

SECTION 07 62 00 SHEET METAL FLASHING AND TRIM

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data Shop Drawings and Samples.
- B. Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- C. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2—PRODUCTS

2.01 SHEET METAL

- A. Metallic-Coated Steel Sheet: Galvanized structural-steel sheet, ASTM A 653/A 653M, G90 (Z275)

2.02 ACCESSORIES

- A. Self-Adhering Sheet Underlayment, High Temperature: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied.
- B. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.
- C. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.
 1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
 2. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 3. Fasteners for Metallic-Coated Steel Sheet: Hot-dip galvanized steel or Series 300 stainless steel.
- D. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.

2.03 FABRICATION

- A. Fabricate sheet metal 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 the item indicated.
- B. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

PART 3—EXECUTION

3.01 INSTALLATION

- A. Comply with SMACNA's "Architectural Sheet Metal Manual." Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.



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- B. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- C. Fabricate nonmoving seams in sheet metal with flat-lock seams.
- D. Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment.

END OF SECTION 07 62 00

**SECTION 07 71 00
ROOF SPECIALTIES****PART 1—GENERAL****1.01 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.

PART 2—PRODUCTS**2.01 MATERIALS**

- A. Prepainted, Zinc-Coated Steel: 0.028 inch (0.71 mm)
- B. ABS Plastic:
- C. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements.
 - 1. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel.

2.02 ROOF SPECIALTIES

- A. Downspouts:
 - 1. Products:
 - a. Englert Incorporated or similar product from other manufacturer
 - 2. Downspouts: Plain rectangular . Furnish wall brackets of same material and finish as downspouts, with anchors.
 - a. Formed Aluminum: .019 gauge
- B. Scupper drains:
 - 1. Products:
 - a. Roofmaster Products Company or similar product from other manufacturer.
 - 2. Scupper Drain 4"x4" non-canted product# 157471
 - a. ABS plastic

PART 3—EXECUTION**3.01 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. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless indicated.



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- D. Fastener Sizes: Use fasteners of sizes that will penetrate [wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws] [substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance]
- E. Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.

END OF SECTION 07 71 00

SECTION 07 81 60
INTERIOR INTUMESCENT FIREPROOFING

PART 1 - GENERAL**1.01 WORK INCLUDED**

- A. Preparing surfaces to receive fireproofing.
- B. Protection of adjacent surfaces from overspraying.
- C. Spray application of water based, intumescent, fireproofing on interior, exposed structural steel wide flange columns, beams, pipe columns, and related exposed structural steel to provide rated fireproofing.

1.02 RELATED WORK

- A. Section 051200 - Structural Steel.

1.03 REFERENCES

- A. ASTM D 256 - Impact Resistance Test.
- B. ASTM D 638 - Tensile Strength.
- C. ASTM D 695 - Standard Test Method for Compressive Strength.
- D. ASTM D 790 - Standard Test Method for Flexural Strength.
- E. ASTM D 1002 - Standard Test Method for Bond Strength.
- F. ASTM D 1044 - Standard Test Method for Abrasion Resistance Test.
- G. ASTM D 4541 - Bond Strength.
- H. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
- I. ASTM E 119 - Fire Tests of Building Construction and Materials.
- J. U.L., Inc. - Fire Resistance Directory.
- K. SSPC-SP-1 Solvent Cleaning - Steel Structures Painting Council (SSPC).
- L. SSPC-SP-2 Hand Tool Cleaning - Steel Structures Painting Council (SSPC).
- M. SSPC-SP-3 Power Tool Cleaning - Steel Structures Painting Council (SSPC).
- N. SSPC-SP-6 Commercial Blast Cleaning - Steel Structures Painting Council (SSPC).

1.04 PERFORMANCE REQUIREMENTS

- A. Intumescent fireproofing system to provide a fire rating of one, one and one half, two, two and One half, three, three and one half hours.

1.05 SUBMITTALS

- A. Submit product data under provisions of Section 013000.
 - 1. Indicate product characteristics, performance, and limitation criteria.
- B. Submit manufacturer's installation instructions under provisions of Section 013000.

-
- C. Submit manufacturer's certificate under provisions of Section 01400 that products meet or exceed specified requirements.
 - D. Submit test reports under provisions of Section 014000.
 - E. Submit certified test reports indicating the following:
 - 1. Fire test reports of fireproofing application to substrate materials similar to project conditions.
 - 2. U.L. Design Listings from U.L., Inc.
 - 3. Submit applicator's current certification, by product manufacturer, as a factory trained and manufacturer approved installer of this product.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
- B. B. Applicator: Company specializing in applying the work of this Section with minimum 3 years documented experience and approved by manufacturer.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire resistance ratings.
- B. Submit certification of acceptability of fireproofing materials to authority having jurisdiction and to Architect.

1.08 MOCKUP

- A. Provide mockup of applied intumescent fireproofing under provisions of Section 014000.
- B. Provide testing and analysis of mockup to manufacturer's published data.
- C. Apply sample section of 100 sq ft in size to representative substrate on site.
- D. Comply with project requirements as to thickness, density, fire rating, and finish texture.
- E. Examine installation to determine variances.
- F. If accepted, mockup will demonstrate minimum standard for the Work. Mockup may remain as part of the Work.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. When temperature is less than 40F, follow manufacturer's field instructions for cold weather installation. So not apply when surface temperature is less than 5 degrees F above the dew point.
- B. Provide ventilation in areas to receive fireproofing during and 72 hours, minimum, after application, to dry materials and dissipate solvent odors.
- C. Maintain non-toxic, unpolluted working area. Provide temporary enclosure to prevent spray from contaminating air.

1.10 SEQUENCING AND SCHEDULING

- A. Sequence work under provisions of Section 051200_Structural Steel
- B. Sequence work in conjunction with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

1.11 WARRANTY

- A. Provide one year manufacturer's warranty under provisions of Section 017000.
- B. Provide one year applicator's warranty under provisions of Section 017000.
- C. Warranty: Fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering. Reinstall or repair such defects or failures.

PART 2-PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. Albi Manufacturing, East Berlin, CT (860) 828-0571; "ALBI CLAD TF."

2.02 MATERIALS

- A. Intumescent Fireproofing: Single component, water based, factory mixed, asbestos free, intumescent material blended for uniform texture; conforming to the following requirements:
 - 1. Bond Strength: ANSI/ASTM E 736, 40 lb/sq in when set and dry.
 - 2. Bond Impact: ASTM E 760, no cracking, flaking, or delamination.
 - 3. Dry Density: ASTM E 605, minimum average density of 85 lb/cu ft.
 - 4. Surface Burning Characteristics, ASTM E84:
 - a. Flame Spread: 2.
 - b. Smoke Developed: 5.
 - 5. Compressive Strength: Minimum 300 lb/sq ft.
- B. Primer: Albi 487S, 490W, or type recommended or approved by fireproofing manufacturer.

PART 3 - EXECUTION**3.01 INSPECTION**

- A. Verify that surfaces are ready to receive work.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- C. Verify ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is complete.
- D. Verify that voids and cracks in substrate are filled, and projections are removed where fireproofing is exposed to view as a finish material.
- E. Beginning of installation means applicator accepts existing substrate.

3.02 PREPARATION

- A. Work in accordance with SSPC guidelines SSPC-SP-1, SSPC-SP-2, SSPC-SP-3, or SSPC-SP-6 as appropriate to prepare substrate.
- B. Clean substrate of dirt, dust, grease, oil, loose material, or other matter which may effect bond of fireproofing.
- C. Seal all penetrations or open ended fireproofing termination by chamfering at a 45 degree angle and sealing with high heat silicone sealant.
- D. Install reinforcement over structural members as indicated on Drawings, or U.L. Fire Resistance Directory Listings.

3.03 PROTECTION

- A. Protect floor areas from this Work by completely covering with tarps or 4 mil polyethylene sheets.
- B. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting.
- C. Close off and seal ductwork in areas where fireproofing is being applied.

3.04 APPLICATION

- A. Apply primer and fireproofing in accordance with manufacturer's instructions. Do not apply to surfaces which would prohibit proper adhesions.
- B. Apply primer according to primer manufacturer's recommendations. Provide primer "cut-back" three inches for bolted connections and 12 inches for welded connections.
- C. Apply fireproofing in sufficient thickness to achieve rating, with as many passes necessary to cover with monolithic blanket of uniform hardness, density and texture. Spray, and roll smooth the finished surface.

3.05 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed using manufacturer's guidelines under provisions of Section [01400.]
- B. Inspections will be performed to verify compliance with requirements.
- C. Patch fireproofing, which has been cut away to facilitate work of other trades, so as to maintain complete coverage of full thickness on appropriate substrate.
- D. Correct unacceptable Work and provide further inspection to verify compliance with requirements, at no cost.

3.06 CLEANING


- A. Clean work under provisions of Section 017000.
- B. Remove excess material, overspray, droppings, and debris.
- C. Remove fireproofing from materials and surfaces not specifically required to be fireproofed.

PART 4—SCHEDULE**4.01 SCHEDULE OF FIREPROOFING**

- A. 4.5"x4.5"x.25" HSS interior columns
 - 1. Components:
 - 2. U.L. Rating: [1] [1-1/2] [2] [2-1/2] [3] [3-1/2] hours.

FIGURES:

FIGURE 078160.1 FIRE RATED PAINT


	<p>Albi Albi Manufacturing Division of StanChem Inc. 401 Berlin St., East Berlin, CT 06023 860/828-0571 Fax: 860/828-3297 http://www.albi.com</p>	<p>ALBI CLAD TF (Interior Intumescent Fireproofing) Section 07816 page 1 of 5</p>
<p>SECTION 07816 INTERIOR INTUMESCENT FIREPROOFING</p>		
<p>PART 1 - GENERAL</p>		
<p>1.01 WORK INCLUDED</p> <ul style="list-style-type: none"> A. Preparing surfaces to receive fireproofing. B. Protection of adjacent surfaces from overspraying. C. Spray application of water based, intumescent, fireproofing on interior, exposed structural steel wide flange columns, beams, pipe columns, and related exposed structural steel to provide rated fireproofing. 		
<p>1.02 RELATED WORK</p> <ul style="list-style-type: none"> A. Section 051200 - Structural Steel. 		
<p>1.03 REFERENCES</p> <ul style="list-style-type: none"> A. ASTM D 256 - Impact Resistance Test. B. ASTM D 638 - Tensile Strength. C. ASTM D 695 - Standard Test Method for Compressive Strength. D. ASTM D 790 - Standard Test Method for Flexural Strength. E. ASTM D 1002 - Standard Test Method for Bond Strength. F. ASTM D 1044 - Standard Test Method for Abrasion Resistance Test. G. ASTM D 4541 - Bond Strength. H. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials. I. ASTM E 119 - Fire Tests of Building Construction and Materials. J. U.L., Inc. - Fire Resistance Directory. K. SSPC-SP-1 Solvent Cleaning - Steel Structures Painting Council (SSPC). L. SSPC-SP-2 Hand Tool Cleaning - Steel Structures Painting Council (SSPC). 		
<p>WARRANTY</p> <p><small>LIMITED WARRANTY/LIMITATION OF LIABILITY: Seller warrants that its products will meet the specifications which it sets for them. Seller's responsibility under this warranty will be limited solely to replacing the products which prove defective, provided that Buyer gives Seller prompt notice in writing of said defect and satisfactory proof thereof. Products may be returned to Seller only after written authorization has been obtained from Seller. The foregoing warranty is in lieu of all other warranties, whether oral, written, express, implied or statutory. IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WILL NOT APPLY. Technical or other advice is furnished by us solely as an accommodation and shall not increase the scope of our responsibilities or liability. Seller's warranty obligations and Buyer's remedies hereunder are solely and exclusively as stated herein: in no event will Seller be liable either for the labor and other associated costs incurred in replacing the product, including, but not limited to, its removal and application, or for other incidental or consequential damages.</small></p>		



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FIGURE 078160.2 UL LISTING FIRE PAINT

		Albi Manufacturing Division of StanChem, Inc. 401 Berlin St., East Berlin, CT 06023 860/828-0571 Fax: 860/828-3297 www.albi.com info@albi.com			ALBI CLAD TF Underwriters' Laboratories Listings	
COLUMNS: Wide Flange (Contour Application)				FIRE TEST: ASTM E-119		
COLUMN SIZE	U.L. DESIGN NO.	HOURLY RATING	MATERIAL THICKNESS	REINFORCEMENT		
W8 x 24	X-625	1 hr.	.100 in. dft	none		
	X-625	2 hr.	.313 in. dft	none		
W10 x 49	X-625	1 hr.	.055 in. dft	none		
	X-625	1-1/2 hrs.	.132 in. dft	none		
	X-625	2 hrs.	.310 in. dft	none		
	X-625	2-1/2 hrs.	.430 in. dft	none		
	X-625	3 hrs.	.550 in. dft	fiberglass ribbon		
	X-625	3-1/2 hrs.	.670 in. dft	fiberglass ribbon		
W12 x 120	X-625	1 hr.	.037 in. dft	none		
	X-625	1-1/2 hrs.	.108 in. dft	none		
	X-625	2 hrs.	.192 in. dft	none		
COLUMNS: Hollow Sections				FIRE TEST: ASTM E-119		
COLUMN SIZE	U.L. DESIGN NO.	HOURLY RATING	MATERIAL THICKNESS	REINFORCEMENT		
8-Inch pipe (schedule 60)	X-628	1 hr.	.120 in. dft	none		
	X-628	1-1/2 hrs.	.230 in. dft	fiberglass ribbon		
	X-628	2 hrs.	.370 in. dft	fiberglass ribbon		
	X-628	2-1/2 hrs.	.520 in. dft	fiberglass ribbon		
	X-628	3 hrs.	.660 in. dft	fiberglass ribbon		
(schedule 100)	X-628	3 hrs.	.625 in. dft	fiberglass ribbon		
4 x 4 x 3/8"	X-638	2 hrs.	.431 in. dft	fiberglass ribbon		
8 x 8 x 3/8"	X-638	1 hrs.	.119 in. dft	none		
8 x 8 x 1/2"	X-638	2 hrs.	.334 in. dft	fiberglass ribbon		
10 x 10 x 5/8"	X-638	1 hr	.065 in. dft	none		
16 x 16 x 1/2"	X-638	2 hr	.265 in. dft	fiberglass ribbon		
	X-638	1 hr	.065 in. dft	none		
16 x 16 x 5/8"	X-638	2 hr	.334 in. dft	fiberglass ribbon		
	X-638	1hr	.065 in. dft	none		
X-638	2 hrs.	.265 in. dft	fiberglass ribbon			
BEAMS: Wide Flange				FIRE TEST: ASTM E-119		
COLUMN SIZE	U.L. DESIGN NO.	HOURLY RATING	MATERIAL THICKNESS	REINFORCEMENT		
W8 x 31	N-607	1 hr. (unrestrained)	.090 in. dft	none		
W8 x 31	N-607	1-1/2 hr. (restrained)	.090 in. dft	none		
W8 x 31	N-607	2 hr. (restrained)	.140 in. dft	none		
W10 x 88	N-607	1 1/2 hr.(unrestrained)	.149 in. dft	none		
W10 x 88	N-607	2 hr.(unrestrained)	.149 in. dft	none		
W10 x 88	UL 11-29-99	3 hr. (restrained)	.400 in. dft	fiberglass ribbon		
WARRANTY						
<small>LIMITED WARRANTY/LIMITATION OF LIABILITY: Seller warrants that its products will meet the specifications which it sets for them. Seller's responsibility under this warranty will be limited solely to replacing the products which prove defective, provided that Buyer gives Seller prompt notice in writing of said defect and satisfactory proof thereof. Products may be returned to Seller only after written authorization has been obtained from Seller. The foregoing warranty is in lieu of all other warranties, whether oral, written, express, implied or statutory. IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WILL NOT APPLY. Technical or other advice is furnished by us solely as an accommodation and shall not increase the scope of our responsibilities or liability. Seller's warranty obligations and Buyer's remedies hereunder are solely and exclusively as stated herein. In no event will Seller be liable either for the labor and other associated costs incurred in replacing the product, including, but not limited to, its removal and application, or for other incidental or consequential damages.</small>						
<small>Rev. 1/08</small>						

END OF SECTION 07 81 60

SECTION 07 92 00
JOINT SEALANTS**PART 1—GENERAL****1.01 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.

PART 2—PRODUCTS**2.01 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 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 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.
- E. 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.
- F. 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.

2.02 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.



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PART 3—EXECUTION

3.01 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 07 92 00

DIVISION 08 – OPENINGS

SECTION 08 11 74 SLIDING GLASS DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dual Track Sliding Glass Doors
- B. Multiple Bay Sliding Glass Doors.

1.02 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry.
- B. Section 06 20 00 - Finish Carpentry.
- C. Section 07 21 16 - Blanket Insulation.
- D. Section 07 46 33 - Plastic Siding.
- E. Section 07 62 00 - Sheet Metal Flashing and Trim.
- F. Section 07 90 00 - Joint Protection.

1.03 REFERENCES

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
- C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.
- D. ASTM B 221 / B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- E. ASTM B 241 / B 241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Tube.
- F. ASTM C 1115 - Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
- G. ASTM C 864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- H. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- I. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
- J. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
- K. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials

- L. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
- M. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls, and Doors.
- N. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
- O. AWS D1 - Structural Welding Code.
- P. FGMA - Flat Glass Marketing Association, Glazing Manual

1.04 PERFORMANCE REQUIREMENTS

- A. System Design: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of door system as calculated in accordance with applicable code.
- B. Multi Track Door system (with or without pocket) when tested on a typical four panel door unit, 190-3/8 inches (4836 mm) in width and 95 inches (2413 mm) in height shall meet or exceed SD-HC40 Product Designation conforming to AAMA/WDMA/CSA 101/I.S.2/A440 and the following performance tests.
 - 1. Air Infiltration Test: ASTM E 283:
 - a. Force of 1.57 psf (25 mph) = Products in testing.
 - b. Force of 6.24psf (50 mph) = Products .
 - 2. Water Penetration Test: ASTM E 331 and ASTM E 547:
 - a. Water pressure of 6.0 psf and 5.0 gph/ft² = Products in testing.
 - 3. Uniform Structural Load Test: ASTM E 330:
 - a. Force of 60.0 psf min. exterior = Products in testing.
 - b. Force of 60.0 psf min. interior = Products in testing.
 - 4. Thermal Penetration Test: AAMA 1503-9:
 - a. Thermal Transmittance (U Value) = Products in testing.
 - b. Condensation Resistance Factor (CRF) = Products in testing.
- C. Submit under provisions of Section 01 30 00.
- D. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- E. Shop Drawings: Detailed drawings prepared specifically for the project by manufacturer. Show opening dimensions, framed opening tolerances, profiles, product components, anchorages, accessories.
 - 1. Elevations indicating size and configuration of fixed and sliding panels.
 - 2. Detail sections of fittings.

3. Indicate location and sizes of anchorages and reinforcement.
 4. Indicate material thickness, fastener locations, glazing and hardware arrangements.
 5. Include schedule identifying each unit, with marks or numbers referencing drawings.
- F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- G. Verification Samples:
1. Aluminum Finish: Two samples, minimum size 2 by 3 inches (50 by 75 mm), representing actual product and color.
 2. Glass: Two samples, minimum size 12 inches (300 mm) square, of specified glass.
 3. Assembly Sample: 24 by 36 inch (600 by 900 mm) assembly complete with glazing, gaskets, fasteners, anchors, and finish; do not proceed with fabrication until workmanship and color are approved by Architect.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum 5 years experience in fabrication and erection of sliding glass door systems for projects of similar scope.
- B. Installer Qualifications: Experienced in performing work of this section that has specialized in installation of work similar to that required for this project.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Install glass door system mock-up in location designated by Architect.
 2. Do not proceed with remaining work until installed system is approved by Architect.
 3. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect factory finishes from damage, precipitation and construction materials until ready for installation.

1.07 PROJECT CONDITIONS

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

1.08 WARRANTY

- A. Provide manufacturer's warranty that properly installed door system will be free from significant defects in material, workmanship, and uncontrolled water leakage for five years from date of Substantial Completion.
- B. Warranty anodized aluminum finish for five years.
- C. For stock color PPG Duranar 70 percent fluoropolymer finishes, provide paint manufacturer's warranty for color and film integrity for at least 10 years from date of application.



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- D. For custom color PPG Duranar 70 percent fluoropolymer finishes, provide paint manufacturer's warranty for color and film integrity for at least ten years from date of application.
- E. For stock color PPG Acrynar 50 percent fluoropolymer finishes, provide warranty for color and film integrity for ten years from date of application.
- F. For glazing, provide glazing manufacturer's standard warranty against defective materials, delamination, seal failure, and defects in manufacturing for at least five years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Custom Windows and Doors, which is located at: 1900 SW 44th ave; Ocala, FL 34474; Tel: 352 291 7714; Web: www.cws.cc/
- B. Acceptable Manufacturer: Pella windows, which is located at: 105000 Ulmerton Rd, suite 304 ; Largo, FL 33771; Toll free 1800 288 7281; Tel: 727 585 4007; Fax: 407 339 7742; Email: blevinsjs@pella.com; Web:www.pella.com
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 SLIDING GLASS DOORS

- A. Provide sliding glass doors factory assembled and glazed, complete with weatherstripping, glazing, operating hardware and specified accessories. Door system shall be provided to fit the openings indicated on the Drawings and as follows:
 - 1. Multiple Bay Sliding Doors 8900 Series:
 - a. Door Size/Configuration:
 - 1) Size: As indicated on the Drawings.
 - 2) Configuration: 4 Operable Panels and 2 Fixed Panels.
 - b. Glazing:
 - 1) 1 inch (25 mm) sealed insulating glass.
 - c. Framing:
 - 1) Extruded aluminum.
 - 2) Extruded aluminum frame with thermal break separation.
 - d. Sill:
 - 1) Provide with standard multiple bay sill with 0.48 inch (12 mm) height.
 - 2) Provide with mid-performance sill with a 1.25 inch (32 mm) interior lip at the interior side of the opening.
 - e. Standard Bottom Rail: Provide with standard 2.587 inch (66 mm) height using a 1-1/2 inch (38 mm) roller.
 - f. Standard Flush Rail: Provide with standard 1.420 inch (36.06 mm) width.
 - g. Hardware:
 - 1) Steel bearings.
 - 2) Sliding door roller size: 1-1/2 inch (38 mm).

-
- h. Interior Door Handles:
 - 1) Finish: White.
 - 2) Two point anti-slam lock set without keyed cylinder.
 - i. Exterior Door Handles:
 - 1) Finish: White.
 - 2) Handle Type: Recessed handle and lock.
 - j. Weather Gaskets: Provide doors with perimeter weather gaskets of high quality EPDM with anti-shrink cord.
2. Dual Track Sliding Doors 8900 and 350 Series:
- a. Door Size/Configuration:
 - 1) Size: 95.5 x 130.5”.
 - 2) Configuration: 1 Operable Panels and 2 Fixed Panels.
 - b. Glazing:
 - 1) 1 inch (25 mm) sealed insulating tempered glass.
 - c. Framing:
 - 1) Extruded aluminum.
 - 2) Extruded aluminum frame with thermal break separation.
 - d. Sill: Provide with standard sill with 1.1 inch (28 mm) interior lip.
 - e. Sill: Provide with high performance sill with a 2 inch (51 mm) interior lip.
 - f. Standard Bottom Rail: Provide with standard 2.587 inch (66 mm) height using a 1-1/2 inch (38 mm) roller.
 - g. Standard Flush Rail: Provide with standard 1.420 inch (36.06 mm) width.
 - h. Hardware:
 - 1) Steel bearings.
 - 2) Provide with interior mount head and sill security locks.
 - i. Interior Door Handles:
 - 1) Finish: White.
 - 2) Two point anti-slam lock set without keyed cylinder.
 - j. Exterior Door Handles:
 - 1) Finish: White.
 - 2) Handle Type: Recessed handle and lock.
 - k. Weather Gaskets: Provide doors with perimeter weather gaskets of high quality EPDM with anti-shrink cord.

2.03 MATERIALS

- A. Aluminum: 6063-T6, 6063-T5, or 6105-T5 alloy and temper. Other alloys and tempers may be used for non-structural members provided they do not void the required warranties. Indicate alloys and tempers clearly on shop drawings and in structural calculations.
1. Framing Members: Thickness based on the design loading, cross sectional configuration, and fabrication requirement.
 2. Aluminum Flashing and Closures: Minimum of 0.040 inches (1.0 mm) thick.
 3. Snap-On Covers and Miscellaneous Non-Structural Trim: Minimum thickness recommended by the manufacturer.
- B. Glazing: Provide glazing type as recommended by the manufacturer for the project.
- C. Flashings: Sheet aluminum, same finish as for system components; secured with concealed fastening method or fastener with head finished to match; thickness as required for conditions encountered.
- D. Thermal Break: Manufacturer's standard thermal separation between exterior and interior components.
- E. Internal Reinforcing:
1. ASTM A 36/A 36M for carbon steel; or ASTM B 221/B 221M and ASTM B 241/B 241M for structural aluminum.
 2. Shapes and sizes to suit installation.
 3. Shop coat steel components after fabrication with manufacturer recommended primer.
- F. Glazing Gaskets: Compression type design, replaceable; EPDM, complying with ASTM C 864, with solid strand cord to prevent shrinkage or; Elastomeric silicone with solid strand cord to prevent shrinkage, complying with ASTM C 1115, as recommended by the manufacturer.
1. Completely compatible with glazing sealant to be used.
 2. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
 3. Manufacturer's standard black color.
 4. Factory molded corners required at interior.
- G. Setting Blocks, Edge Blocks, and Spacers: As required by manufacturer and compatible with insulated glass where required.
- H. Structural Glazing Sealant: GE Silpruf; black.
- I. Perimeter Sealant: GE Silpruf; color to match framing finish if available; otherwise color as selected from manufacturer's standard range.
- J. Anchors and Fasteners:
1. Aluminum and stainless steel of type which will not cause electrolytic action or corrosion.
 2. Zinc cadmium-plated fasteners may be used if acceptable to manufacturer.
 3. Finish exposed fasteners to match aluminum frame.
- K. Accessories: Provide accessories as scheduled to achieve design intent and environmental control.
- L. Aluminum Finish:
1. Color: Manufacturer's standard white color.

M. Vinyl Finish:

1. Color: Manufacturer's standard white color.

2.04 FABRICATION

- A. Fabricate components in accordance with approved shop drawings. Remove burrs and rough edges. Shop fabricate to greatest extent practicable to minimize field cutting, splicing, and assembly. Disassemble only to extent necessary for shipping and handling limitations. Install gaskets and tapes in factory.
- B. Welding:
 1. Comply with recommendations of American Welding Society.
 2. Grind exposed welds smooth and flush with adjacent surfaces before finishing; restore mechanical finish.
- C. Steel Components:
 1. Clean surfaces after fabrication and immediately prior to application of primer in accord with manufacturer's recommendations.
 2. Apply specified shop coat primer in accord with manufacturer's instructions to provide 2.0 mil (0.05 mm) minimum dry film thickness.
- D. Fabricate components true to detail and free from defects impairing appearance, strength or durability. Contour outdoor horizontal glazing to minimize water ponding and ice or snow buildup.
- E. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weathertight. Ensure slip joints make full, tight contact and are weathertight.
- F. Reinforce components at anchorage and support points, at joints, and at attachment points for interfacing work.
- G. Glass: Accurately size glass to fit openings allowing clearances following recommendations of "Glazing Manual" published by Flat Glass Marketing Association.
- H. Cut glass clean and carefully. Nicks and damaged edges will not be accepted. Replace glass that has damaged edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify openings are ready to receive work and dimensions and clearances are as indicated on the approved shop drawings.
- C. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 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.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install sliding glass door system in accordance with approved shop drawings and manufacturer's instructions.
- C. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.
- D. Provide attachments and shims to permanently fasten system to building structure.
- E. Maintain dimensional tolerances and alignment with adjacent Work.
- F. Anchor securely in place, allowing for required movement, including expansion and contraction.
- G. Install glazing and sealants in accordance with manufacturer's instructions without exception, including surface preparations.
- H. Set sill members in bed of sealant. Set other members with internal sealants to provide weathertight construction.
- I. Install flashings, closures, corners, and other accessories as required or detailed.
- J. Clean surfaces and install sealant in accordance with sealant manufacturer's instructions and structure manufacturer's guidelines.

3.04 ADJUSTING AND CLEANING

- A. Adjust hinge sets, locksets, and other hardware for proper operation. Lubricate using a suitable lubricant compatible with door and frame coatings.
- B. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions before owner's acceptance.
- C. Any abraded surface of the finish shall be cleaned and touched up with air dry paint, as approved and furnished by the manufacturer, in a color to match factory applied finish.
- D. Remove from project site and legally dispose of construction debris associated with this work.

3.05 PROTECTION

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

END OF SECTION

SECTION 08 21 20
STILE AND RAIL WOOD DOORS

PART 1—GENERAL**1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data, including details of construction and factory-finishing specifications and finish Samples for custom doors.

PART 2—PRODUCTS**2.01 STILE AND RAIL DOORS**

- A. Safety Glass: Comply with testing requirements in 16 CFR 1201, for Category II materials.
- B. Exterior Door : Custom door assembled with wet-use adhesives and made from Cypress
1. Front Entrance Door: Custom Made Solid Core Cypress door.
 2. Glass: Uncoated, clear insulating-glass units made from two lites of 3.0-mm-thick, fully tempered glass with 1/4-inch (6.4-mm) interspace.

2.02 FABRICATION AND FINISHING

- A. Factory fit doors to suit frame-opening sizes and to comply with referenced quality standard.
1. Provide 1/8-inch (3.2-mm) clearance at jambs, heads, and meeting stiles and 1/2 inch (12.7 mm) at bottom. At thresholds, provide 3/8-inch (9.5-mm) clearance.
 2. Comply with NFPA 80 for fire-resistance-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
- C. Glaze doors at factory.
- D. Factory treat exterior doors after fabrication with water repellent to comply with WDMA I.S.4.
- E. Factory finish wood doors with manufacturer's standard stain and two-coat conversion varnish finish in color selected.

PART 3—EXECUTION**3.01 INSTALLATION**

- A. Align and fit doors in frames with uniform clearances and bevels indicated below. Machine doors for hardware. Seal cut surfaces after fitting and machining.
1. Provide 1/8-inch (3.2-mm) clearance at jambs, heads, and meeting stiles and 1/8 inch (3.2 mm) at bottom. At thresholds, provide 1/4-inch (6.4-mm) clearance from bottom of door.
- B. Align factory-fitted doors in frames for uniform clearances.
- C. Repair, refinish, or replace factory-finished doors damaged during installation as directed by Architect.

END OF SECTION 08 21 20

SECTION 08 55 00
WOOD WINDOWS**PART 1—GENERAL****1.01 SECTION INCLUDES**

- A. Clad wood windows.

1.02 RELATED SECTIONS

- A. Section 06100 - Rough Carpentry: Framed openings.
- B. Section 06200 - Finish Carpentry: Interior wood casing.
- C. Section 07210 - Building Insulation: Batt insulation at window perimeter.
- D. Section 07460 - Siding and trim.
- E. Section 07620 - Flashing and Sheet Metal: Flashing associated with windows and doors.
- F. Section 07900 - Joint Sealers: Perimeter joint sealant and backer rod.

1.03 REFERENCES

- A. AAMA/WDMA/CSA 101/I.S.2/A440-08 NAFS - North American Fenestration Standard/Specification for windows, doors, and skylights.
- B. AAMA 611-98 - Voluntary Specification for Anodized Architectural Aluminum.
- C. AAMA 2604-05 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- D. AAMA 2605-05 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- E. ASTM C 1036-06 - Standard Specification for Flat Glass.
- F. ASTM C 1048-04 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
- G. ASTM C1172-03 - Standard Specification for Laminated Architectural Flat Glass.
- H. ASTM D 2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates; 1993 (Reapproved 2000).
- I. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 1998.
- J. ASTM E 774-97 - Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.
- K. ASTM E 330-02 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- L. ASTM E 1886 - Standard Test method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.

- M. ASTM E 1996-06 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
- N. WDMA I.S.4-07A - Water-Repellent Preservative Treatment for Millwork.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Certification: Evidence of certification to specified ratings.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.05 QUALITY ASSURANCE

- A. Impact Rated Windows and Doors:
 - 1. High Velocity Hurricane Zone: Eagle Harbor Master Windows conform to ASTM E 330-02 for Static Air Pressure.
 - 2. Large Missile Impact and Cyclic Pressure Loading: Eagle Harbor Master Windows conform to ASTM E 1886 and ASTM E 1996-06 for large missile impact and cyclic pressure loading.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver units to project site until ready to install, unless indoor storage area is available.
- B. Store products in manufacturer's unopened packaging until ready for installation.

1.07 WARRANTY

- A. Provide manufacturer's standard warranty for:
 - 1. Wood Members: 10 years.
 - 2. Aluminum Cladding Structural Performance: Lifetime.
 - 3. Exterior Aluminum Finish: Thermoset siliconized polyester finish 20 years.
 - 4. Exterior Aluminum Finish: Kynar finish 20 years.
 - 5. Anodized Aluminum Finish: 5 years.
 - 6. Insulating Glass: 20 years.
 - 7. Other Components: 10 years.

PART 2–PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Pella windows, which is located at: 105000 Ulmerton Rd, suite 304 ; Largo, FL 33771; Toll free 1800 288 7281; Tel: 727 585 4007; Fax: 407 339 7742; Email: blevinsjs@pella.com; Web: www.pella.com
- B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 WINDOWS AND DOORS - GENERAL

- A. Windows and Doors: Complying with AAMA/WDMA/CSA 101/I.S.2/A440-08; factory assembled and glazed, complete with weatherstripping, operating hardware and specified accessories.
 - 1. Total Jamb Depth: As indicated on Drawings; provide factory installed jamb extensions.
 - 2. NFRC certified thermal performance.

2.03 CLAD WOOD WINDOWS

- A. Awning Windows:
 - 1. Rating: LC-PG50; maximum size 48 by 36 inches (1220 by 914 mm).
 - 2. Rating: Impact Rated Awning with Impact resistant glazing.
 - 3. Frame Depth: 2-7/8 inches (22.5 mm).
 - 4. Nailing Fin:
 - a. No nailing fin.
 - b. Vinyl nailing fin with clear drip cap.
 - c. Vinyl nailing fin with extruded aluminum drip cap.
 - 5. Screens:
 - a. Screen Mesh: Tru-Scene.
 - b. Screen Frame: Aluminum, with corners mitered and secured with corner locks; spring-loaded.
 - 6. Awning Hardware:
 - a. Weatherstripping: Compression type on all sash and frame meeting surfaces.
 - b. Operator: Gear type with hardened steel gears and stainless steel arms.
 - c. Operator Handle: Folding crank type.
 - d. Hinges: Concealed from exterior, with stainless steel hinge track and screws.
 - e. Locks: Two cam action concealed sash locks on each sash; provide temporary construction lock lever/operator handle for each unit.
 - 7. Hardware Finishes:
 - a. Window Hardware Exposed to View on Interior when window is closed. Finish in color selected from manufacturer's standard selection as follows:

- 1) White.
 - 2) As selected from manufacturer's standard selection.
 - b. Window Hardware Exposed to View on Interior When Window is Closed: Alternative finishes in colors selected from manufacturer's optional selection. Finish in color selected from manufacturer's alternative finishes as follows:
 - 1) Satin Chrome.
 - c. Finish of Hardware Exposed to Weather or Concealed from View When Window is Closed: Manufacturer's standard stainless steel hardware.
 - d. Vinyl nailing fin with extruded aluminum drip cap.
- B. Aluminum Cladding: Aluminum extrusions, 0.045 inch thick minimum on both frame
1. Provide matching exterior trim in profiles as indicated on the drawings.

2.04 MATERIALS

- A. Insulated Glazing: Sealed insulating glass; glass of thickness recommended by manufacturer for size and application; rated CBA in accordance with ASTM E 774.
1. All windows, without Decorative glass or between-the-glass blinds, shall be covered with a protective film applied to the interior and exterior lites to protect against damage and aid in final cleaning.
- B. Thickness in accordance with performance requirements specified for Impact Rated windows and doors.
1. HarborMaster Insulated Glazing: Cardinal LG, HarborMaster Insulated Laminated Safety Glass conforming to ASTM C1172 and ASTM E 774. Performance as follows:
 - a. Clear.
 - b. Total Thickness as required.

PART 3—EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 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.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. After installation adjust units for proper operation, without binding, sticking, or racking.



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3.04 PROTECTION

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

END OF SECTION 085500

**SECTION 08 71 00
DOOR HARDWARE****PART 1–GENERAL****1.01 SECTION REQUIREMENTS**

- A. Allowances: Provide hardware under Hardware Allowance in Division 01 Section “Price and Payment Procedures.”
- B. Submittals: Hardware schedule.
- C. Deliver keys to Owner.

PART 2–PRODUCTS**2.01 HARDWARE**

- A. Manufacturers:
 - 1. Schlage
 - 2. Similar products from other manufacturers
- B. Locksets and Latchsets:
 - 1. BHMA A156.13, Series 1000 for mortise locks and latches.
- C. Provide wall stops or floor stops for doors without closers.
- D. Provide hardware finishes as follows:
 - 1. Other Hardware: Matching finish of lockset/latchset.

PART 3–EXECUTION**3.01 INSTALLATION**

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

3.02 HARDWARE SCHEDULE

- A. Hardware Set No. 1- Pivoting Front Entry Door
 - 1. Pivot- <http://www.vxb.com/page/bearings/CTGY/Tapered-Roller>
Product # L44643 Tapered roller bearing
 - 2. Bored entry handleset.
 - 3. Bored auxiliary deadlock, key both sides.
 - 4. Threshold and weather stripping.
- B. Hardware Set No. 02 Partition Panels
 - 1. Bypassing sliding door set including overhead guide, recessed casters, floor track, and flush pulls.



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C. Hardware Set No. 03 Bathroom Doors

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

D. Hardware Set No. 04 Mechanical Closet Doors

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

END OF SECTION 08 71 00

**SECTION 08 90 00
LOUVERS AND VENTS**

PART 1—GENERAL**1.01 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, and Samples.

PART 2—PRODUCTS**2.01 MATERIALS**

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005.
- B. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.

2.02 LOUVERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product(s) indicated on Drawings or comparable product.
- B. Horizontal, Extruded-Aluminum, Storm-Resistant Louvers:

2.03 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: Aluminum 1/2-inch- (12.7-mm-) square mesh.

2.04 LOUVER FINISHES

- A. Aluminum Louvers: Conversion-coated and factory-primed finish, AA-C12C42R1x.

2.05 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 08 90 00

DIVISION 09 – FINISHES**SECTION 09 29 00
GYPSUM BOARD****PART 1–GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data.

PART 2–PRODUCTS**2.01 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.

2.02 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. Regular type unless otherwise indicated.
- C. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M, in thickness indicated. Regular type unless otherwise 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.

2.03 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 Class II, clear anodic finish; AA-C12C22A31.
- 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 or drying-type, all-purpose compound.
- 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

3.01 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.
 3. Multilayer Fastening Methods: Fasten base layers with adhesives and with screws. Fasten face layers to base layers with adhesive and supplementary fasteners.
- B. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.
- C. 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.
- D. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.
- F. 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 09 29 00

SECTION 09 30 00
TILE**PART 1—GENERAL****1.01 SECTION INCLUDES**

- A. Glazed Wall Tile.
- B. Ceramic Mosaic Tile.
- C. Glass Mosaic Tile.
- D. Cementitious backer board.
- E. Waterproofing.

1.02 RELATED SECTIONS

- A. Section 035050 - Self-Leveling Underlayment.
- B. Section 079200 - Joint Sealant.

1.03 REFERENCES

- A. ANSI A108.1A, 1999 - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
- B. ANSI A108.1B, 1999 - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
- C. ANSI A108.1C, 1999 - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
- D. ANSI A108.8, 1999 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.
- E. ANSI A108.10, 1999 - Specifications for Installation of Grout in Tilework.
- F. ANSI A118.1, 1999 - Standard Specification for Dry-Set Portland Cement Mortar.
- G. ANSI A118.4, 1999 - Latex-Portland Cement Mortar.
- H. ANSI A118.6, 1999 - Standard Ceramic Tile Grouts.
- I. ANSI A118.7, 1999 - Polymer Modified Cement Grouts
- J. ANSI A118.9, 1999 - Test Methods and Specifications for Cementitious Backer Units
- K. ASTM C50 - Standard Specification for Portland Cement.
- L. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- M. ASTM C1028 - Test method for Determining the Static Coefficient of Friction or Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull meter Method.
- N. TCA (HB) - Handbook for Ceramic Tile Installation; Tile Council of America, Inc.

1.04 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
1. Level Surfaces: Minimum of 0.6 (Wet).
 2. Step Treads: Minimum of 0.6 (Wet).
 3. Ramp Surfaces: Minimum of 0.8 (Wet).

1.05 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data : Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Selection Samples: Color charts illustrating full range of colors and patterns.
- E. Selection Samples: Samples of actual tiles for selection.
- F. Samples: Mount tile and apply grout on two plywood panels, size, pattern, color variations, and grout joint size variations as indicated in drawings,.
- G. Manufacturer's Certificate:
1. Certify that products meet or exceed specified requirements.
 2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.06 QUALITY ASSURANCE

- A. Maintain one copy each of all Referenced standards and specifications on site. Include the TCA Handbook, ANSI A108 Series, ANSI A118 Series ANSI A136.1 and ANSI A137.1 and others as specified under paragraph References.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.
- C. Single Source Responsibility:
1. Obtain each type and color of tile from a single source.
 2. Obtain each type and color of mortar, adhesive and grout from the same source.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.

- C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

PART 2—PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: DalTile Corporation, which is located at:
7834 C.F. Hawn Fwy. P. O. Box 170130
Dallas, TX 75217
Toll Free Tel: 800-933-TILE
Tel: 214-398-1411
Email: [request info \(mari.anne.wohlfeil@daltile.com\)](mailto:request info (mari.anne.wohlfeil@daltile.com);); Web: www.daltileproducts.com
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 TILE

- A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
 - 1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
 - 2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
 - 3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.
- B. Glass Mosaic Tile:
 - 1. Product: Daltile Sonterra Collection.
 - 2. Product: Daltile Kolorines Venetian Glass Mosaics.
 - 3. Size and Shape:
 - a. 1 inch (25 mm) square, nominal.
 - b. 2 inch (51 mm) square nominal.
 - c. 3/4 inch (19 mm) square nominal.
 - 4. Colors: To be selected from manufacturer's standard range.

-
5. Colors: As scheduled.
 6. Mounted Sheet Size: 12 by 12 inches (305 by 305 mm).
- C. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.
1. Soap Dish: With wash cloth holder, clam shell design, surface mounted or recessed; cast strength sufficient to resist lateral pull force of 75 lbs (34 Kg).
 2. Toilet Tissue Holder: Surface mounted or recessed, for single roll, with spring loaded holder.
 3. Towel Bars: Standard design, surface mounted with extensions for casting into small wall openings; cast strength sufficient to resist lateral pull force of 30 lbs (14 Kg).
 4. Corner Shelf.

2.03 SETTING MATERIALS

- A. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure.
- B. Epoxy Adhesive: ANSI A118.3, thinset bond type.
- C. Mortar Bed Materials:
1. Portland cement: ASTM C150, type 1, gray or white.
 2. Hydrated Lime: ASTM C207, Type S.
 3. Sand: ASTM C144, fine.
 4. Latex additive: As approved.
 5. Water: Clean and potable.
- D. Mortar Bond Coat Materials:
1. Dry-Set Portland Cement type: ANSI A118.1.
 2. Latex-Portland Cement type: ANSI A118.4.
 3. Epoxy: ANSI A118.3, 100 percent solids.
- E. Standard Grout: Cement grout, sanded or unsanded, as specified in ANSI A118.6; color as selected.
- F. Polymer modified cement grout, sanded or unsanded, as specified in ANSI A118.7; color as selected.
- G. Epoxy Grout: ANSI A118.8, 100 percent solids epoxy grout; color as selected.
- H. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced with 2 inch (50 mm) wide coated glass fiber tape for joints and corners:
1. Thickness: 1/4 inch (6 mm).
 2. Thickness: 1/2 inch (13 mm).
 3. Thickness: 5/8 inch (16 mm).

PART 3—EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.
- B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.
- C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Remove any curing compounds or other contaminates.
- C. Vacuum clean surfaces and damp clean.
- D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- E. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.
- F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.
- B. Lay tile to pattern indicated. Arrange pattern so that a full tile or joint is centered on each wall and that no tile less than 1/2 width is used. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- E. Form internal angles square and external angles bullnosed.
- F. Sound tile after setting. Replace hollow sounding units.
- G. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- H. Allow tile to set for a minimum of 48 hours prior to grouting.
- I. Grout tile joints. Use standard grout unless otherwise indicated.
- J. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.



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3.04 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCA Handbook Method W244, using membrane at toilet rooms.
- B. Over cementitious backer units install in accordance with TCA Handbook Method W223, organic adhesive.
- C. Over gypsum wallboard on wood or metal studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-portland cement bond coat, unless otherwise indicated.
 - 1. Where mortar bed is indicated, install in accordance with TCA Handbook Method W222, one coat method.
 - 2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCA Handbook Method W222, one coat method.

3.05 CLEANING

- A. Clean tile and grout surfaces.

3.06 PROTECTION OF FINISHED WORK

- A. Do not permit traffic over finished floor surface for 72 hours after installation.

END OF SECTION 09 30 00

SECTION 09 64 00
WOOD FLOORING**PART 1–GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data and material Samples.
- B. Hardwood Flooring: Comply with NOFMA grading rules for species, grade, and cut.
 - 1. Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.

PART 2–PRODUCTS**2.01 FIELD-FINISHED WOOD FLOORING**

- A. Solid-Wood Strip and Plank Flooring: Kiln dried, as manf. by :

Big River Cypress & Hardwood, Inc.
PO Box 189
Blountstown, FL 32424
Tel: 850-674-5991
Fax: 850-674-5615
E-mail: info@bigrivercypress.com

and as follows:

- 1. Species and Grade: #2 Cypress
- 2. Cut: Quarter/rift sawn.
- 3. Thickness: 3/4 inch.
- 4. Face Width: 5-1/8 inches.
- 5. Lengths: Random-length strips complying with applicable grading rules.

2.02 FACTORY-FINISHED WOOD FLOORING

- A. Solid-Wood Strip and Plank Flooring: Kiln dried, as manf. by Big River Cypress & Hardwoods and as follows:

- 1. Species and Grade: #2 Cypress
- 2. Cut: Quarter/rift sawn.
- 3. Thickness: 3/4 inch.
- 4. Face Width: 5-1/8 inches.
- 5. Lengths: Random-length strips complying with applicable grading rules.
- 6. Edge Style: Square.
- 7. Finish: UV urethane system.

2.03 FINISHING MATERIALS

- A. Urethane Finish System: Complete water-based system of compatible components that is recommended by finish manufacturer for application indicated.
 - 1. Stain: None
 - 2. Floor Sealer: Pliable, penetrating type.
 - 3. Finish Coats: Formulated for multicoat application on wood flooring.
- B. Wood Filler: Formulated to fill and repair seams, defects, and open-grain hardwood floors; compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved samples, provide pigmented filler.

2.04 ACCESSORY MATERIALS

- A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils (0.15 mm) thick.
- B. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.
- C. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFAs "Installation Guidelines: Wood Flooring."

PART 3—EXECUTION**3.01 INSTALLATION**

- A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFAs "Installation Guidelines: Wood Flooring."
- B. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 1/2 inch
- C. Felt Underlayment: Where strip or plank flooring is nailed to solid-wood subfloor, install flooring over a layer of asphalt-saturated felt.
- D. Solid-Wood Plank Flooring: Blind nail or staple flooring to substrate.
 - 1. Plank Flooring: For flooring of face width more than 3 inches (75 mm), install blind nails at each end of each piece in addition to blind nailing along perimeter.

3.02 SANDING AND FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
- B. Fill open-grained hardwood.
- C. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
 - 1. Apply stains to achieve an even color distribution matching approved Samples.

END OF SECTION 09 64 00

**SECTION 09 68 13
TILE CARPETING**

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
- B. Extra Materials: Deliver to Owner carpet tiles equal to 5 percent of each type and color carpet tile installed, packaged with protective covering for storage.

PART 2—PRODUCTS

2.01 CARPET TILE CPT-1 (approx. 90 sq. ft.)

- A. Products:
 - 1. Interface Flooring Inc; color TBD.
- B. Fiber Content: 100 percent nylon 6
- C. Face Construction: cut pile.
- D. Density: 27 oz./cu. yd.
- E. Pile Thickness: .164 in.
- F. Primary Backing: Manufacturer's standard material
- G. Secondary Backing: Manufacturer's standard material
- H. Size: 19.7 in x 19.7 in

PART 3—EXECUTION

3.01 INSTALLATION

- A. Comply with CRI 104.
- B. Installation Method: As recommended by manufacturer
- C. Install borders parallel to walls.

END OF SECTION 09 68 13

SECTION 09 77 23
FABRIC-WRAPPED PANELS

PART 1–GENERAL**1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data, Shop Drawings, and fabric Samples.
- B. Extra Materials: Deliver to Owner full-size rolls of fabric equal to 5 percent of each type and color installed.

PART 2–PRODUCTS**2.01 FABRIC-FINISHED PANEL AC-1 (approx. 36 sq. ft.)**

- A. Products:
 - 1. AVL Systems inc; AcousTech wall system.
- B. Fabric: As selected from manufacturer's full range.
 - 1. Manufacturer: Guilford of Maine/True Textiles, Inc
 - 2. Source: AVL Systems
 - 3. Product Line/Pattern: Terratex
 - 4. Color: 799 Red
 - 5. Fiber Content: 100% Post-Consumer Recycled Polyester
 - 6. Applied Treatments: None
 - 7. Fabric Application: N/A
- C. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of not more than 25 (Class A) per ASTM E 84.
- D. Edge Profile: Radius
- E. Corner Detail: Square.
- F. Core Material: Thermo-molded medium density fiberglass
 - 1. Provide wood nailing strips as indicated on Drawings.
- G. Nominal Core Thickness: 1/2 inch (12 mm)
- H. Edge Material: Chemically hardened
- I. Core Material Overlay: Glass fiberboard

2.02 FABRICATION

- A. Fabricate panels with fabric straight on the grain, without seams, and with patterned or directional weave fabrics matched in adjacent panels.
- B. Stretch fabric tight and square without puckers, ripples, sagging, or distortion.
- C. Mounting Devices: Impaled Metal "Z" clips concealed on backside of panels.

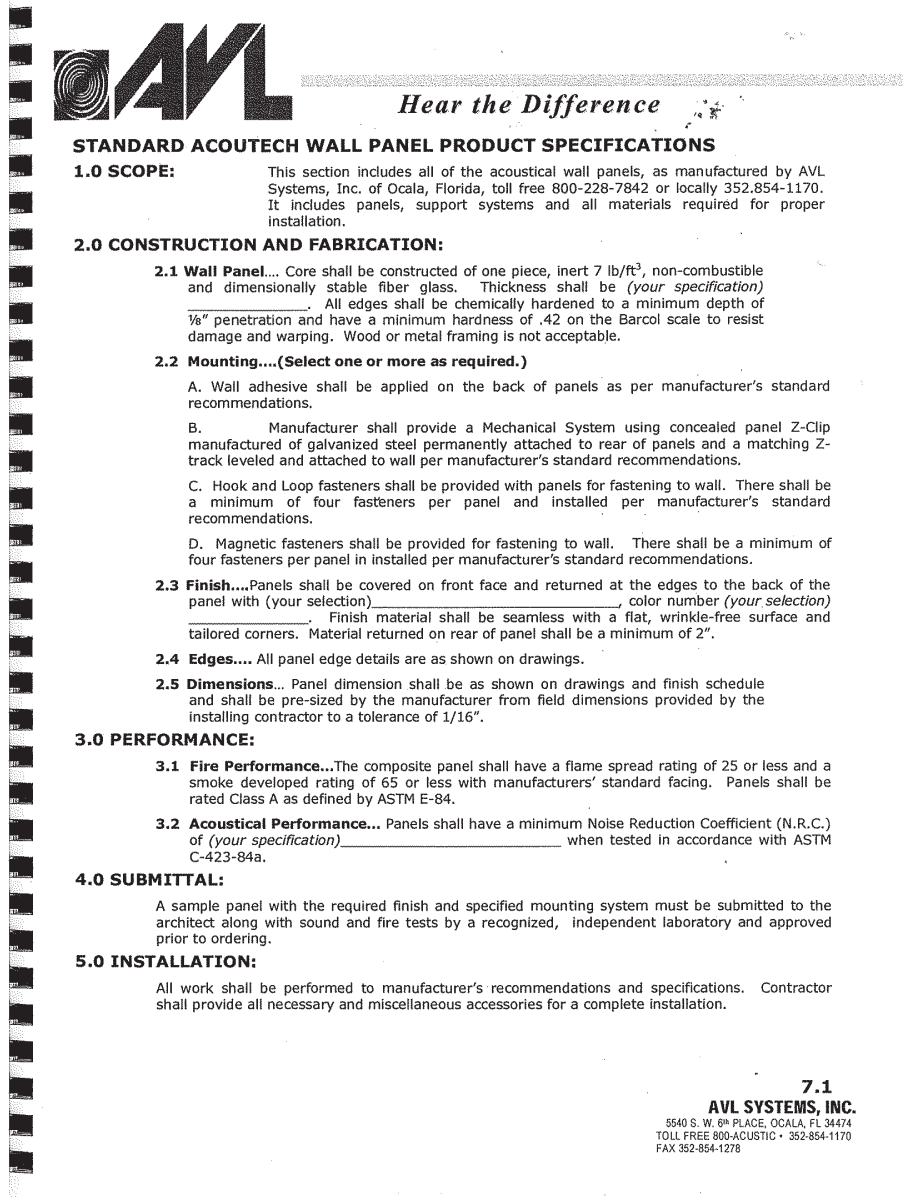
PART 3-EXECUTION

3.01 INSTALLATION

- A. Install panels level and aligned at top and bottom, vertical and plumb, with faces flush.
- B. Panel Joints: No greater than 1/16 inch wide.

FIGURES:

FIGURE 097723.1 ACOUTECH WALL PANELS



AVL
Hear the Difference

STANDARD ACOUTECH WALL PANEL PRODUCT SPECIFICATIONS

1.0 SCOPE: This section includes all of the acoustical wall panels, as manufactured by AVL Systems, Inc. of Ocala, Florida, toll free 800-228-7842 or locally 352.854-1170. It includes panels, support systems and all materials required for proper installation.

2.0 CONSTRUCTION AND FABRICATION:

2.1 Wall Panel... Core shall be constructed of one piece, inert 7 lb/ft³, non-combustible and dimensionally stable fiber glass. Thickness shall be *(your specification)*. All edges shall be chemically hardened to a minimum depth of 1/8" penetration and have a minimum hardness of .42 on the Barcol scale to resist damage and warping. Wood or metal framing is not acceptable.

2.2 Mounting...(Select one or more as required.)

- A. Wall adhesive shall be applied on the back of panels as per manufacturer's standard recommendations.
- B. Manufacturer shall provide a Mechanical System using concealed panel Z-Clip manufactured of galvanized steel permanently attached to rear of panels and a matching Z-track leveled and attached to wall per manufacturer's standard recommendations.
- C. Hook and Loop fasteners shall be provided with panels for fastening to wall. There shall be a minimum of four fasteners per panel and installed per manufacturer's standard recommendations.
- D. Magnetic fasteners shall be provided for fastening to wall. There shall be a minimum of four fasteners per panel in installed per manufacturer's standard recommendations.

2.3 Finish... Panels shall be covered on front face and returned at the edges to the back of the panel with *(your selection)*, color number *(your selection)*. Finish material shall be seamless with a flat, wrinkle-free surface and tailored corners. Material returned on rear of panel shall be a minimum of 2".

2.4 Edges... All panel edge details are as shown on drawings.

2.5 Dimensions... Panel dimension shall be as shown on drawings and finish schedule and shall be pre-sized by the manufacturer from field dimensions provided by the installing contractor to a tolerance of 1/16".

3.0 PERFORMANCE:

3.1 Fire Performance... The composite panel shall have a flame spread rating of 25 or less and a smoke developed rating of 65 or less with manufacturers' standard facing. Panels shall be rated Class A as defined by ASTM E-84.

3.2 Acoustical Performance... Panels shall have a minimum Noise Reduction Coefficient (N.R.C.) of *(your specification)* when tested in accordance with ASTM C-423-84a.

4.0 SUBMITTAL:

A sample panel with the required finish and specified mounting system must be submitted to the architect along with sound and fire tests by a recognized, independent laboratory and approved prior to ordering.

5.0 INSTALLATION:

All work shall be performed to manufacturer's recommendations and specifications. Contractor shall provide all necessary and miscellaneous accessories for a complete installation.

7.1
AVL SYSTEMS, INC.
 5540 S. W. 6th PLACE, OCALA, FL 34474
 TOLL FREE 800-ACUSTIC • 352-854-1170
 FAX 352-854-1278

END OF SECTION 09 77 23

**SECTION 09 91 00
PAINTING****PART 1—GENERAL****1.1 SECTION REQUIREMENTS**

- A. Submittals:
 - 1. Product Data : Color Wheel Deer Feather
 - 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. Color Wheel
- B. MPI Standards: Provide materials that comply with MPI standards indicated and listed in its “MPI Approved Products List.”
- C. 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.
- D. Use[interior] 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: [350] g/L.
 - 5. Clear Wood Finishes, Lacquers: [550] g/L.
 - 6. Floor Coatings: [100] g/L.
 - 7. Shellacs, Clear: [730] g/L.
 - 8. Shellacs, Pigmented: [550] g/L.
 - 9. Stains: [250] <Insert value> g/L.
 - 10. Primers, Sealers, and Undercoaters: [200] g/L.
 - 11. Dry-Fog Coatings: [400] g/L.
- E. Colors: As P-1, P-2

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 surfaces 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.
- E. Apply stains and transparent finishes to produce surface films without color irregularity, cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other imperfections. Use multiple coats to produce a smooth surface film of even luster.

3.3 EXTERIOR PAINT APPLICATION SCHEDULE

- A. Steel:
 - 1. Semigloss] [High-Gloss], Quick-Dry Enamel: Two coats over rust-inhibitive primer: MPI EXT 5.1A.
 - 2. [Flat] [Semigloss] [Gloss], Alkyd Enamel: [One coat] [Two coats] over rust-inhibitive primer: MPI EXT 5.1D.
- B. Galvanized Metal:
 - 1. [Flat] [Semigloss] [Gloss] Latex: [One coat] [Two coats] over cementitious galvanized-metal primer: MPI EXT 5.3A.
 - 2. [Flat] [Semigloss] [Gloss] Latex: [One coat] [Two coats] over waterborne galvanized-metal primer: MPI EXT 5.3H.

C. Aluminum:

1. [Flat] [Semigloss] [Gloss] Latex: [One coat] [Two coats] over quick-drying primer for aluminum: MPI EXT 5.4H.
2. [Flat] [Semigloss] [Gloss], Alkyd Enamel: [One coat] [Two coats] over quick-drying primer for aluminum: MPI EXT 5.4F.

D. Dressed Lumber: Including architectural woodwork, doors, siding, decks.

1. Solid-Color Latex Stain: [One coat] [Two coats] over [alkyd] [latex] primer: MPI EXT 6.3K.
2. Semitransparent Stain: Two coats: MPI EXT 6.3D.
3. [Semigloss] [Gloss] Varnish: [Two] [Three] coats over semitransparent stain: MPI EXT 6.3E.
4. [Semigloss] [Gloss] Varnish: [Three] [Four] coats: MPI EXT 6.3F.
5. Clear, Two-Component Polyurethane: Three Coats: MPI EXT 6.3G.

3.4 INTERIOR PAINT APPLICATION SCHEDULE

A. Steel:

1. High-Gloss, Quick-Dry Enamel: Two coats over quick-drying alkyd metal primer: MPI INT 5.1A.

B. Galvanized Metal:

1. [Flat] [Low-Sheen] [Eggshell] [Satin] [Semigloss] [Gloss] Latex: [One coat] [Two coats] over cementitious galvanized-metal primer: MPI INT 5.3A.
2. [Flat] [Low-Sheen] [Eggshell] [Satin] [Semigloss] [Gloss] Latex: [One coat] [Two coats] over waterborne galvanized-metal primer: MPI INT 5.3J.
3. [Flat] [Eggshell] [Semigloss] [Gloss], Alkyd Enamel: [One coat] [Two coats] over cementitious galvanized-metal primer: MPI INT 5.3C.

C. Dressed Lumber: Including [architectural woodwork] [doors] <Insert description>

1. Semigloss Alkyd Varnish: Two coats over stain and alkyd sanding sealer: MPI INT 6.3D.
2. Semigloss Alkyd Varnish: Two coats over alkyd sanding sealer: MPI INT 6.3J.
3. Satin Polyurethane: Two coats over stain: MPI INT 6.3E.
4. Satin Polyurethane: Two coats: MPI INT 6.3K.

D. Gypsum Board:

1. Eggshell Latex: Two coats over primer/sealer: MPI INT 9.2A.

FIGURE 099100.1 HARMONY PAINT



**SHERWIN
WILLIAMS.**



101.23

HARMONY®

**INTERIOR LATEX EG-SHEL
B9-900 SERIES**

As of 09/22/08, Complies with:		
OTC	Yes	LEED® C1v2.0 Yes
SCAQMD	Yes	LEED® NCv2.2Yes
CARB	Yes	LEED® CSv2.0Yes
MPI Spec #	144	LEED® H Yes
NAHB	Yes	LEED® Schools Yes

<u>CHARACTERISTICS</u>	<u>SPECIFICATIONS</u>	<u>SURFACE PREPARATION</u>									
<p>Harmony® Interior Latex Eg-Shel provides a durable, low-odor, anti-microbial*, interior paint formulated without silica. You can use this product, without typical odor complaints, in occupied areas because of the very low odor during application and drying.</p> <p>Color: Most Colors To optimize hide and color development, always use the recommended P-Shade primer</p> <p>Coverage: 350-400 sq ft/gal @ 4 mils wet; 1.6 mils dry</p> <p>Drying Time, @ 77°F, 50% RH: Touch: 1 hour Recoat: 4 hours Drying and recoat times are temperature, humidity, and film thickness dependent</p> <p>Flash Point: N/A Finish: 10 - 20 units @ 85°</p> <p>Tinting with Blend-A-Color:</p> <table border="1"> <tr> <th>Base</th> <th>oz/gal</th> <th>Strength</th> </tr> <tr> <td>Extra White</td> <td>0-5</td> <td>100%</td> </tr> <tr> <td>Deep Base</td> <td>4-12</td> <td>100%</td> </tr> </table> <p><u>Addition of Blend-A-Color Tinting Color may increase the VOC.</u></p> <p>Vehicle Type: 100% Acrylic B09W00951</p> <p>VOC (EPA Method 24): 0 g/L; 0.0 lb/gal</p> <p>Volume Solids: 39 ± 2%</p> <p>Water Vapor Permeance ASTME96 A 1.7 perms</p> <p>Weight Solids: 53 ± 2%</p> <p>Weight per Gallon: 10.7 lb</p> <p>* Anti-microbial - This product contains agents which inhibit the growth of microbes on the surface of this paint film.</p>	Base	oz/gal	Strength	Extra White	0-5	100%	Deep Base	4-12	100%	<p>Block 1 ct. Loxon Block Surfer* 2 cts. Harmony Interior Latex Eg-Shel</p> <p>Drywall 1 ct. Harmony Interior Latex Primer 2 cts. Harmony Interior Latex Eg-Shel</p> <p>Masonry 1 ct. Premium Wall & Wood Primer* or Harmony Interior Latex Primer 2 cts. Harmony Interior Latex Eg-Shel</p> <p>Plaster 1 ct. Loxon Concrete & Masonry Primer* or Harmony Interior Latex Primer 2 cts. Harmony Interior Latex Eg-Shel</p> <p>Wood, Composition Board 1 ct. Premium Wall & Wood Primer* or Harmony Interior Latex Primer 2 cts. Harmony Interior Latex Eg-Shel</p> <p>* These primers contain relatively low amounts of VOCs, but could result in minor, noticeable odors.</p>	<p>WARNING! Removal of old paint by sanding, scraping or other means may generate dust or fumes that contain lead. Exposure to lead dust or fumes may cause brain damage or other adverse health effects, especially in children or pregnant women. Controlling exposure to lead or other hazardous substances requires the use of proper protective equipment, such as a properly fitted respirator (NIOSH approved) and proper containment and cleanup. For more information, call the National Lead Information Center at 1-800-424-LEAD (in US) or contact your local health authority.</p> <p>Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Glossy surfaces should be sanded dull. Stains from water, smoke, ink, pencil, grease, etc. should be sealed with the appropriate primer/sealer.</p> <p>Drywall Fill cracks and holes with patching paste/spackle and sand smooth. Joint compounds must be cured and sanded smooth. Remove all sanding dust.</p> <p>Masonry, Concrete, Cement, Block All new surfaces must be cured according to the supplier's recommendations—usually about 30 days. Remove all form release and curing agents. Rough surfaces can be filled to provide a smooth surface. If painting cannot wait 30 days, allow the surface to cure 7 days and prime the surface with Loxon Concrete & Masonry Primer.</p>
Base	oz/gal	Strength									
Extra White	0-5	100%									
Deep Base	4-12	100%									

DIVISION 10 – SPECIALTIES**SECTION 10 14 00
SIGNAGE****PART 1–GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data, Shop Drawings, and Samples.
 - 1. Submit full-size rubbings for metal plaques.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2–PRODUCTS**2.01 MATERIALS**

- A. Aluminum Castings: Alloy recommended by sign manufacturer for casting process used and for use and finish indicated.
- B. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher, with not less than the strength and durability of 5005-H15.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher, with not less than the strength and durability properties of 6063-T5.
- D. Bronze Castings: ASTM B 584, Alloy UNS C83600 (No. 1 manganese bronze).
- E. Bronze Plate: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal).
- F. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304.
- G. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- H. Plastic Laminate: High-pressure laminate engraving stock with face and core in contrasting colors.
- I. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications.

2.02 SIGNS

- A. Plaques: As indicated, free from pits, scale, sand holes, and other defects. Provide manufacturer's standard satin polished finish on borders and raised copy.
- B. Dimensional Characters: As indicated
 - 1. Finish and Color: As indicated
 - 2. Illuminated Characters: Manufacturer's standard LED lighting including transformers, insulators, and other components.

-
- C. Interior Panel Signs: As indicated with square-cut edges and square corners.
 - 1. Finishes and Colors: As indicated
 - 2. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.
 - 3. Provide signs for all rooms as indicated
 - D. Exterior Framed Panel Signs: Extruded-aluminum frames with translucent acrylic panels and matte-finished opaque acrylic characters chemically welded to faces of panels.
 - 1. Finishes and Colors: As indicated
 - 2. Illuminated Signs: Manufacturer's standard LED lighting including transformers, insulators, and other components.

PART 3—EXECUTION

3.01 INSTALLATION

- A. Locate signs where indicated or directed by Architect. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
- B. Wall-Mounted Signs:
 - 1. Two-Face Tape: Mount signs to smooth, nonporous surfaces, other than vinyl.
 - 2. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.
 - 3. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
 - 4. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
 - 5. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes.
- C. Dimensional Characters: Mount characters ¼ inch from wall surface or as indicated.
- D. Cast-Metal Plaques: Mount plaques with threaded studs on back of plaque set in quick-setting cement or as indicated.

END OF SECTION 10 14 00

SECTION 10 22 26 OPERABLE PARTITIONS

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, and material Samples.
 - 1. Include test reports for acoustical properties.

PART 2—PRODUCTS

2.01 OPERABLE PANEL PARTITION

- A. Products:
 - 1. Specialty Doors bottom rolling panels
- B. Partition Operation and Configuration: Manually operated, individual panels.
- 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. Surface-Burning Characteristics: Provide finishes with flame-spread and smoke-developed indexes not more than 25 and 450, respectively, per ASTM E 84.
- E. Panel Thickness: Not less than 1-1/2 inches.
- F. Panel Edges: Trimless.
- G. Panel Closure: As indicated.
 - 1. Initial Closure: As indicated
 - 2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.
- H. Panel: Laminated plank, solid hardwood, quarter sawn, alternating grain
 - 1. Species: Cypress.
 - 2. Plank Thickness: 1/2 inch
- I. STC: 45 per ASTM E 90 and ASTM E 413.
- J. NRC: 0.60 per ASTM C 423.
- K. Suspension System: Steel trolley-system carriers and steel or aluminum track. Limit track deflection to 0.10 inch (2.54 mm) between supports.

PART 3—EXECUTION

3.01 INSTALLATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions. Proceed with installation only after unsatisfactory conditions have been corrected.



TEAM FLORIDA:

University of South Florida, University of Florida, Florida State University & the University of Central Florida
USF School of Architecture & Community Design • 4202 E. Fowler Avenue, HMS 301 • Tampa, FL 33620

- B. Install operable panel partitions to comply with ASTM E 557 after other finishing operations, including painting, had been completed.
- C. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware and other moving parts.

END OF SECTION 10 22 26

**SECTION 10 44 16
FIRE EXTINGUISHERS**

PART 1–GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2–PRODUCTS

2.01 FIRE EXTINGUISHERS AND BRACKETS

- A. Portable Fire Extinguishers NFPA 10, listed and labeled for the type, rating, and classification of extinguisher.
1. Products:
 - a. Kidde Full Home Fire Extinguisher.
 - b. Kidde Kitchen Fire Extinguisher (secondary protection).
 2. Multipurpose Dry-Chemical Type: UL-rated 3-A:40-B:C, 5.5-lb nominal capacity, in enameled-aluminum
 3. Multipurpose Dry-Chemical Type: UL-rated 10-B:C, 2.9-lb nominal capacity, in enameled-aluminum
- 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

3.01 INSTALLATION

- A. Install mounting brackets in locations indicated at 54 inches above finished floor to top of fire extinguisher.
- B. Install fire extinguishers in mounting brackets where indicated.

FIGURE:

FIGURE 104416.1 HOME FIRE EXTINGUISHER

Full Home Fire Extinguisher

Part number 21006704	Full Home use	Single use
----------------------	---------------	------------



UL Rated 3-A, 40-B:C

Meets NFPA recommendations for the home, garage and workshop

Description

The Full Home extinguisher offers exceptional fire fighting protection and value. The multipurpose unit meets NFPA requirements for living areas, as well as the garage and workshop.

The Full Home unit is the #1 choice for all round home protection and came top in a recent consumer survey.

Fights fires common to the home, garage and workshop such as textiles, paint, wood, gasoline & energized electrical equipment. This unit is easy to use and has a 10 year warranty.

Features bilingual nameplate and carton

At a Glance

- Model FX340GW
- Multipurpose Dry Chemical
- UL listed
- UL rated 3-A, 40-B:C
- Supplied with wall hanger
- Monoammonium Phosphate
- 10 year limited warranty

Features

- Pressure gauge allows for immediate pressure status check
- Easy-to-pull safety pin
- Rust and impact resistant nylon handle
- 5.5 lb. of fire extinguishing agent (Average)
- 10 year limited warranty
- UL approved wall hanger
- Powder coated cylinder for corrosion protection



For use on the following types of fire:

A TRASH
WOOD
PAPER



B LIQUIDS



C ELECTRICAL
EQUIPMENT



Product Specification

Net agent weight (Average)	5.5 lb.
Unit weight (Average)	8.25 lb.
Diameter	4.5 inches
Height	16.07 inches
Discharge time	13-15 seconds
Discharge range	12-18 feet
Operating pressure	195 psi
Cylinder	Seamless aluminum
Valve, handle, lever	Nylon
Wall hanger	UL Listed

Kidde Residential and Commercial Division
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END OF SECTION 10 44 16

DIVISION 11 – EQUIPMENT**SECTION 11 31 00
RESIDENTIAL APPLIANCES****PART 1–GENERAL****1.01 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. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ICC/ANSI A117.1.
- E. Energy Ratings: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

PART 2–PRODUCTS**2.01 RESIDENTIAL APPLIANCES**

- A. Electric Incuction Cooktop: 30-inch, built-in cooktop with four burner elements.
- B. Electric Wall Oven: Built-in, single electric, self-cleaning wall oven with broiler unit.
- C. Exhaust Hood: 30-inch retractable-downdraft exhaust hood with variable-speed fan.
 - 1. Fan Control: Hood-mounted switch, with separate light switch.
 - 2. Weatherproof wall cap with backdraft damper and rodent-proof screening.
- D. Refrigerator/Freezer: Freestanding, frost-free Double Drawer Refrigerator Freezer with interior cabinet liners.
 - 1. Fresh Food Compartment Volume: 4.8 cu. Ft.
 - 2. Freezer Compartment Volume: 4.8 cu. Ft.
- E. Dishwasher: Built-in, undercounter, automatic dishwasher, sized to replace 18-inch base cabinet, 7 wash cycles with hot-air and heat-off drying cycles, stainless-steel tub and door liner, nylon-coated sliding dish racks.
- F. Clothes Washer: Freestanding front loading stackable automatic washing machine. with 3.4cu. ft. capacity stainless steel drum and 12 amp drive motor.
- G. Clothes Dryer: Front loading stackable automatic clothes dryer with 3.9cu. ft. capacity stainless steel drum.



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PART 3—EXECUTION

3.01 INSTALLATION

- H. 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.
- I. Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- J. Test each item of residential appliances to verify proper operation. Make necessary adjustments.
- K. Verify that accessories required have been furnished and installed.

FIGURES:

FIGURE 1 1 3 1 0 0 . 1 A

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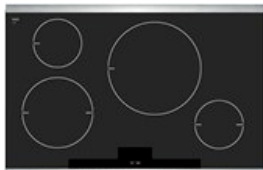
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NIT8065UC

30" Induction Cooktop with SteelTouch™ Control and AutoChef™
 800 Series - Black with Stainless Steel Strips
 NIT8065UC

- [Overview](#)
- [Technical specs](#)
- [Additional documents](#)
-



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Accessories

- [HEZ390230](#)
- [HEZ390210](#)

General Properties

SKU: NIT8065UC
 Construction type:
 Energy source: Electric
 Total number of cooktop burners: 4
 Number of gas burners: 0
 Number of electric cooking zones: 4
 Number of induction elements: 4
 Gas type:
 Alternative gas type:
 Watts (W): 7,200 W
 Current (A): 40 A
 Volts (V): 208-240 V



FIGURE 1 1 3 1 0 0 . 1 B

Frequency (Hz): 60 Hz
Approval certificates: CSA
Plug type: No plug
Location of 1st heating element: front left
Power of 1st heating element (kW): 2.2 kW
Location of 2nd heating element: back left
Power of 2nd heating element (kW): 1.4 kW
Location of 3rd heating element: back right
Power of 3rd heating element (kW): 2.4 kW
Location of 4th heating element: Cooking zone front right
Power of 4th heating element (kW): 1.4 kW
Location of 5th heating element:
Power of 5th heating element (kW): kW
Location of 6th heating element:
Power of 6th heating element (kW): kW
Type of grate:
Included accessories:
UPC code: 825225866190
Knob Material:
Natural Gas Connection Rating (BTU): BTU
LP Gas Connection Rating (BTU): BTU
Power cord length (in): 37 "
Required cutout size (HxWxD) (in): 4 1/8" x 28 3/4" x 19 7/8" "
Minimum distance from counter front (in): 2 1/4" "
Minimum distance from rear wall (in): 2" "
Overall appliance dimensions (HxWxD) (in): 5/16"+4 1/8" x 31" x 21 1/4" "
Product packaging dimensions (HxWxD) (in): 7 1/16" x 36 5/8" x 26 5/8" "
Net weight (lbs): 40 lbs
Gross weight (lbs): 50 lbs
Dimension of 1st heating element (in): 9" "
Power of 1st burner (BTU): BTU
Dimension of 2nd heating element (in): 6" "
Power of 2nd burner (BTU): BTU
Dimension of 3rd heating element (in): 11" "
Power of 3rd burner (BTU): BTU
Dimension of 4th heating element (in): 6" "
Power of 4th burner (BTU): BTU
Dimension of 5th heating element (in): "
Power of 5th burner (BTU): BTU
Dimension of 6th heating element (in): "
Power of 6th burner (BTU): BTU
Number of Single grates:
Number of Double grates:
Sealed Burners: No
ADDITIONAL_PROPERTY_15:
Burners with booster: All
SERIES: 800 Series

Accessories

- [HEZ390230](#)
- [HEZ390210](#)

FIGURE 1 13100.2A

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HBN5450UC

27" Single Wall Oven
 500 Series - Stainless Steel
 HBN5450UC

- [Overview](#)
- [Technical specs](#)
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-



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General Properties

Product name / series name: built-in/under single oven
 SKU: HBN5450UC
 Product color: Stainless steel
 Energy source: Electric
 Watts (W): 7,300 W
 Current (A): 30 A
 Volts (V): 240/208 V
 Frequency (Hz): 60 Hz
 Approval certificates: CSA
 Plug type: Fixed connection, No plug
 Cooking method first cavity: Bake, Broil, Convection Bake, Convection Broil, Convection Roast, Dehydrate, Pie, Pizza, Proof, Sabbath function, Speed Convection, Top heating, 1/3 bottom heat., True Convection, Warm
 Cleaning system - cavity 1: Self Clean
 Interior Lights - cavity 1: 2

FIGURE 1 13100.2B

Included accessories: 3 x Oven racks /upper, 1 x Broiler pan /upper, 1 x Temperature probe /upper
Timer settings: Alarm, timer
Telescopic rack:
Cavity type: Shelf support rails
UPC code: 825225840220
Power cord length (in): 50" "
Appliance Dimensions (h x w x d) (in): 29 1/16" x 26 3/4" x 23 7/8" "
Product packaging dimensions (HxWxD) (in): 34" x 34" x 31" "
Required cutout size (HxWxD) (in): 28 1/4" x 25 1/2" x 24" "
Net weight (lbs): 153 lbs
Gross weight (lbs): 179 lbs
Drawer wattage (W): W
Bake Element Wattages cavity 1 (W): 2000 kW
Broil Element Wattages cavity 1 (W): 3600 W
Convection Element Wattages cavity 1 (W): 2000 kW
Microwave Wattages (W): W
ADDITIONAL_PROPERTY_15:
SERIES: 500 Series



FIGURE 1 1 3 1 0 0 . 3 A

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DHD3014UC

Specialty Ventilation
 30" Downdraft

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-

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General Properties

SKU: DHD3014UC
 Material: Stainless steel
 Motor location: External
 Operating Mode: Convertable: Ducted / Recirculating
 Watts (W): W
 Current (A): 10 A
 Volts (V): 120 V
 Frequency (Hz): 60 Hz
 Approval certificates: CSA, UL
 Plug type: 120V-3 prong
 Remote control: No
 Number of motors: 0 No.
 Number of speed settings: 3-stage
 Number of lights: 0 No.
 Type of lamps used:
 Total power of the lamps (W): 0 W
 Silence level (dBA): 0 dB
 No-return airflow flap: No
 Grease filter material: Metal grease filter
 Grease filter type: Multilayer cassette
 Power cord length (in): "
 Height of the chimney (in): "
 Overall appliance dimensions (HxWxD) (in): / x 31 " x 3 3/4 " "
 Product packaging dimensions (HxWxD) (in): 7.48 x 32.67 x 27.16 "


FIGURE 1 13100.3B

Vertical rise height: 13" "
Required distance above cooktop/ranges:
Net weight (lbs): 37 lbs
Gross weight (lbs): 41 lbs
Maximum CFM: Cu Ft mi
Discharge direction:
Clean filter reminders:
Delay Shut off modes: min
Diameter of air duct (in) top: "
Diameter of air duct (in) back: 10 "
Required accessories: Blower
UPC code: 825225865810
ADDITIONAL_PROPERTY_15:
SERIES: 800 Series



FIGURE 1 13100.4A

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SRX53C15UC

18" Special Application
Dishwasher

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-



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General Properties

Product group: Dishwasher
SKU: SRX53C15UC
Installation Type: Built-under
Panel ready: Not possible
Tub material: Stainless steel
Concealed heating element: Yes
Watts (W): 1400 W

FIGURE 1 13100.4B

Current (A): 12 A
 Volts (V): 120 V
 Frequency (Hz): 60 Hz
 Approval certificates: CSA, UL
 Power cord length (cm): 170.0 cm
 Plug type: 120V-3 prong
 Adjustable feet: Yes
 Overall appliance dimensions (HxWxD) (mm): 810 x 448 x 550 mm
 Number of place settings: 9
 Number of wash cycles: 5
 Leak Protection System: Aqua Stop Plus
 Water softener: No
 Start delay time max (h): 19 h
 Status indicator: Time remaining indic. internal
 Display: Yes
 ChildLock: No
 Adjustable upper rack: Rackmatic
 Glass protection: No
 Top basket type: Normal
 Bottom basket type: Normal
 Program 1: Power Scrub Plus US
 Program 2: Regular US
 Program 3: Delicate/Economy Wash US
 Program 4: Quick Wash US
 Program 5: Rinse & Hold US
 Program 6:
 Silence level (dBA): 49 dB
 Load sensor: No
 Variable spray pressure: No
 Energy Star® qualified: Yes
 Total annual energy consumption (kWh): 306 kWh
 Number of options: 1
 Flip tines in upper rack:
 Plastic item clips:
 Cup shelves:
 Fine cutlery and silver tray: Yes
 Flip tines in lower rack: 2
 Mezzanine rack: No
 Silverware basket: Standard
 Extra-tall item sprinkler: Yes
 LED: No
 Multi-function LED: Yes
 Multi-function text LCD: No
 Program status light:
 Sanitized indicator light: No
 Triple filtration system: No
 Five-level wash: Yes
 Required cutout size (HxWxD) (in): x 17 3/4 " x 22 7/16 " "
 Overall appliance dimensions (HxWxD) (in): 31 7/8 " x 17 5/8 " x 21 5/8 " "
 ADA Compliant: Yes
 Product packaging dimensions (HxWxD) (in): 34 7/16" x 20 1/16" x 26" "
 Net weight (lbs): 78 lbs
 Gross weight (lbs): 83 lbs
 Power cord length (in): "

FIGURE 1 13100.4c

Length inlet hose (in): "
Length outlet hose (in): 55 1/8 "
Shelf Racks in Top Basket: 2 No.
Bottom basket Inserts: 0
SERIES:



FIGURE 1 13100.5B

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WAS20160UC

Bosch Axxis
 Stackable Automatic washing machine

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-

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General Properties

Brand: Bosch
 SKU: WAS20160UC
 Watts (W): 2300 W
 Current (A): 12 A
 Volts (V): 208-240 V
 Frequency (Hz): 60 Hz
 Approval certificates: CE, UL, VDE
 Plug type: 240V-3 prong
 Maximum spin speed (rpm): 1,000 rpm
 Silence level - washing (dBA): 54 dB (A)
 Silence level - spinning (dBA): 74 dB (A)
 Energy consumption (kWh/yr): 140 kWh
 Spin speed options: Variable
 Suds Sensor: Yes
 Unbalance Sensor: Yes
 Leak protection system: Multiple water protection
 Status indicator: LED
 Display: No
 Start delay time max (h): 0 h
 Pre-Wash Option:
 Quick Wash Option:
 Tub Material: Stainless steel
 UPC code: 825225855620
 Door ring: silver-grey


FIGURE 1 13100.5B

Buttons: silver
Dial: white
Internal Water Heater: Yes
Power cord length (in): 69" "
Power cord included: Yes
Overall appliance dimensions (HxWxD) (in): 33 3/16" x 23 9/16" x 24 1/2" "
Stackability: Yes
Product packaging dimensions (HxWxD) (in): 34 1/4" x 25 1/4" x 26 3/4" "
Net weight (lbs): 163 lbs
Gross weight (lbs): 165 lbs
Capacity (cu. ft.): 3.4 Cu Ft
Energy efficiency class: Tier 1
Energy Star® qualified: Yes
Water Consumption (gal/y): 3904 gal
Main color of product: White
Length outlet hose (in): 59.05 "
Length inlet hose (in): 47.24 "
Comforter: No
Drum Sanitize: No
Active wear: No
Dark colors: No
Number of Options: 6
Rinse Plus Option: Yes
Stain Removal Option: No



FIGURE 1 1 3 1 0 0 . 6 A

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WTV76100US

Axxis
Vented Dryer Dryer

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-




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General Properties

Door Hinge: Right-hand
Energy Source: electric
Watts (W): 2,800 W
Current (A): 13 A
Volts (V): 208/220-240 V
Frequency (Hz): 60 Hz
Approval certificates: CE, CSA, UL
Plug type: 240V-4 prong
Capacity cotton (Kg): 7 kg
Dryer Type: Vented
Silence level (dBA): dB

FIGURE 1 1 3 1 0 0 . 6 B

Moisture monitoring system: Eco-Sensor
Timed Dry: Yes
Adjustable drying temperature: Yes
Interior light: No
Location of Vent: At rear, Left-hand
Status indicator: LED
Display: No
Delay Start: No delay
Start delay time max (h): 0 h
Lint Filter Indicator: Yes
Tub Material: Stainless steel
Brand: Bosch
SKU: WTV76100US
Door ring: Silver
Buttons: silver
Dial: white
Power cord included: Yes
Net weight (lbs): 95 lbs
Gross weight (lbs): 97 lbs
Capacity (cu. ft.): 3.9 Cu Ft
ADDITIONAL_PROPERTY_15:
Power cord length (in): 57" "
Overall appliance dimensions (HxWxD) (in): 33 3/16" x 23 9/16" x 24 5/8" "
Product packaging dimensions (HxWxD) (in): 34.25 x 24.80 x 27.55 "
UPC code: 825225852209
Length outlet hose (in): 78.74 "
Length inlet hose (in): "
Stackability: Yes
Timed Dry: Yes
Air fluff / no heat: No
Jeans: No
ActiveWear: No
Number of Options: 2
Delicates: Yes
Signal: No
Extended wrinkleblock: No


END OF SECTION 11 31 00



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DIVISION 21 – FIRE SUPPRESSION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1–GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2–PRODUCTS

2.01 SLEEVES

- A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. PVC Pipe: ASTM D 1785, Schedule 40.

2.02 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

2.03 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2.04 VIBRATION ISOLATION AND SEISMIC CONTROL DEVICES

- A. Vibration Supports:
 - 1. Pads: Arranged in single or multiple layers of oil- and water-resistant neoprene of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match supported equipment.
 - 2. Mounts: Double-deflection type, with molded, oil-resistant fiberglass, rubber or neoprene isolator elements with factory-drilled, encapsulated top plate and baseplate. Provide isolator with minimum 0.5-inch static deflection.
- B. Seismic Restraints:
 - 1. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2. Channel Support System: MFMA-4, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
3. Postinstalled Anchors: Torque-controlled expansion anchors seismic rated, zinc plated carbon steel for interior applications and stainless steel for exterior locations. Provide anchor bolts with strength four times the load imposed as tested according to ASTM E 488.

PART 3—EXECUTION

3.01 MOTOR INSTALLATION

- A. Anchor motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions.

3.02 GENERAL PIPING INSTALLATIONS

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.
- C. Install sleeves for pipes passing through gypsum board partitions and wood floor and roof assemblies.
- D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.
- E. Install unions at final connection to each piece of equipment.
- F. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.03 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.

3.04 BASES, SUPPORTS, AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- B. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors. Place grout, completely filling equipment bases.

END OF SECTION 21 05 00

SECTION 21 10 00
WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1—GENERAL**1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data for valves, sprinklers, specialties, and alarms.
 - 1. Submit sprinkler system drawings identified as “working plans” and calculations according to NFPA 13. Submit required number of sets to authorities having jurisdiction for review, comment, and approval. Include system hydraulic calculations.
 - 2. Submit test reports and certificates as described in NFPA 13.
- B. Design and Installation Approval: Acceptable to authorities having jurisdiction.
- C. Hydraulically design sprinkler systems according to NFPA 13.
- D. Comply with [NFPA 13R] and NFPA 70.
- E. UL-listed and -labeled and FM-approved pipe and fittings.

PART 2—PRODUCTS**2.01 PIPE AND FITTINGS**

- A. CPVC Plastic Pipe: ASTM F 442/F 442M, UL 1821, 175-psig (1207-kPa) rating, made in NPS (DN) for sprinkler service. Include “Listed” and “CPVC Sprinkler Pipe” marks on pipe.
- B. CPVC Plastic Pipe Fittings: ASTM F 438 for NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40) and ASTM F 439 for NPS 2 (DN 50), UL listed, 175-psig (1207-kPa) rating, for sprinkler service. Include “Listed” and “CPVC Sprinkler Fitting” marks on fittings.
- C. Provide hangers, supports, and seismic restraints with UL listing and FM approval for fire-protection systems.

2.02 VALVES

- A. Fire-Protection Service Valves: UL listed and FM approved, with 175-psig (1207-kPa) nonshock minimum working-pressure rating. Indicating valves shall be butterfly or ball type, bronze body, and integral indicating device with 115-V ac, electric, single-circuit supervisory switch indicator.

2.03 SPRINKLERS

- A. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 1626, for residential applications.
- B. Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for “Ordinary” temperature classification rating unless otherwise indicated or required by application.
- C. Sprinkler types include the following:
 - 1. Upright, pendent, and sidewall sprinklers.
- D. Sprinkler Finishes: White enamel.

2.04 PIPING SPECIALTIES AND ALARM DEVICES

- A. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
- B. Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa).

PART 3–EXECUTION**3.01 PIPE AND FITTING APPLICATION**

- A. Use steel pipe with threaded, press-seal, roll-grooved, or cut-grooved joints; copper tube with wrought-copper fittings and brazed joints; or CPVC plastic pipe and fittings and metal-to-plastic transition fittings with solvent-cemented joints.
 - 1. For steel pipe joined by threaded fittings, use Schedule 40.
 - 2. For steel pipe joined by welding or roll-grooved pipe and fittings, use Schedule 10.
 - 3. For steel pipe NPS 2 (DN 50) and smaller, joined by press-seal fittings, use Schedule 5 pipe, fabricated with manufacturer's press-seal tools.
- B. Install shutoff valve, check valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water service piping.

3.02 PIPING INSTALLATION

- A. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve.
- B. Install sprinkler zone control valves, test assemblies, and drain headers adjacent to standpipes.
- C. Install alarm devices in piping systems and connect to fire-alarm system.
- D. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Install gages to permit removal, and install where they will not be subject to freezing.
- E. Install fire-protection service valves supervised-open, located to control sources of water supply except from fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating portion of system controlled by each valve.
- F. Install check valve in each water supply connection. Install backflow preventers in potable-water supply sources.
- G. Install alarm check valves for proper direction of flow, including bypass check valve and retard chamber drain line connection.

3.03 SPRINKLER APPLICATIONS

- A. Rooms without Ceilings: Upright sprinklers.
- B. Rooms with Suspended Ceilings: Concealed sprinklers.
- C. Wall Mounting: Sidewall sprinklers.
- D. Sprinklers Subject to Freezing: Upright, pendent, or sidewall, dry sprinklers as indicated.
- E. Special Applications: Extended coverage or quick-response sprinklers as indicated.



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- F. Sprinkler Finishes: White enamel in finished spaces, rough bronze in unfinished spaces, and white in residential spaces. Provide escutcheons in finished and residential spaces.
- G. Install sprinklers in suspended ceilings in center of [long dimension of]ceiling panels.

3.04 TESTING


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

END OF SECTION 21 10 00

FIGURE 211313.1 HOME FIRE SPRINKLER SYSTEM



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Series LFII Residential Concealed Pendent Sprinklers, Flat Plate 4.9 K-factor

General Description

The Tyco® Rapid Response™ Series LFII (TY3596) Residential Concealed Pendent Sprinklers are decorative, fast response, fusible solder sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels.

The cover plate assembly conceals the sprinkler operating components above the ceiling. The flat profile of the cover plate provides the optimum aesthetically appealing sprinkler design. In addition, the concealed design of the Series LFII (TY3596) provides 1/4 inch (6,4 mm) vertical adjustment. This adjustment provides a measure of flexibility with regard to which the length of fixed pipe drops to the sprinklers must be cut.


The Series LFII are to be used in wet pipe residential sprinkler systems for one-and two-family dwellings and mobile homes per NFPA 13D; wet pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R; or, wet pipe sprinkler systems for the residential portions of any occupancy per NFPA 13.

The Series LFII (TY3596) has a 4.9 (60,5) K-factor that provides the required residential flow rates at reduced

pressures, enabling smaller pipe sizes and water supply requirements.

The Series LFII (TY3596) has been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.

The Series LFII (TY3596) Residential Concealed Pendent Sprinklers are shipped with a Disposable Protective Cap. The Protective Cap is temporarily removed for installation, and then it can be replaced to help protect the sprinkler while the ceiling is being installed or finished. The tip of the Protective Cap can also be used to mark the center of the ceiling hole into plaster board, ceiling tiles, etc. by gently pushing the ceiling product against the Protective Cap. When the ceiling installation is complete the Protective Cap is removed and the Cover Plate Assembly installed.



Sprinkler/Model Identification Number

SIN TY3596

NOTICE

The Series LFII (TY3596) Residential Concealed Pendent Sprinklers described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

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TFP442

Maximum Coverage Area ^(a) Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow ^(b) and Residual Pressure For Horizontal Ceiling (Max. 2 Inch Rise for 12 Inch Run)
		160°F/71°C Sprinkler
12 x 12 (3,7 x 3,7)	12 (3,7)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	13 GPM (53,0 LPM) 7.0 psi (0,48 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	13 GPM (60,6 LPM) 7.0 psi (0,48 bar)
18 x 18 (5,5 x 5,5)	18 (5,5)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
20 x 20 (6,1 x 6,1)	20 (6,1)	20 GPM (75,7 LPM) 16.7 psi (1,15 bar)

- (a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.
- (b) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details.

TABLE A
NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA
FOR THE SERIES LFII (TY3596) RESIDENTIAL CONCEALED PENDENT SPRINKLER

Technical Data

Approvals:
 UL and C-UL Listed. NYC Approved under MEA 44-03-E-2.

The Series LFII Concealed Pendent Sprinklers are only listed with the Series LFII Concealed Cover Plates having a factory applied finish.

Maximum Working Pressure:
 175 psi (12,1 bar)

Discharge Coefficient:
 K=4.9 GPM/psi^{1/2} (70,6 LPM/bar^{1/2})

Temperature Rating:
 160°F/71°C Sprinkler with
 139°F/59°C Cover Plate

Vertical Adjustment:
 1/2 inch (12,7 mm)

Finishes:
 Refer to Ordering Procedure section.

Physical Characteristics:

Body	Brass
Cap	Bronze
Saddle	Brass
Sealing Assembly	.....
.....	Beryllium Nickel w/ Teflon ¹
Soldered Link Halves	Nickel
Lever	Bronze
Compression Screw	Brass
Deflector	Copper or Brass
Guide Pin Housing	Bronze
Guide Pins	Stainless Steel

Support Cup	Steel
Cover Plate	Copper
Retainer	Brass
Cover Plate Ejection Spring	.....
.....	StainlessSteel

¹DuPont Registered Trademark

Operation

When exposed to heat from a fire, the Cover Plate, which is normally soldered to the Support Cup at three points, falls away to expose the Sprinkler Assembly. At this point the Deflector supported by the Arms drops down to its operated position. The fusible link of the Sprinkler Assembly is comprised of two link halves that are soldered together with a thin layer of solder. When the rated temperature is reached, the solder melts and the two link halves separate allowing the sprinkler to activate and flow water.

Design Criteria

The Tyco® Rapid Response™ Series LFII (TY3596) Residential Concealed Pendent Sprinklers are UL and C-UL Listed for installation in accordance with the following criteria.

Note: When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may

be acceptable to the Authority Having Jurisdiction.

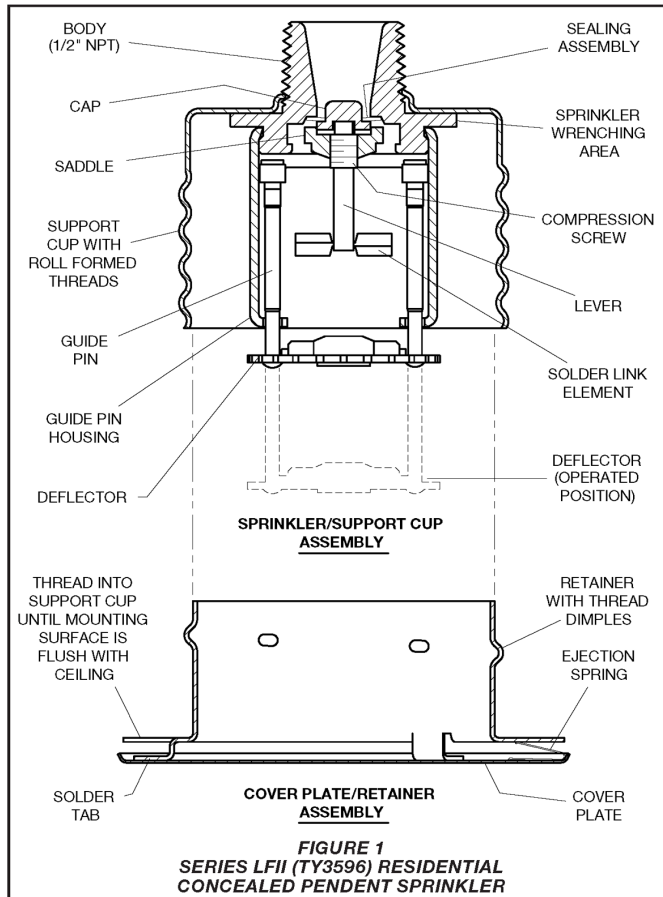
System Type. Only wet pipe systems may be utilized.

Hydraulic Design. The minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R are given in Table A as a function of temperature rating and the maximum allowable coverage areas. The sprinkler flow rate is the minimum required discharge from each of the total number of "design sprinklers" as specified in NFPA 13D or NFPA 13R.

For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Table A for NFPA 13D and 13R as a function of temperature rating and the maximum allowable coverage area.
- A minimum discharge of 0.1 gpm/sq. ft. over the "design area" comprised of the four most hydraulically demanding sprinklers for the actual coverage areas being protected by the four sprinklers.

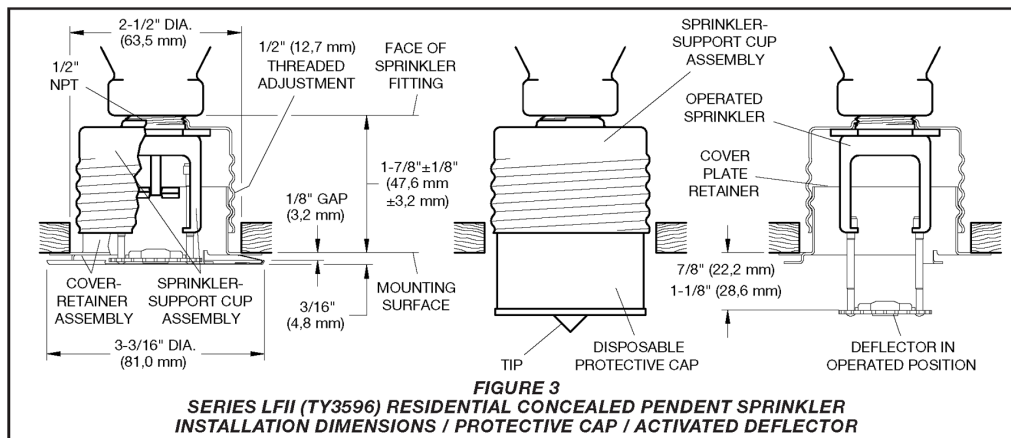
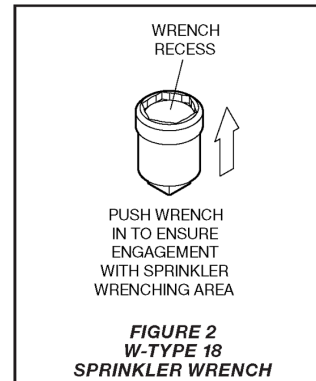
Obstruction To Water Distribution. Locations of sprinklers are to be in accordance with the obstruction rules of NFPA 13 for residential sprinklers.



Operational Sensitivity. The sprinklers are to be installed relative to the ceiling mounting surface as shown in Figure 3.

Sprinkler Spacing. The minimum spacing between sprinklers is 8 feet (2,4 m). The maximum spacing between sprinklers cannot exceed the length of the coverage area (Ref. Table A) being hydraulically calculated (e.g., maximum 12 feet for a 12 ft. x 12 ft. coverage area, or 20 feet for a 20 ft. x 20 ft. coverage area).

The Series LFII must not be used in applications where the air pressure above the ceiling is greater than that below. Down drafts through the Support Cup could delay sprinkler operation in a fire situation.



Installation

The Series LFII (TY3596) must be installed in accordance with the following instructions:

NOTICE

Damage to the fusible Link Assembly during installation can be avoided by handling the sprinkler by the support cup only (i.e., do not apply pressure to the fusible link Assembly).

A 1/2 inch NPT sprinkler joint should be obtained with a minimum to maximum torque of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the Cover Plate/Retainer Assembly by under- or over-tightening the Sprinkler. Readjust the position of the sprinkler fitting to suit.

Step 1. The sprinkler must only be installed in the pendent position and with the centerline of the sprinkler perpendicular to the mounting surface.

Step 2. Remove the Protective Cap.

Step 3. With pipe thread sealant applied to the pipe threads, and using the W-Type 18 Wrench shown in Figure 2, install and tighten the Sprinkler/Support Cup Assembly into the fitting. The W-Type 18 Wrench will accept a 1/2 inch ratchet drive.

Step 4. Replace the Protective Cap by pushing it upwards until it bottoms out against the Support Cup. The Protective Cap helps prevent damage to the Deflector and Guide Pins during ceiling installation and/or during application of the finish coating of the ceiling. It may also be used to locate the center of the clearance hole by gently pushing the ceiling material against the center point of the Cap.

NOTICE

As long as the protective Cap remains in place, the system is considered to be "Out Of Service".

Step 5. After the ceiling has been completed with the 2-1/2 inch (63 mm) diameter clearance hole and in preparation for installing the Cover Plate Assembly, remove and discard the Protective Cap, and verify that the Deflector moves up and down freely.

If the Sprinkler has been damaged and the Deflector does not move up and down freely, replace the entire Sprinkler assembly. Do not attempt to mod-

ify or repair a damaged sprinkler.

Step 6. Screw on the Cover Plate Assembly until its flange comes in contact with the ceiling.

Do not continue to screw on the Cover Plate Assembly such that it lifts a ceiling panel out of its normal position.

If the Cover Plate Assembly cannot be engaged with the Mounting Cup or the Cover Plate Assembly cannot be engaged sufficiently to contact the ceiling, the Sprinkler Fitting must be repositioned.

Care and Maintenance

The Tyco® Rapid Response™ Series LFII (TY3596) must be maintained and serviced in accordance with the following instructions:

NOTICE

Absence of a Cover Plate may delay the sprinkler operation in a fire situation.

When properly installed, there is a nominal 1/8 inch (3,2 mm) air gap between the lip of the Cover Plate and the ceiling, as shown in Figure 3. This air gap is necessary for proper operation of the sprinkler by allowing heat flow from a fire to pass below and above the Cover Plate to help assure appropriate release of the Cover Plate in a fire situation. If the ceiling is to be repainted after the installation of the Sprinkler, care must be exercised to ensure that the new paint does NOT seal off any of the air gap.

Factory painted Cover Plates MUST NOT be repainted. They should be replaced, if necessary, by factory painted units. Non-factory applied paint may adversely delay or prevent sprinkler operation in the event of a fire.

Do not pull the Cover Plate relative to the Enclosure. Separation may result.

Before closing a fire protection system main control valve for maintenance work on the fire protection system which it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified or over heated sprinklers must be replaced.

Care must be exercised to avoid damage -before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

NOTICE

The owner must assure that the sprinklers are not used for hanging of any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.

Automatic sprinkler systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.



Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

When placing an order, indicate the full product name. Contact your local distributor for availability.

Sprinkler Assembly:
Series LFII (TY3596), K=4.9, Residential Concealed Pendent Sprinkler without Cover Plate Assembly, P/N 51-112-1-160.

Cover Plate Assembly:
Cover Plate Assembly having a (specify) finish for the Series LFII (TY3596), K=4.9, Residential Concealed Pendent Sprinkler, P/N (specify).

- Chrome P/N 56-122-9-135
- Signal White (a)
(RAL 9003) P/N 56-122-4-135
- Pure White (b)
(RAL 9010) P/N 56-122-3-135
- Custom P/N 56-122-X-135

- (a) Previously known as Bright White.
- (b) Eastern Hemisphere sales only.

Sprinkler Wrench:
Specify: W-Type 18 Sprinkler Wrench, P/N 56-000-1-265.

END OF SECTION 21 13 13

DIVISION 22 – PLUMBING

SECTION 22 05 00 COMMON WORK RESULTS FOR PLUMBING

PART 1–GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2–PRODUCTS

2.01 SLEEVES

- A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. PVC Pipe: ASTM D 1785, Schedule 40.

2.02 HANGERS AND SUPPORTS

- A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.
- B. Powder-Actuated Fasteners: Threaded-steel stud, with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.03 VIBRATION ISOLATION AND SEISMIC CONTROL DEVICES

- A. Vibration Supports:
 - 1. Pads: Arranged in single or multiple layers of oil- and water-resistant, rubber of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match supported equipment.
 - 2. Mounts: Double-deflection type, with molded, oil-resistant fiberglass, rubber, or neoprene isolator elements with factory-drilled, encapsulated top plate and baseplate. Provide isolator with minimum **0.5-inch (13-mm)** static deflection.
- B. Vibration Hangers:
 - 1. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Provide isolator with minimum **0.5-inch (13-mm)** static deflection.
- C. Seismic Restraints:
 - 1. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2. Channel Support System: MFMA-4, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

2.04 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

3.01 MOTOR INSTALLATION

- A. Anchor motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions.

3.02 GENERAL PIPING INSTALLATIONS

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.
- C. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.
- D. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.
- E. Install unions at final connection to each piece of equipment.
- F. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.
- G. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.03 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.

3.04 HANGERS AND SUPPORTS

- A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.
- B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.
- C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.

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- D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- E. 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).
- F. 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.

3.05 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 22 05 00

SECTION 22 07 00 PLUMBING INSULATION

PART 1—GENERAL

1.01 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

2.01 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. Mineral-Fiber Blanket Insulation: Comply with ASTM C 553, Type II and ASTM C 1290, Type I.
- D. Mineral-Fiber Board Insulation: Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied FSK jacket.
- E. Mineral-Fiber, Preformed Pipe Insulation: Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.
- F. Mineral-Fiber, Pipe and Tank Insulation: Complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB; and having factory-applied [ASJ] [FSK jacket]. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less.
- G. Polyolefin Insulation: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
- H. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- I. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- J. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
- K. 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.
- L. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
- M. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 3—EXECUTION

3.01 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. Mineral-Fiber Insulation Installation:
 - 1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - 3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- F. Polyolefin Insulation Installation:
 - 1. Seal split-tube 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 polyolefin pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- G. 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.
- H. 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.

3.02 EQUIPMENT INSULATION SCHEDULE

- A. Domestic water and domestic hot-water hydropneumatic tank insulation shall be [one of] the following:
1. Flexible Elastomeric: 1/2 inch (25 mm) thick.
- B. Thermal storage tanks insulation shall be the following:
1. Spray foam insulation: 6 inches (152.4 mm) thick and between 1.5-lb/cu. ft. (32-kg/cu. m) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
- C. Domestic water storage tank insulation shall be [one of] the following:
1. Spray foam insulation: 2 inches (50.8 mm) thick and between 1.5-lb/cu. ft. (32-kg/cu. m) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

3.03 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 one of the following:
 - a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 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.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- C. Domestic Hot and Recirculated Hot Water:
1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3/4 inch (19 mm) thick.
 2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1.5 inch (38 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1.5 inch (38 mm) thick.

END OF SECTION 22 07 00

SECTION 22 11 13 FACILITY WATER DISTRIBUTION PIPING

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Summary: This Section includes water-distribution piping outside the building for combined water service and fire-service mains.
- B. Comply with FMG’s “Approval Guide” or UL’s “Fire Protection Equipment Directory” for fire-service-main products.
- C. Comply with NFPA 24, “Standard for the Installation of Private Fire Service Mains and Their Appurtenances,” for materials, installations, tests, and flushing.
- D. Comply with NSF 14 for plastic potable-water-service piping. Include marking «NSF-pw» on piping.
- E. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

PART 2—PRODUCTS

2.01 PIPE AND FITTINGS

- A. PVC Plastic Pipe: ASTM D 1785, Schedule 80.
 - 1. PVC Socket Fittings: Schedule 80, ASTM D 2467.
 - 2. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- B. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket and spigot end.
 - 1. Comply with UL 1285 for fire-service mains.
 - 2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 - 3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.02 VALVES

- A. Nonrising-Stem, Resilient-Seated Gate Valves, NPS 3 (DN 80) and Larger: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Include 200-psig (1380-kPa) minimum working-pressure design, interior coating according to AWWA C550, and mechanical-joint ends.
- B. UL/FMG, Nonrising-Stem Gate Valves: UL 262, FMG-approved, iron body and bonnet with flange for indicator post, bronze seating material, and inside screw; 175-psig (1200-kPa) working pressure, and flanged end connections.
- C. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering “WATER,” and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

- D. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.
- E. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.03 SPECIALTIES

- A. Backflow Prevention Devices: ASSE standard backflow preventers, bronze body, 150-psig (1035-kPa) working pressure, of size indicated for maximum flow rate and maximum pressure loss indicated.
- B. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches (150 mm) wide by 4 mils (0.1 mm) thick, solid blue in color with metallic core and continuously printed black-letter caption "CAUTION--WATER LINE BURIED BELOW."

PART 3—EXECUTION

3.01 INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main, water service to water meter, and water meter.
- B. Connect water system piping and water-supply source and building water-distribution and fire-protection systems at the building wall in locations and pipe sizes indicated.
- C. Install restrained joints for buried piping within 60 inches (1500 mm) of building. Use restrained-joint pipe and fittings, thrust blocks, anchors, tie rods and clamps, and other supports at vertical and horizontal offsets.
- D. 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.
- E. Install fittings for changes in direction and branch connections.
- F. Comply with NFPA 24 for fire-service-main piping materials and installation.
- G. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- H. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- I. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.
- J. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration.
- K. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping.
- L. Clean and disinfect water distribution piping according to authorities having jurisdiction.

END OF SECTION 22 11 13

SECTION 22 11 16 DOMESTIC WATER PIPING

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Comply with NSF 14 for plastic, potable domestic water piping and components.[Include marking “NSF-pw” on piping.]
- B. Comply with NSF 61 for potable domestic water piping and components.

PART 2—PRODUCTS

2.01 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. Galvanized-Steel Piping: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe, with ASME B16.4, Class 125, galvanized, standard pattern gray-iron, threaded fittings.
- D. CPVC Piping: ASTM F 441/F 441M, Schedule 40 pipe with ASTM F 438, CPVC Schedule 40 socket-type fittings.
- E. 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.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
 - 1. PVC Fittings: ASTM D 2466, Schedule 40, socket type.
- G. 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 Union Ball Valves: MSS SP-122, with full-port ball, socket detachable end connectors, and pressure rating not less than 125 psig (860 kPa) at 73 deg F (23 deg C).
 - 4. CPVC Non-Union Ball Valves: MSS SP-122, with full- or reduced-port ball, socket or threaded ends, and pressure rating not less than 125 psig (860 kPa) at 73 deg F (23 deg C).

5. CPVC Butterfly Valves: With lever handle and pressure rating not less than 150 psig (1035 kPa) at 73 deg F (23 deg C).
6. CPVC Check Valves: Swing or ball-check design and pressure rating not less than 150 psig (1035 kPa) at 73 deg F (23 deg C).
- H. 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.
- I. Flexible Connectors: Bronze, corrugated-metal tubing with wire-braid covering. Working-pressure rating a minimum of 200 psig (1380 kPa).

PART 3–EXECUTION

3.01 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 without pitch 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.

3.02 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.
- B. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
- C. 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.

3.03 PIPING SCHEDULE

- A. Underground, Service Entrance Piping: Schedule 80 PVC piping.
- B. Aboveground Distribution Piping: PEX piping.

3.04 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 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 22 11 16

SECTION 22 11 23 DOMESTIC WATER PUMPS

PART 1–GENERAL

1.01 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

2.01 DOMESTIC WATER PUMPS

- A. In-Line, Sealless Centrifugal Pumps: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps. Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft 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. IPT; 2761-IPT-95; Self Priming
 - b. Casing: Bronze, with threaded or companion-flange connections.
- 2. Impeller: Plastic.

2.02 MOTORS

- A. NEMA MG 1, “Standard for Motors and Generators.” Include NEMA listing and labeling.
- 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.

2.03 CONTROLS

- A. Thermostats: Electric; adjustable for control of Solar thermal pump.
 - 1. Type: Water-immersion temperature sensor, for installation in piping.
 - 2. Settings: Start pump at less than 140 deg F.
- B. Timers: Electric, for control of solar thermal pump.
 - 1. Type: Programmable from sunrise to sunset with manual override on-off switch and thermal on/off trigger at panel.

PART 3–EXECUTION

3.01 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 on suction and discharge of each pump. Install at integral pressure gage tapings where provided.

END OF SECTION 22 11 23

SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

PART 1—GENERAL

1.01 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

2.01 PIPES AND FITTINGS

- A. PVC Plastic, DWV Pipe and Fittings: ASTM D 2665, Schedule 40, plain ends with PVC socket-type, DWV pipe fittings.

PART 3—EXECUTION

3.01 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.
- D. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- E. 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.
- F. 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.
- G. 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.
- H. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

- I. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- K. Comply with requirements in Division 22 Section “Common Work Results for Plumbing” for basic piping joint construction.
- L. 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.
- M. Comply with requirements in Division 22 Section “Common Work Results for Plumbing” for pipe hanger and support devices.

3.02 PIPE SCHEDULE

- A. Aboveground Applications: PVC plastic, DWV pipe and fittings with solvent-cemented joints.

END OF SECTION 22 13 16

**SECTION 22 40 00
PLUMBING FIXTURES**

PART 1–GENERAL**1.01 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 ICC A117.1, “Accessible and Usable Buildings and Facilities” for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, “Energy Policy Act,” about water flow and consumption rates for plumbing fixtures.
- D. 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**2.01 WATER CLOSET**

- A. Vitreous-China Water Closet: Elongated, siphon-jet type, floor-mounted, floor outlet with close-coupled, gravity-type dual flush tank, one-piece bowl and tank.
 - 1. Basis-of-Design Product: Kohler
 - 2. Kohler elongated one piece toilet item# K-3564-0
 - 3. Design Consumption: Dual flush system 1.6gpf and 0.8gpf.
 - 4. Toilet seat: Soft closing seat cover and bolts are included
- B. Fixture Support: Combination carrier designed for accessible 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.

2.02 LAVATORY

- A. Porcelain Lavatory with overflow: Accessible, wall-mounting, 18-1/2in x 22-1/4in.
 - 1. Basis-of-Design Product: Kohler
 - a. Vox Square Vessel item# K-2661-0
- B. Solid-Surface Lavatory Countertop specified in Division 06 Section “Solid Surface Fabrications”.
- C. Faucets: ASME A112.18.1
 - 1. Basis-of-Design Product: Kohler
 - a. Purist lavatory faucet item# K-14407-4-cp
 - 2. Type: Center set with central inlets and with pop-up waste.
 - 3. Finish: Polished chrome-plate.
 - 4. Handle(s): Two handle

5. Maximum Flow Rate: 1.7 gpm
- D. Drain: Pop up with NPS 1-1/4 tailpiece, included with faucet.
- E. Trap: plastic tubular fittings with slip-joint inlet and wall flange.
- F. Supply and Drain Insulation: Soft-plastic covering; removable at stops.
- G. Fixture Support: Hanger plate for wall-mounting, lavatory-type fixture.

2.03 SHOWER

- A. Shower Base Receptor: Acrylic or fiberglass tile ready shower base with threshold matching enclosure 60 in x 66 in. Include integral corrosion-resistant-metal drain with removable strainer and NPS 2 bottom outlet.
 1. Basis-of-Design Product: Tile-Redi Shower base
 2. Type: Accessible.
- B. Mixing-Valve Faucet and Miscellaneous Fittings: Single-lever, pressure-balance antiscald-type faucet; maximum 1.5-gpm flow rate.
 1. Basis-of-Design Product: Kohler
 - a. Purist multifunction shower head item#K-997-cp
 - b. Shower arm and flange item# k-7397-cp
 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
- C. Drain: NPS 2, nickel-bronze-strainer, floor drain.

2.04 SINK

- A. Stainles-Steel Sink: 1 compartment
 1. Basis-of-Design Product: Kohler
 - a. Stages 33" stainless steel kitchen sink
 - b. item # K-3760-na
- B. Faucet: Solid brass Maximum 2.2-gpm flow rate.
 1. Basis-of-Design Product: Kohler
 - a. Hybrid gooseneck touchless deck-mount faucet with mixer item# K-7519-cp
 2. Type: Center set with central inlets
 3. Finish: brushed stainless-steel
 4. Handle: Single-lever toggle.
 5. Spout: Swing gooseneck, 1.9 gpm limited flow

- C. Disposer: 3/4 hp, UL labeled.
 - 1. Basis-of-Design Product: Insinkerator
 - a. Insinkerator Badger 5XP


PART 3–EXECUTION

3.01 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. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- E. 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.
- F. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.
- G. Fasten wall-mounted fittings to reinforcement built into walls.
- H. Fasten counter-mounting plumbing fixtures to casework.
- I. Secure supplies to supports or substrate within pipe space behind fixture.
- J. Set shower receptors and mop basins in leveling bed of cement grout.
- K. Install individual supply inlets, supply stops, supply risers, and tubular brass traps with cleanouts at fixture.
- L. Install water-supply stop valves in accessible locations.
- M. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes unless otherwise indicated.
- N. Install disposers in sink outlets. Install switch where indicated, or in wall adjacent to sink if location is not indicated.
- O. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.
- P. 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.
- Q. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.
- R. Install piping connections between plumbing fixtures and piping systems and plumbing equipment. Install insulation on supplies and drains of fixtures for people with disabilities.
- S. Ground equipment.

FIGURES:

FIGURE 22 40 00 1A



CHEF INSPIRED COLLECTION™ STAGES™ 33"

UNDERCOUNTER KITCHEN SINK

K-3760

Features

- 16-gauge stainless steel
- Undercounter
- Includes installation hardware
- Single compartment with wet surface work area
- Includes wood cutting board, bowls, and serving tray/cutting board
- Includes utensil tray/cutting board, bottom basin rack, and accessory rack
- 33" (83.8 cm) x 18-1/2" (47 cm)

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.19.3/CSA B45.4

Colors/Finishes

- NA: None applicable

Accessories

- CP: Polished Chrome
- ST: Stainless Steel
- NA: None applicable
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	Colors/Finishes
K-3760	Undercounter kitchen sink	<input type="checkbox"/> NA

Included Accessories

Model	Description	Colors/Finishes	Other
K-6230	Utensil tray	<input type="checkbox"/> NA	
K-6231	Flip tray	<input type="checkbox"/> NA	
K-6232	Cutting board	<input type="checkbox"/> NA	
K-6234	Bottom basin rack		<input type="checkbox"/> ST
K-6235	Prep bowls	<input type="checkbox"/> NA	
K-6236	Accessory storage rack		<input type="checkbox"/> ST

Optional Accessories

K-8801	Duostrainer® sink strainer	<input type="checkbox"/> CP	<input type="checkbox"/> Other_____
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Product Specification

The undercounter kitchen sink shall be made of 16-gauge stainless steel. The kitchen sink shall be 33" (83.8 cm) in length and 18-1/2" (47 cm) in width. Sink shall include wood cutting board, bowls, and serving tray/cutting board. Sink shall include utensil tray/cutting board, bottom basin rack, and accessory rack. Sink shall be single compartment with wet surface work area. Sink shall include installation hardware. Sink shall be Kohler Model K-3760-_____.

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1109791-4-C

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

FIGURE 22 40 00 1 B

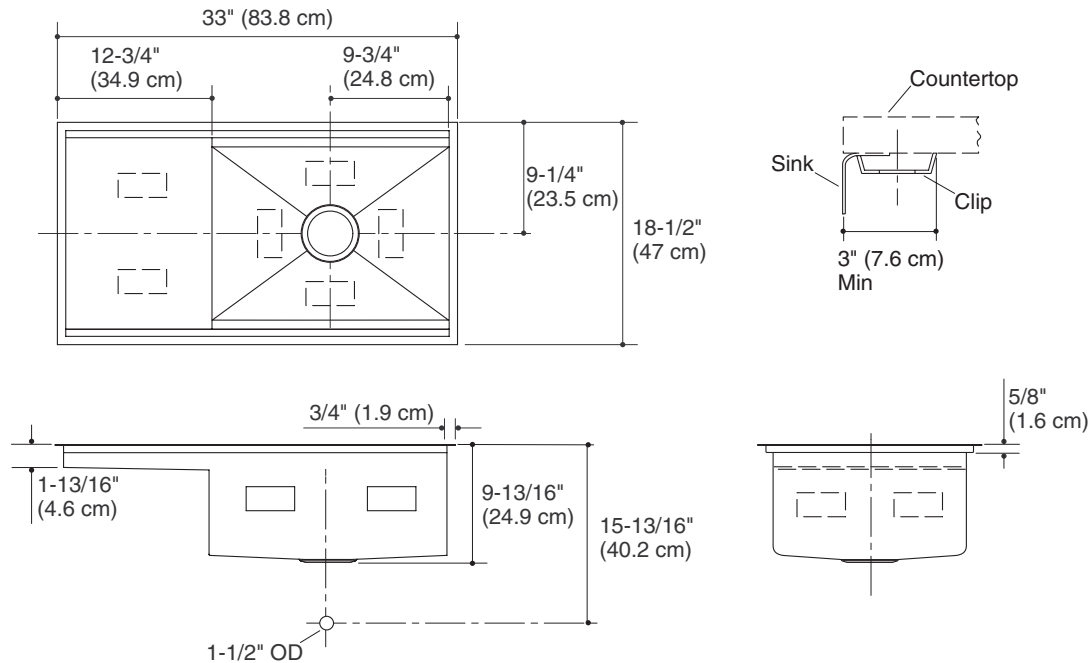
CHEF INSPIRED COLLECTION™ STAGES™ 33"

Technical Information

Fixture*:	
Basin area	31-1/2" (80 cm) x 17" (43.2 cm)
Water depth	9-1/2" (24.1 cm)
Drain hole	3-5/8" (9.2 cm) D.
*Approximate measurements for comparison only.	
Included components:	
Hardware kit	91915
Cut-out template	1109793-7

Installation Notes

Install this product according to the installation guide.
 Allow a minimum of 3" (7.6 cm) clearance around the sink rim for clip attachment.



Product Diagram

CHEF INSPIRED COLLECTION™ STAGES™ 33" UNDERCOUNTER KITCHEN SINK
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THE BOLD LOOK
 OF **KOHLER**®

FIGURE 22 40 00 2A



Features

- Brass construction
- Single-hole mounting
- Above-counter valve for easy installation and maintenance
- Vandal-resistant aerator
- 24" (61 cm) flexible supply hoses for easy installation
- 6-3/16" (15.7 cm) spout reach
- Stationary gooseneck spout
- Available with or without mixer
- Includes 30-year Hybrid Energy Cell
- Less drain
- .5 gallons (1.9 L) per minute flow rate

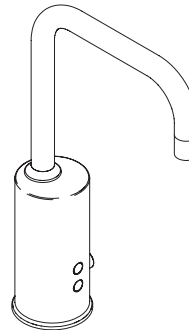
Codes/Standards Applicable

Specified model meets or exceeds the following at date of manufacture:

- ADA
- ICC/ANSI A117.1
- CSA B651
- OBC
- ASME A112.18.1/CSA B125.1
- Energy Policy Act of 1992

**ELECTRONIC FAUCET
K-7518
ALSO K-7519**

ADA **CSA B651** **OBC**



Colors/Finishes

- CP: Polished Chrome
- VS: Stainless Steel

Accessories

- CP: Polished Chrome
- VS: Stainless Steel
- NA: None applicable
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	Colors/Finishes	
K-7518	Electronic faucet – without mixer	<input type="checkbox"/> CP	<input type="checkbox"/> VS
K-7519	Electronic faucet – with mixer	<input type="checkbox"/> CP	<input type="checkbox"/> VS

Optional Accessories			
K-7129-A	Grid drain with overflow	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
K-7129	Grid drain without overflow	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
K-13478-A	4" (10.2 cm) escutcheon plate – round	<input type="checkbox"/> CP	<input type="checkbox"/> VS
K-13479-A	8" (20.3 cm) escutcheon plate – round	<input type="checkbox"/> CP	<input type="checkbox"/> VS
K-13601	Thermostatic mixing valve		<input type="checkbox"/> NA

Product Specification

The electronic faucet shall be made of brass construction. Product shall have 0.5 gal (1.9 L) per minute flow rate. Product shall feature a 6-3/16" (15.7 cm) spout reach, stationary gooseneck spout, and 24" (61 cm) flexible supply hoses for easy installation. Product shall feature an above-counter valve for easy installation and maintenance. Product shall include a 30-year Hybrid Energy Cell. Product shall be for single-hole mounting. Product shall be available with or without mixer. Product shall be less drain. Faucet shall be Kohler Model K-____-____.

FIGURE 22 40 00 2B

Optional Accessories (Cont.)		
1160593	Small Spray 0.38 gpm (1.44 lpm) – Insert only	<input type="checkbox"/> NA
_____	Additional flow options are available (refer to the Price Book)	<input type="checkbox"/> NA

Installation Notes

Install this product according to the installation guide.

A 1-1/4" (3.2 cm) minimum to 1-1/2" (3.8 cm) diameter maximum mounting hole is required.

The minimum distance between the back of the faucet spout and the wall must be 1-3/4" (4.4 cm). This will allow proper clearance for setscrew access.

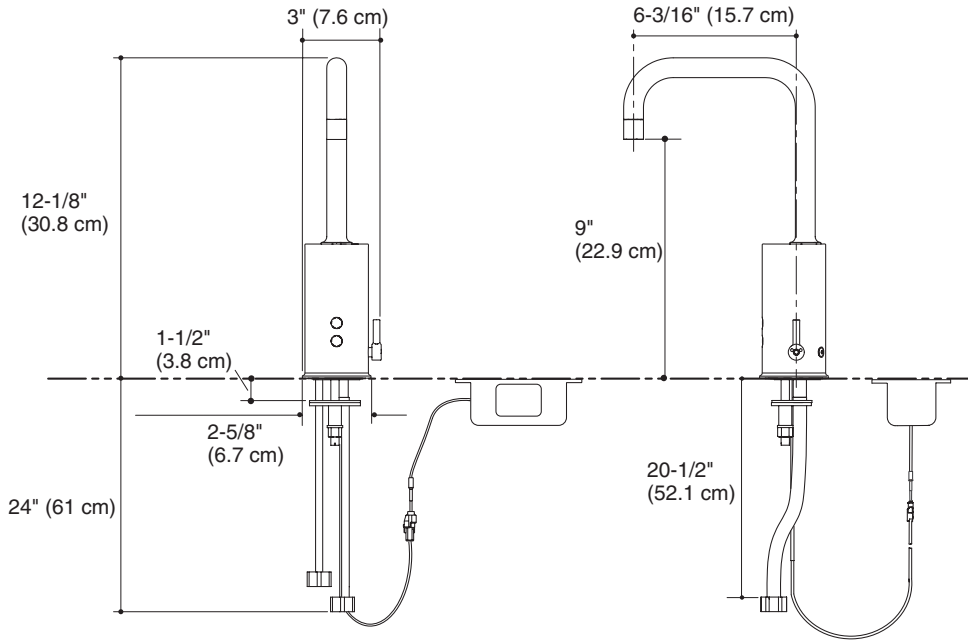
The maximum distance between the lavatory basin edge to the base of the faucet spout must be 1-3/4" (4.4 cm).

The maximum height of the lip basin should be 3/4" (1.9 cm).

Product includes 0.5 gpm (1.9 lpm) rosebud spray aerator. Other aerator styles are available. Please contact your distributor or see Kohler.com.

This product requires a 30-year Hybrid Energy Cell (included).

ADA, CSA B651, OBC compliant when installed to the specific requirements of these regulations.



Product Diagram

ELECTRONIC FAUCET
 Page 2 of 2
 1126266-4-D



FIGURE 22 40 00 3A

KOHLER
FAUCETS

DUOSTRAINER®

SINK STRAINER
K-8801
ALSO K-8799

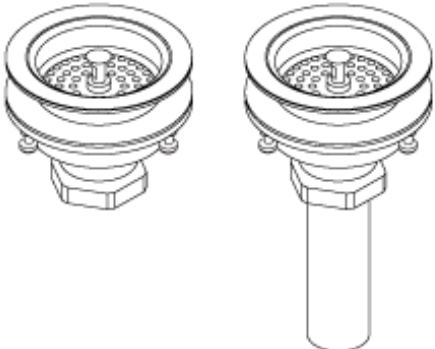
Features

- Brass construction
- For sink installations with 3-1/2" (8.9 cm) or 4" (10.2 cm) outlet
- Removable basket strainer with open/close stopper
- 1-1/2" connection

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.18.1
- CSA B125
- IAPMO/UPC



Colors/Finishes

- CP: Polished Chrome
- PB: Polished Brass
- Other: Refer to Price Book for additional colors/finishes

Specified Model:

Model	Description	Colors/Finishes		
K-8799	Sink strainer less tailpiece	<input type="checkbox"/> CP	<input type="checkbox"/> PB	
K-8801	Sink strainer with tailpiece	<input type="checkbox"/> CP	<input type="checkbox"/> PB	<input type="checkbox"/> Other _____

PRODUCT SPECIFICATION

Duostrainer sink strainer shall be of brass construction. Product shall feature removable basket strainer with an open/close stopper, and 1-1/2" connection. Product is intended for sink installations with 3-1/2" (8.9 cm) or 4" (10.2 cm) outlet. Optional feature shall be a brass tailpiece. Strainer shall be Kohler Model K-_____-_____.

Page 1 of 2
105248-4-BB

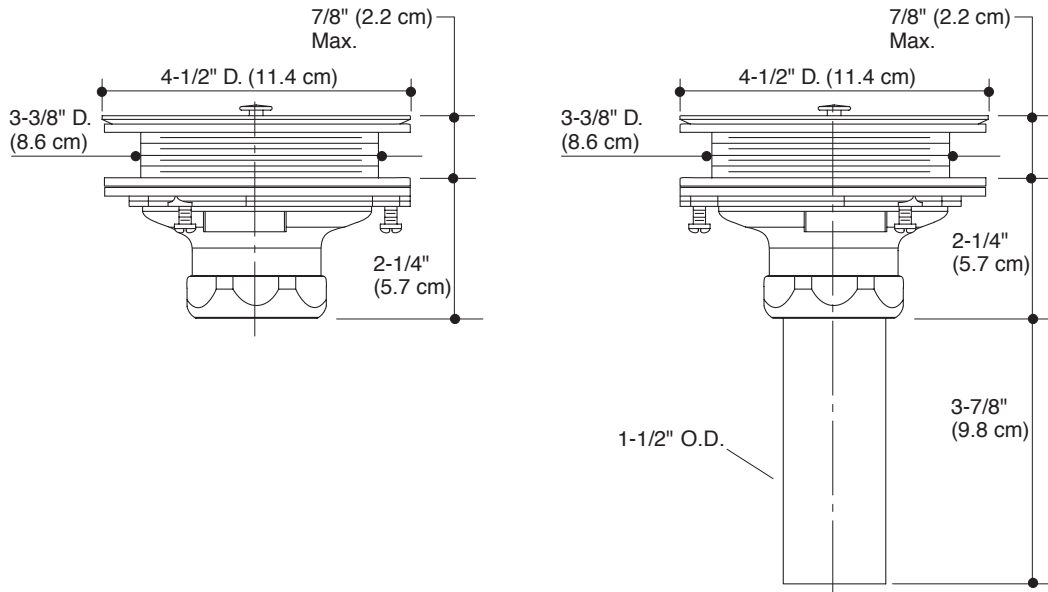
USA: 1-800-4-KOHLER
 Canada: 1-800-964-5590
 kohler.com

FIGURE 22 40 00 3B

DUOSTRAINER®

Installation Notes

Install this product in accordance with the installation instructions.




Product Diagram

DUOSTRAINER® SINK STRAINER
Page 2 of 2
105248-4-BB

THE BOLD LOOK
OF **KOHLER.**

FIGURE 22 40 00 4A




SAILE®

TOILET

K-3564

ALSO K-14338



Features

- Vitreous china
- Required minimum 12" (30.5 cm) rough-in
- One-piece
- Elongated bowl
- Available with KOHLER Artist Editions designs
- Dual flush flushing system
- High efficiency 1.6 gpf (6 lpf) or 0.8 gpf (3 lpf)
- 2-1/8" (5.4 cm) fully glazed trapway
- Skirted bowl design
- Includes polished chrome top-mount flush actuator
- Includes Saile seat and cover [K-4748]
- Less supply
- 28-1/2" (72.4 cm) x 14-1/4" (36.2 cm) x 28-3/4" (73 cm)

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.19.2/CSA B45.1
- ASME A112.19.14
- EPA WaterSense®

Colors/Finishes

- 0: White
- Other: Refer to Price Book for additional colors/finishes

Accessories

- CP: Polished Chrome
- G: Brushed Chrome
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	Colors/Finishes	
K-3564	One-piece toilet – elongated bowl	<input type="checkbox"/> 0	<input type="checkbox"/> Other_____
K-14338	One-piece toilet, elongated bowl – Artist Editions	<input type="checkbox"/> 0	

Recommended Accessories

K-7637	Angle supply with stop – 3/8" NPT connection		<input type="checkbox"/> CP	<input type="checkbox"/> Other_____
K-9384	Dual flush actuator	<input type="checkbox"/> G		

Product Specification

The one-piece toilet with elongated bowl shall be made of vitreous china. Toilet shall be 28-1/2" (72.4 cm) in length, 14-1/4" (36.2 cm) in width, and 28-3/4" (73 cm) in height. Toilet shall feature a required minimum 12" (30.5 cm) rough-in and 2-1/8" (5.4 cm) fully glazed trapway. Toilet shall feature a dual flush flushing system. Toilet shall be high efficiency with 1.6 gpf (6 lpf) or 0.8 gpf (3 lpf). Toilet shall feature a skirted bowl design. Toilet shall include a polished chrome top-mount flush actuator. Toilet shall include a Saile seat and cover [K-4748]. Toilet shall be less supply. Toilet shall be available with Artist Editions designs. Toilet shall be Kohler Model K-3564-_____ or K-14338-_____.

Page 1 of 2
1086323-4-D

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

FIGURE 22 40 00 4B

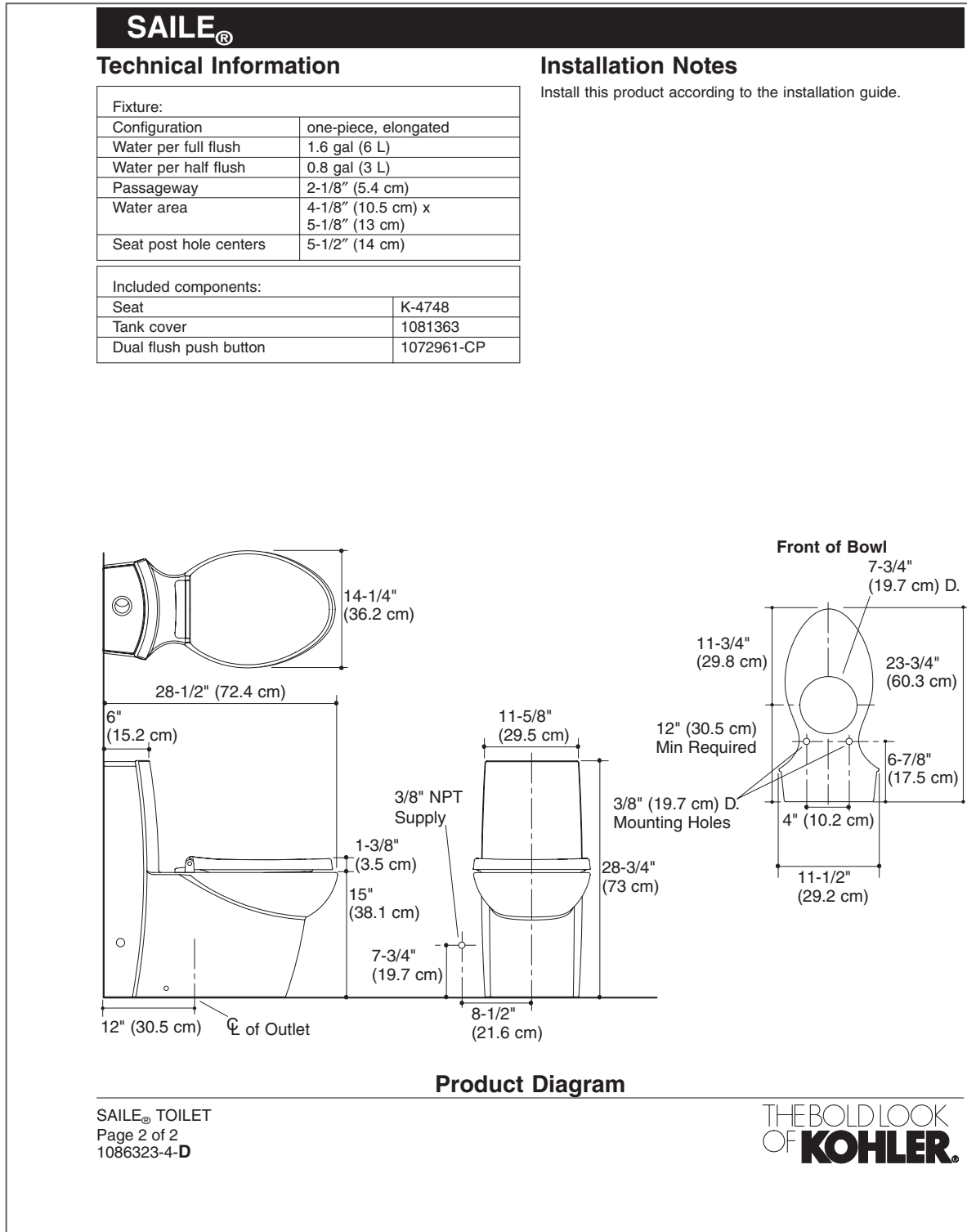


FIGURE 22 40 00 5A

KOHLER®

VOX

Features

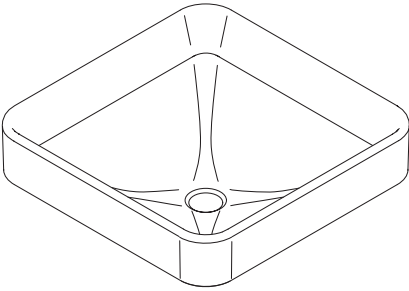
- Vitreous china
- Above-the-counter
- With overflow
- 16-1/4" (41.3 cm) x 16-1/4" (41.3 cm)

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.19.2/CSA B45.1

VESSELS LAVATORY
K-2661



Colors/Finishes

- 0: White

Specified Model

Model	Description	Colors/Finishes
K-2661	Vessels lavatory	☐ 0

Product Specification

The vessel lavatory shall be made of vitreous china. Lavatory shall be 16-1/4" (41.3 cm) in length and 16-1/4" (41.3 cm) in width and mounted above-the-counter. Lavatory shall have overflow. Lavatory shall be Kohler Model K-2661-0.

Page 1 of 2
1145035-4-A

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

FIGURE 22 40 00 5B

VOX

Technical Information

Fixture*:	
Basin area	15-3/4" (40 cm) x 15-3/4" (40 cm)
Water depth	3-3/4" (9.5 cm)
Drain hole	1-3/4" (4.4 cm) D.
* Approximate measurements for comparison only.	

Included components:	
Cut-out template	1144642-7

Installation Notes

Install this product according to the installation guide.

Choose a faucet that will provide adequate clearance and will direct the water stream to the center of the lavatory.

Spout must be mounted high enough to clear 3-1/4" (8.3 cm) rim height and provide a 1" (2.5 cm) air gap per ASME A112.1.2.

NOTICE: Countertop manufacturer or cutter must use the cut-out template provided with the product or a current one provided by Kohler (call 1-800-For-KOHLER). Kohler is not responsible for cut-out errors when incorrect cut-out template is used.

Product rests on countertop. Consider height when designing installation.

The diagram includes three views of the VOX Vessels Lavatory. The top view shows a square basin with rounded corners, a central drain hole, and a spout. Dimensions include a total width of 16-1/4" (41.3 cm) and a height of 8-1/8" (20.6 cm) from the center of the drain to the top of the basin. The side view shows a depth of 16-1/4" (41.3 cm) and a rim height of 3-1/4" (8.3 cm). The front view shows a total height of 14" (35.6 cm) from the countertop to the top of the basin, with a 9-3/4" (24.8 cm) height to the top of the spout. The spout has a 1/4" OD and is mounted on a 4" (10.2 cm) wide base. The base has two 3/8" diameter holes for hot and cold water supply.

Product Diagram

VOX VESSELS LAVATORY
 Page 2 of 2
 1145035-4-A

THE BOLD LOOK
 OF **KOHLER**

FIGURE 22 40 00 6A

KOHLER
FAUCETS

PURIST®
WIDESPREAD LAVATORY FAUCET
K-14406
ALSO K-14407

Features

- Metal construction
- Brass valve bodies
- Flexible connections for easy installation
- Pop-up drain with lift rod and tailpiece
- 5-1/2" (14 cm) spout reach
- Stationary spout
- For 8" (20.3 cm) or 16" (40.6 cm) centers
- Quarter-turn washerless ceramic disc valves
- Available with cross, high cross, lever, or high lever handles
- Low gooseneck spout
- 1.5 gallons (5.7 liters) per minute maximum flow rate

ADA

Codes/Standards Applicable

Specified model meets or exceeds the following at date of manufacture:

- ADA
- ICC/ANSI A117.1
- ASME A112.18.1/CSA B125.1
- NSF 61
- EPA WaterSense®
- All applicable US Federal and State material regulations

Colors/Finishes

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes
- NA: None applicable

Specified Model

Model	Description	Cross 	Lever 	High Cross 	High Lever
K-14406-3	Lavatory faucet	<input type="checkbox"/> CP <input type="checkbox"/> Other ___			
K-14406-4	Lavatory faucet		<input type="checkbox"/> CP <input type="checkbox"/> Other ___		
K-14407-3	Lavatory faucet			<input type="checkbox"/> CP <input type="checkbox"/> Other ___	
K-14407-4	Lavatory faucet				<input type="checkbox"/> CP <input type="checkbox"/> Other ___

Product Specification

The two-handle widespread lavatory faucet shall be made of metal construction with brass valve bodies. Product shall have a maximum flow rate of 1.5 gallons (5.7 liters) per minute. Product shall feature quarter-turn washerless ceramic disc valves, flexible connections for easy installation, a 5-1/2" (14 cm) spout reach, and a stationary spout. Product shall be for 8" (20.3 cm) or 16" (40.6 cm) centers. Product shall feature a low gooseneck spout and a pop-up drain with lift rod and tailpiece. Product shall be available with cross, high cross, lever, or high lever handles. Faucet shall be Kohler Model K-____-____-____.

Page 1 of 2
1106616-4-D

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

FIGURE 22 40 00 6B

PURIST®

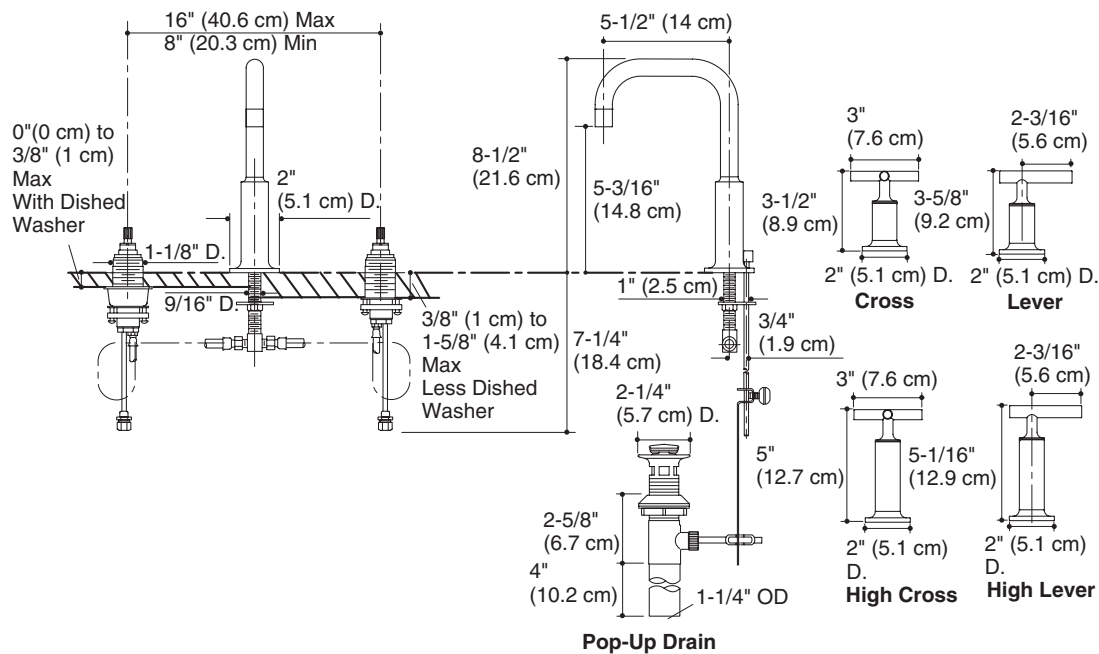
Optional Accessories

1160593	Small Spray 0.38 gpm (1.44 lpm) – Insert only	<input type="checkbox"/> NA
_____	Additional flow options are available (refer to the Price Book)	<input type="checkbox"/> NA

Installation Notes

Install this product according to the installation guide.

ADA compliant when installed to the specific requirements of these regulations.



Product Diagram

PURIST® WIDESPREAD LAVATORY FAUCET
 Page 2 of 2
 1106616-4-D

THE BOLD LOOK
 OF **KOHLER**®

FIGURE 22 40 00 7A

**KOHLER®
 FAUCETS**

Features

- 3-function showerhead with wide coverage, medium coverage, and concentrated spray options
- 1.75 gpm (6.6 L) per minute flow rate
- 5-1/2" (14 cm) diameter showerhead
- Complements Purist® Suite
- MasterClean™ spray nozzles to prohibit mineral build-up for easy cleaning
- 1/2" - 14 NPT connection

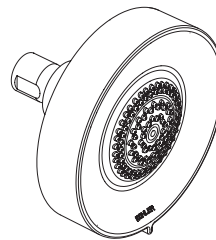
Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.18.1/CSA B125.1
- EPA WaterSense®

PURIST®

**MULTI-FUNCTION SHOWERHEAD
 K-997**



Colors/Finishes

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Accessories

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	<input type="checkbox"/> CP	<input type="checkbox"/> Other ____
K-997	Multi-function showerhead	<input type="checkbox"/> CP	<input type="checkbox"/> Other ____
Recommended Accessories			
K-7397	Shower arm and flange – 7-1/2" (13.7 cm) length, 1/2" NPT	<input type="checkbox"/> CP	<input type="checkbox"/> Other ____

Product Specification

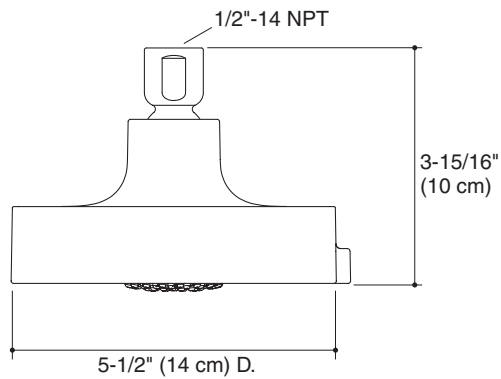
The showerhead shall feature a Masterclean sprayface nozzles to prohibit mineral build-up for easy cleaning. Showerhead shall have a 5-1/2" (14 cm) diameter showerhead and a 1/2"-14 NPT connection. Showerhead shall feature a 1.75 gpm (6.6 L) per minute flow rate. Showerhead shall be available with a 3-function showerhead with wide coverage, medium coverage and concentrated spray options. Showerhead shall complement Purist suite. Multi-function showerhead shall be Kohler Model K-997-____.

FIGURE 22 40 00 7B

PURIST®

Installation Notes

Install this product according to the installation guide.



Product Diagram

PURIST® MULTI-FUNCTION SHOWERHEAD
Page 2 of 2
1100341-4-B

THE BOLD LOOK
OF **KOHLER.**

FIGURE 22 40 00 8A

KOHLER®

SHOWER ARM AND FLANGE

K-7395

ALSO K-7397

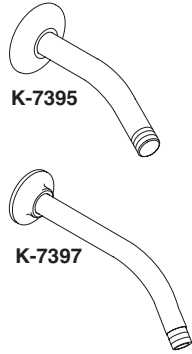
Features

- Metal construction
- 1/2"-14 NPT thread both ends
- Wall-mount flange

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.18.1
- IAPMO/UPC



K-7395

K-7397

Colors/Finishes

- CP: Polished Chrome
- PB: Vibrant® Polished Brass
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	Colors/Finishes		
K-7395	Shower arm and flange - 5-3/8" (13.7 cm)	<input type="checkbox"/> CP	<input type="checkbox"/> PB	
K-7397	Shower arm and flange - 7-1/2" (19.1 cm)	<input type="checkbox"/> CP	<input type="checkbox"/> PB	<input type="checkbox"/> Other_____

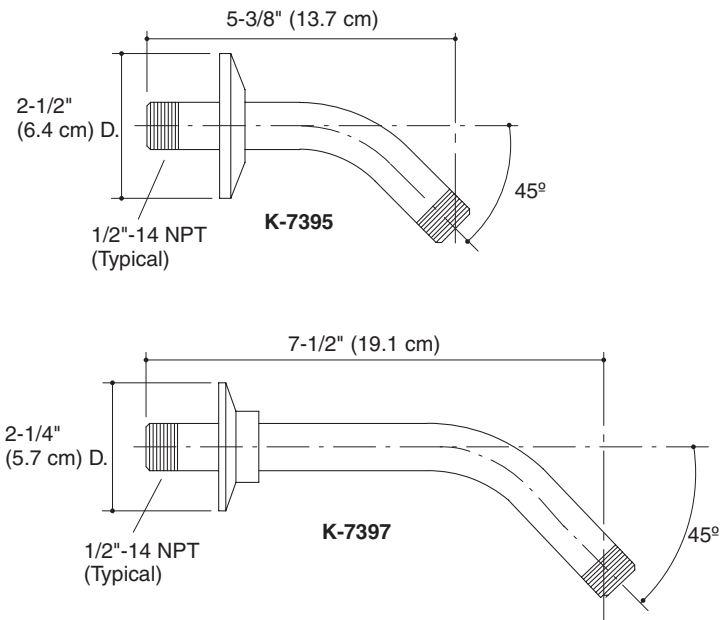
Product Specification

Shower arm and flange shall be of metal construction. Product shall have 1/2"-14 NPT thread both ends. Product shall have wall-mount flange. Shower arm shall be Kohler Model K-_____-_____.

Page 1 of 2
113698-4-C

USA: 1-800-4-KOHLER
 Canada: 1-800-964-5590
 kohler.com

FIGURE 22 40 00 8B




Product Diagram

SHOWER ARM AND FLANGE
Page 2 of 2
113698-4-C

THE BOLD LOOK
OF **KOHLER.**

FIGURE 22 40 00 9A



PURIST®

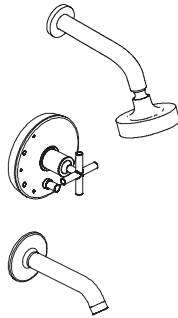
BATH AND SHOWER FAUCET TRIM
K-T14420
ALSO K-T14421, K-T14422, K-T14423

Features

- Brass construction
- Available with cross or lever handles
- Push-button diverter
- 35° and 90° spouts

Codes/Standards Applicable
Specified model meets or exceeds the following:

- ASME A112.18.1/CSA B125.1
- ASSE 1016



Colors/Finishes

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Accessories

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes
- NA: None applicable

Specified Model

Model	Description	Colors/Finishes
K-T14420-3	Bath and shower trim, cross handle and 35° Spout (shown)	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14420-4	Bath and shower trim, lever handle and 35° Spout	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14421-3	Bath and shower trim, cross handle and 90° Spout	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14421-4	Bath and shower trim, lever handle and 90° Spout	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14422-3	Shower only trim, cross handle	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14422-4	Shower only trim, lever handle	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14423-3	Non-Diverter valve only trim, cross handle	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14423-4	Non-Diverter valve only trim, lever handle	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14501-3	Valve W/diverter only trim, cross handle	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-T14501-4	Valve W/Diverter only trim, lever handle	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-14426	35° Bath spout	<input type="checkbox"/> CP <input type="checkbox"/> Other ____
K-14427	90° Bath spout	<input type="checkbox"/> CP <input type="checkbox"/> Other ____

Product Specification

The Rite-Temp® pressure-balancing single-control bath and shower faucet trim shall be made of brass construction. Bath and shower trim shall include showerhead with arm and flange, non-diverter spout with NPT connection, and faceplate with handle and push-button diverter. Shower only trim shall include showerhead with arm and flange, and faceplate with handle. Valve only trim shall include faceplate with handle. Faucet shall be K-____-____-____ OR K-____-____, and Rite-Temp® valve shall be K-____-____-NA.

Page 1 of 2
1031692-4-C

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

FIGURE 22 40 00 9B

PURIST®

Required Accessories			
K-304-*	Rite-Temp® valve OR		<input type="checkbox"/> NA
K-2971-KS	HiFlow Rite-Temp valve with stops OR		<input type="checkbox"/> NA
K-11748-K	Rite-Temp valve with diverter OR		<input type="checkbox"/> NA
K-11748-KS	Rite-Temp valve with diverter and stops		<input type="checkbox"/> NA
* For a complete listing of all the Rite-Temp valves, refer to the K-304-* Specification Sheet or Roughing-In Sheet.			
Optional Accessories			
88526	HiFlow Rite-Temp® thin wall installation kit	<input type="checkbox"/> CP	Other ____
1016154	Deep roughing-in kit for Rite-Temp® valve (lever and cross handles)	<input type="checkbox"/> CP	Other ____

Installation Notes

Install this product according to the installation guide.

NOTICE: Risk of product damage. Long screws, for installing trim, can damage the K-2971-KS valve. Consult the trim installation guide to verify if the thin wall installation kit (88526) is needed.

Install this product according to the installation guide.

Avoid cross-flow conditions. Do not install shut-off device on either valve outlet.

Cap shower outlet if deck-mount spout, diverter, or handshower is connected to spout outlet.


Install straight pipe or tube drop of 7" (17.8 cm) to 18" (45.7 cm) with single elbow between valve and wall-mount spout.

Product Diagram

PURIST® BATH AND SHOWER FAUCET TRIM
Page 2 of 2
1031692-4-C

THE BOLD LOOK
OF **KOHLER.**

FIGURE 22 40 00 10A



RITE-TEMP®

PRESSURE-BALANCING VALVE

K-304

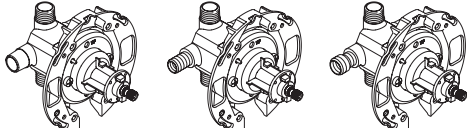
Features

- Brass valve body
- High-temperature limit setting for added safety
- Mixing valve cycles from "cold" to "hot"
- Rite-Temp pressure-balancing diaphragm design valve
- One-piece diaphragm cartridge design for ease of maintenance
- Available with or without screwdriver stops

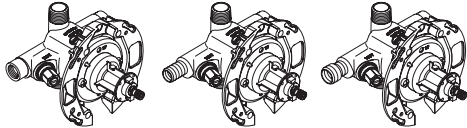
Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.18.1/CSA B125.1
- ASSE 1016



K-304-K K-304-PX K-304-UX



K-304-KS K-304-PS K-304-US

Colors/Finishes

- NA: None applicable

Specified Model

Model	Description	Colors/Finishes
K-304-K	Pressure-balancing valve without screwdriver stops – universal inlets	<input type="checkbox"/> NA
K-304-KS	Pressure-balancing valve with screwdriver stops – universal inlets	<input type="checkbox"/> NA
K-304-PX	Pressure-balancing valve without screwdriver stops – PEX inlets (crimp)	<input type="checkbox"/> NA
K-304-PS	Pressure-balancing valve with screwdriver stops – PEX inlets (crimp)	<input type="checkbox"/> NA
K-304-UX	Pressure-balancing valve without screwdriver stops – PEX inlets (cold expansion)	<input type="checkbox"/> NA
K-304-US	Pressure-balancing valve with screwdriver stops – PEX inlets (cold expansion)	<input type="checkbox"/> NA
K-304-CX	Pressure-balancing valve without screwdriver stops – 1/2" CPVC inlets	<input type="checkbox"/> NA
K-304-CS	Pressure-balancing valve with screwdriver stops – 1/2" CPVC inlets	<input type="checkbox"/> NA
The K-304-CX and K-304-CS are K-304-K and K-304-KS with CPVC adapters installed on the inlets.		

Optional Accessories

58221	Deep roughing-in kit for Rite-Temp® valve for Antique™ valve six-prong and artist edition handles	<input type="checkbox"/> NA
58222	Deep roughing-in kit for Rite-Temp® valve for Antique™ lever handles	<input type="checkbox"/> NA
58223	Deep roughing-in kit for Rite-Temp® valve for IV Georges Brass®, Triton®, lever handles	<input type="checkbox"/> NA
58224	Deep roughing-in kit for Rite-Temp® valve for IV Georges Brass®, cross handles	<input type="checkbox"/> NA
58226	Deep roughing-in kit for Rite-Temp® valve for Taboret® lever and T-handle	<input type="checkbox"/> NA

Optional accessories continued on page 2

Product Specification

Rite-Temp pressure-balancing valve shall have a brass valve body. Product shall include a Rite-Temp pressure-balancing diaphragm design valve with a one-piece diaphragm cartridge design for ease of maintenance. Product shall have mixing valve cycles from "cold" to "hot" and a high-temperature limit stop for added safety. Product shall be available without or with screwdriver stops. Valve shall be Kohler Model K-304-____-NA.

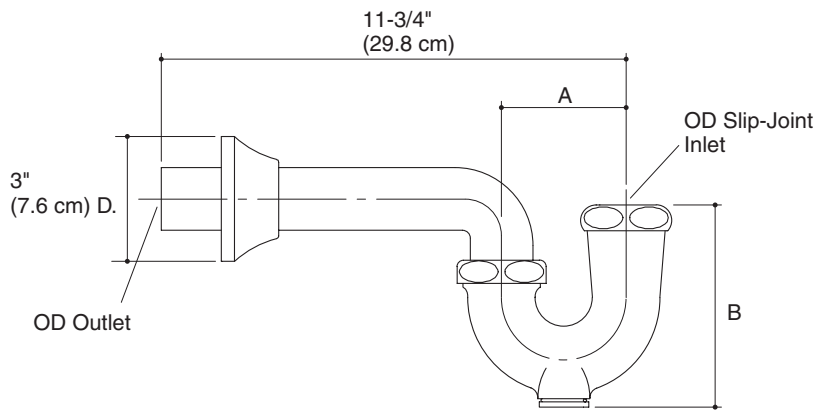
Page 1 of 2
1110626-4-A

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

FIGURE 22 40 00 10B

Installation Notes

Install this product according to the installation guide.



	A	B	OD Outlet	OD Inlet
K-8998	2-3/4" (7 cm)	4-3/8" (11.1 cm)	1-1/4" (3.2 cm)	1-1/4" (3.2 cm)
K-8999	3" (7.6 cm)	4-7/8" (12.4 cm)	1-1/2" (3.8 cm)	1-1/4" (3.2 cm)
K-9000	3" (7.6 cm)	4-7/8" (12.4 cm)	1-1/2" (3.8 cm)	1-1/2" (3.8 cm)

Product Diagram

P-TRAP
Page 2 of 2
115170-4-BB



FIGURE 22 40 00 11A

KOHLER
FAUCETS®

Features

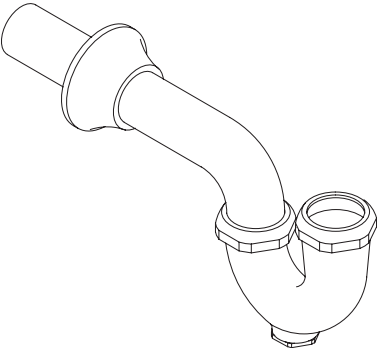
- Cast brass construction
- Adjustable rotation on tube outlet
- Slip-joint inlet
- Cleanout plug
- Flange

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.18.1/CSA B125.1
- IAPMO/UPC

P-TRAP
K-8998
ALSO K-8999, K-9000



Colors/Finishes

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	Colors/Finishes
K-8998	P-trap with 1-1/4" OD inlet and 1-1/4" OD outlet	<input type="checkbox"/> CP
K-8999	P-trap with 1-1/4" OD inlet and 1-1/2" OD outlet	<input type="checkbox"/> CP
K-9000	P-trap with 1-1/2" OD inlet and 1-1/2" OD outlet	<input type="checkbox"/> CP

Product Specification

P-trap shall be of cast brass construction. Adjustable P-trap shall include cleanout plug, and flange. P-trap shall feature 1-1/4" or 1-1/2" OD slip-joint inlet and 1-1/4" or 1-1/2" OD outlet. Product shall be Kohler Model K-____-____.

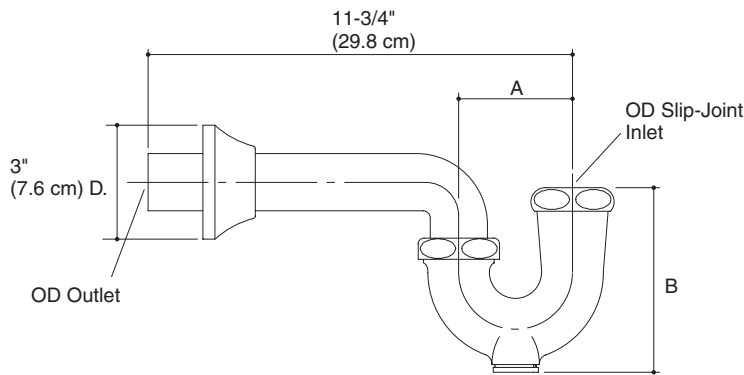
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USA: 1-800-4-KOHLER
Canada: 1-800-964-5590
kohler.com

FIGURE 22 40 00 11 B

Installation Notes

Install this product according to the installation guide.



	A	B	OD Outlet	OD Inlet
K-8998	2-3/4" (7 cm)	4-3/8" (11.1 cm)	1-1/4" (3.2 cm)	1-1/4" (3.2 cm)
K-8999	3" (7.6 cm)	4-7/8" (12.4 cm)	1-1/2" (3.8 cm)	1-1/4" (3.2 cm)
K-9000	3" (7.6 cm)	4-7/8" (12.4 cm)	1-1/2" (3.8 cm)	1-1/2" (3.8 cm)

Product Diagram

P-TRAP
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END OF SECTION 22 40 00

DIVISION 23 – HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

SECTION 23 07 00 HVAC INSULATION

PART 1–GENERAL

1.01 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

2.01 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. Mineral-Fiber Blanket Insulation: Comply with ASTM C 553, Type II and ASTM C 1290, Type I.
- D. Mineral-Fiber Board Insulation: Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation [**without factory-applied jacket**] [**with factory-applied ASJ**] [**with factory-applied FSK jacket**].
- E. Mineral-Fiber, Preformed Pipe Insulation: Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.
- F. Mineral-Fiber, Pipe and Tank Insulation: Complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB; and having factory-applied [**ASJ**] [**FSK jacket**]. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less.
- G. Polyolefin Insulation: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
- H. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- I. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- J. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
- K. 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.
- L. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

- M. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 3—EXECUTION

3.01 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. Mineral-Fiber Insulation Installation:
1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 4. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 5. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier.
- F. Polyolefin Insulation Installation:
1. Seal split-tube 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 polyolefin pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- G. Plenums and Ducts Requiring Insulation:
1. Concealed and exposed supply and outdoor air.
 2. Concealed and exposed return air located in nonconditioned space.
 3. Concealed and exposed exhaust between isolation damper and penetration of building exterior.

H. Plenums and Ducts Not Insulated:

1. Metal ducts with duct liner.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

I. Piping Not Insulated: 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.

3.02 DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed duct insulation shall be [one of] the following:

1. Flexible Elastomeric: [**1 inch (25 mm)**] <Insert dimension> thick.
2. Mineral-Fiber Blanket: [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**3 inches (75 mm)**] <Insert dimension> thick and [**0.75-lb/cu. ft. (12-kg/cu. m)**] [**1.5-lb/cu. ft. (24-kg/cu. m)**] [**3-lb/cu. ft. (48-kg/cu. m)**] nominal density.
3. Mineral-Fiber Board: [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**3 inches (75 mm)**] <Insert dimension> thick and [**2-lb/cu. ft. (32-kg/cu. m)**] [**3-lb/cu. ft. (48-kg/cu. m)**] [**6-lb/cu. ft. (96-kg/cu. m)**] nominal density.
4. Polyolefin: [**1 inch (25 mm)**] <Insert dimension> thick.

B. Exposed duct insulation shall be [one of] the following:

1. Flexible Elastomeric: [**1 inch (25 mm)**] <Insert dimension> thick.
2. Mineral-Fiber Blanket: [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**3 inches (75 mm)**] <Insert dimension> thick and [**0.75-lb/cu. ft. (12-kg/cu. m)**] [**1.5-lb/cu. ft. (24-kg/cu. m)**] [**3-lb/cu. ft. (48-kg/cu. m)**] nominal density.
3. Mineral-Fiber Board: [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**3 inches (75 mm)**] <Insert dimension> thick and [**2-lb/cu. ft. (32-kg/cu. m)**] [**3-lb/cu. ft. (48-kg/cu. m)**] [**6-lb/cu. ft. (96-kg/cu. m)**] nominal density.
4. Polyolefin: [**1 inch (25 mm)**] <Insert dimension> thick.

3.03 HVAC PIPING INSULATION SCHEDULE

A. Chilled Water: Insulation shall be [one of] the following:

1. Flexible Elastomeric: [1 inch (25 mm)] <Insert dimension> thick.
2. Mineral-Fiber, Preformed Pipe, [Type I] [Type I or Pipe Insulation Wicking System]: [1 inch (25 mm)] [1-1/2 inches (38 mm)] [2 inches (50 mm)] <Insert dimension> thick.
3. Polyolefin: [1 inch (25 mm)] <Insert dimension> thick.

B. Heating-Hot-Water Supply and Return: Insulation shall be the following:



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1. Mineral-Fiber, Preformed Pipe, Type I: [1 inch (25 mm)] [2 inches (50 mm)] <Insert dimension> thick.
- C. Refrigerant Suction and Hot-Gas Piping: Insulation shall be[one of] the following:
1. Flexible Elastomeric: [1 inch (25 mm)] <Insert dimension> thick.
 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: [1 inch (25 mm)] <Insert dimension> thick.
 3. Polyolefin: [1 inch (25 mm)] <Insert dimension> thick.
- D. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be[one of] the following:
1. Flexible Elastomeric: [1 inch (25 mm)] <Insert dimension> thick.
 2. Polyolefin: [1 inch (25 mm)] <Insert dimension> thick.
- E. Dual-Service Heating and Cooling: Mineral-Fiber, Preformed Pipe, Type I: [1 inch (25 mm)] [1-1/2 inches (38 mm)] [2 inches (50 mm)] <Insert dimension> thick.

END OF SECTION 230700

SECTION 23 21 13 HYDRONIC PIPING

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Summary: Heating and cooling water piping and condensate drain piping.

PART 2—PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

- A. Soft Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A) with ASME B16.22 wrought-copper solder fittings.
- B. CPVC Pipe: ASTM F 441/F 441M, Schedule 40, plain ends with ASTM F 438, socket-type solvent welding fittings.
- C. Unions: ASME B16.39, malleable-iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.
- D. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig (1035-kPa) minimum working pressure, 250 deg F (121 deg C) maximum operating temperature.
- E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, ends.

PART 3—EXECUTION

3.01 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 service 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 piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping free of sags and bends and install fittings for changes in direction and branch connections.
- E. Use the fewest number of joints belowground and within floor slabs.
- F. Install piping at a uniform slope of 0.2 percent upward in the direction of flow.
- G. Make reductions in pipe sizes using eccentric reducer fitting installed with level side up.
- H. Install branch connections to mains using tee fittings in main with takeoff out the bottom of the main, except for up-feed risers, which shall have swing joint and takeoff out the top of the main line.
- I. Install unions in pipes adjacent to each valve, at final connections with each piece of equipment, and elsewhere as indicated.
- J. Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration-producing equipment.
- K. Remove stems, seats, and packing of valves and accessible internal parts at piping specialties before soldering or brazing.

3.02 VALVE INSTALLATIONS

- A. Shutoff Duty: Use gate or ball valves.
- B. Throttling Duty: Use globe or ball valves.
- C. Install shutoff-duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, and elsewhere as indicated.
- D. Install throttling-duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
- E. Install calibrated plug valves on the outlet of each heating or cooling element and elsewhere as required to facilitate system balancing.
- F. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple and cap.
- G. Install check valves on each pump discharge and elsewhere as required to control flow direction.
- H. Install safety relief valves on hot-water generators and elsewhere as required by authorities having jurisdiction. Pipe discharge to floor drain without valves.
- I. Install manual air vents at high points in the system, at heat-transfer coils, and elsewhere as required for system air venting.
- J. Run piping from boiler air vent connection or air separator to compression tank with 1/4 inch per foot (1:50) upward slope towards tank. Connect boiler outlet piping.
- K. Install valves with stem up. Allow clearance above stem for check mechanism removal.

3.03 SPECIALTIES INSTALLATIONS

- A. Install chemical feeders in each hydronic system in upright position with top of funnel not more than 48 inches (1200 mm) above floor. Install feeder across pump or in bypass line, off main using ball valves on each side of feeder, and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.
- B. Install diaphragm-type compression tanks on floor. Vent and purge air from hydronic system; charge tank with proper air charge to suit system design requirements.
- C. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated.

3.04 TESTING, ADJUSTING, AND BALANCING

- A. Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens.
- B. Hydrostatically test completed piping at a pressure one and one-half times operating pressure. Isolate equipment before testing piping. Repair leaks and retest piping until there are no leaks.
- C. Balance water flow as required by Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.05 PIPING SCHEDULE

- A. Hot and Chilled Water, NPS 2 (DN 50) and Smaller:
 - 1. Aboveground: Drawn-temper copper tubing with soldered joints, or steel pipe with threaded joints.
 - 2. Aboveground: Steel pipe with threaded joints.



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3. Aboveground: CPVC pipe and fittings with solvent welded joints.
 4. Belowground or within Slabs: Annealed-temper copper tubing with soldered joints.
- B. Condensate Drain Lines: Drawn-temper copper tubing with soldered joints or PVC pipe with solvent-welded joints.

END OF SECTION 23 21 13

SECTION 23 21 23 HYDRONIC PUMPS

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data. Include certified pump-performance curves, furnished specialties, motor horsepower and electrical characteristics.
- B. Comply with UL 778 for motor-operated water pumps.

PART 2—PRODUCTS

2.01 HYDRONIC PUMPS

- A. Close-Coupled, In-Line Centrifugal Pumps: Factory-assembled and -tested, overhung impeller, designed for installation with pump and motor shafts mounted horizontally or vertically. Rated for 125-psig (860-kPa) minimum working pressure and minimum continuous water temperature of 225 deg F (107 deg C).
 - 1. Available Products:
 - a. IPT; 2761-IPT-95; Self Priming
 - 2. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
 - 3. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - a. Pump Shaft: Steel, with copper-alloy shaft sleeve.
 - b. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
- B. Separately Coupled, Horizontal, In-Line Centrifugal Pumps: Factory-assembled and -tested, overhung impeller, designed for installation with pump and motor shafts mounted horizontally. Rated for 175-psig (1200-kPa) minimum working pressure and minimum continuous water temperature of 225 deg F (107 deg C).
 - 1. Available Products:
 - a. IPT; 2761-IPT-95; Self Priming
 - 2. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
 - 3. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. Trim impeller to match specified performance.
 - a. Pump Shaft: Steel, with copper-alloy shaft sleeve.
 - b. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
 - c. Pump Bearings: Permanently lubricated ball bearings.
 - d. Motor: Resiliently mounted to pump casing.

- C. Separately Coupled, Vertical, In-Line Centrifugal Pumps: Factory-assembled and -tested, overhung impeller, designed for installation with pump and motor shafts mounted vertically. Rated for 175-psig (1200-kPa) minimum working pressure and a continuous water temperature of 225 deg F (107 deg C).
1. [Available]Products:
 - a. IPT; 2761-IPT-95; Self Priming
 2. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
 3. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - a. Pump Shaft: Steel, with copper-alloy shaft sleeve.
 - b. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
 - c. Pump Bearings: Permanently lubricated ball bearings.

2.02 MOTORS

- A. NEMA MG 1, “Standard for Motors and Generators.” Include NEMA listing and labeling.
Less than 1/2 HP (373 W): Built-in thermal-overload protection.
1/2 to 3 HP (373 to 2238 W): Permanently lubricated ball bearings.
- B. 5 HP (3.73 kW) and Larger: Grease-lubricated ball bearings.
- C. Motor shall be non-overloading within full range of pump performance.

PART 3—EXECUTION

3.01 INSTALLATION

- A. Install pumps with access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.
- B. Support pumps and piping so weight of piping is not supported by pump volute.
- C. Install electrical connections for power, controls, and devices.
- D. Suspend in-line pumps independent from piping. Use continuous-thread hanger rods and vibration isolation hangers. Fabricate brackets or supports as required for pumps.
- E. Install vertical in-line pumps on concrete bases.
- F. Connect piping with valves that are at least the same size as piping connecting to pumps.
- G. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- H. Install shutoff valve and strainer on suction side of pumps.
- I. Install nonslam check valve and throttling valve on discharge side of pumps.

END OF SECTION 23 21 23

SECTION 232300 REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Comply with ASME B31.5, "Refrigerant Piping," and with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

PART 2 - PRODUCTS

2.01 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.

2.02 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)] <Insert temperature> suction temperature; [700-psig (4820-kPa)] [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.

2.03 REFRIGERANT PIPING SPECIALTIES

- A. Strainers: Welded steel with corrosion-resistant coating and 100-mesh stainless-steel screen with socket ends; 500-psig (3450-kPa) working pressure and 275 deg F (135 deg C) working temperature.
- B. Moisture/Liquid Indicators: 500-psig (3450-kPa) operating pressure, 240 deg F (116 deg C) operating temperature; with replaceable, polished, optical viewing window and color-coded moisture indicator.
- C. Filter Dryers: 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature; with [replaceable core kit,]gaskets, and [filter] [filter-dryer] [wax removal] cartridge.
- D. Mufflers: Welded steel with corrosion-resistant coating and socket ends; 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature.
- E. Refrigerant: ASHRAE 34, [R-22] [R-407C] [R-410A].

PART 3 - EXECUTION

3.01 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.

3.02 PIPING SCHEDULE FOR REFRIGERANT R-22

- A. Suction Lines: Copper, [Type ACR] [Type K (A)] [Type L (B)], annealed- or drawn-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.
- B. Hot-Gas and Liquid Lines: Copper, [Type ACR] [Type K (A)] [Type L (B)], annealed- or drawn-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.

3.03 PIPING APPLICATIONS FOR REFRIGERANT R-407C.

- A. Suction Lines: Copper, [Type ACR] [Type K (A)] [Type L (B)], annealed- or drawn-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.
- B. Hot-Gas and Liquid Lines: Copper, [Type ACR] [Type K (A)] [Type L (B)], annealed- or drawn-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.

3.04 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: Copper, [Type ACR] [Type K (A)] [Type L (B)], annealed- or drawn-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.
- B. Hot-Gas and Liquid Lines: Copper, [Type ACR] [Type K (A)] [Type L (B)], annealed- or drawn-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.

END OF SECTION 232300

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1—GENERAL**1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data for fire and smoke dampers and Shop Drawings detailing duct layout and including locations and types of duct accessories, duct sizes, transitions, radius and vaned elbows, special supports details, and inlets and outlet types and locations.
- B. Comply with NFPA 90A, «Installation of Air Conditioning and Ventilating Systems,» and with NFPA 90B, «Installation of Warm Air Heating and Air Conditioning Systems.»
- C. Comply with NFPA 96 for ducts connected to commercial kitchen hoods.
- D. Comply with UL 181 for ducts and closures.

PART 2—PRODUCTS**2.01 DUCTS**

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip galvanized coating.
- B. Fibrous-Glass Duct Board: Comply with UL 181, Class 1, 1-inch- (25-mm-) thick, fibrous glass with fire-resistant, reinforced foil-scrim-kraft barrier, and having the air-side surface treated to prevent erosion.
- C. Joint and Seam Tape, and Sealant: Comply with UL 181A.
- D. Rectangular Metal Duct Fabrication: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Fibrous-Glass Duct Fabrication: Comply with SMACNA's "Fibrous Glass Duct Construction Standard."
- F. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
 - 1. Thickness: 1/2 inch (13 mm).
 - 2. Airstream surface coated with an antimicrobial erosion-resistant coating.
 - 3. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - 4. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment.

2.02 ACCESSORIES

- A. Volume Dampers and Control Dampers: Single-blade and multiple opposed-blade dampers, standard leakage rating, and suitable for horizontal or vertical applications; factory fabricated and complete with required hardware and accessories.
- B. Fire Dampers: Rated and labeled according to UL 555 by an NRTL; factory fabricated and complete with required hardware and accessories.
- C. Ceiling Fire Dampers: Labeled according to UL 555C by an NRTL and complying with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory." Provide factory-fabricated units complete with required hardware and accessories.

- D. Smoke Dampers: Labeled according to UL 555S by an NRTL. Combination fire and smoke dampers shall also be rated and labeled according to UL 555. Provide factory-fabricated units complete with required hardware and accessories.
- E. Flexible Connectors: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- F. Flexible Ducts: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-inch- (25-mm-) thick complying with UL 181, Class 1.

PART 3–EXECUTION

3.01 INSTALLATION

- A. Install ducts according to SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible” unless otherwise indicated.
- B. Seal ducts to the following seal classes according to SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible”:
 - 1. Outdoor, Supply-Air Ducts: Seal Class A.
 - 2. Outdoor, Exhaust Ducts: Seal Class C.
 - 3. Outdoor, Return-Air Ducts: Seal Class C.
 - 4. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
 - 6. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 7. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 8. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
 - 10. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 11. Conditioned Space, Return-Air Ducts: Seal Class C.
- C. Conceal ducts from view in finished and occupied spaces.
- D. Avoid passing through electrical equipment spaces and enclosures.
- E. Support ducts to comply with SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible,” Ch. 4, “Hangers and Supports.”
- F. Install duct accessories according to applicable details in SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible” for metal ducts and in NAIMA AH116, “Fibrous Glass Duct Construction Standards,” for fibrous-glass ducts.
- G. Install volume and control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.
- H. Install fire dampers according to UL listing.
- I. Install fusible links in fire dampers.



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- J. Clean new duct system(s) before testing, adjusting, and balancing.

3.02 TESTING, ADJUSTING, AND BALANCING

- A. Balance airflow within distribution systems, including submains, branches, and terminals to indicated quantities.

END OF SECTION 233100

**SECTION 23 56 00
 SOLAR ENERGY HEATING EQUIPMENT**

SOLAR COLLECTORS

The GOBI line of solar flat-plate collectors is one of the industry's highest-rated. Over 30 years of design and engineering refinement have gone into making it a world-class performer for heat output, efficiency, and durability. The collector is available in three sizes, with two surface types to choose from (blue sputtered and black paint), making it suitable for all types of solar heating applications.

Features

- Low-profile tapered design for a subtle rooftop presence
- Optimal heat absorption and overall efficiency
- Certified to withstand 50 lbs. per square foot
- Anodized aluminum frame improves durability & rigidity
- No-solder connections with factory installed DYN-O-SEAL unions
- Rated by SRCC and IAPMO as one of the industry's best-performing collectors


ABSORBER SURFACES



Blue sputtered coating (Variant 001)

- Optimal heat absorption with minimal emission
- Suitable for all installations & regions
- Recommended for cool climates

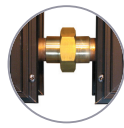
Black paint coating (Variant 002)




- An economical choice
- Adequate heat absorption in ideal climate regions
- Best for warm climates with ample solar radiation



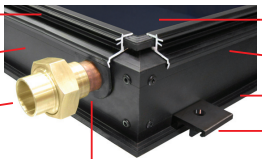



DOS unions are included to connect collectors



OG100 CERTIFIED



Trim groove accepts flashing to keep snow/debris clear of the GOBI

Low profile, tapered frame not only looks good but also makes the collector extremely rigid and rust proof

Factory fitted 1" Dyn-O-Seal inter-connections eliminate the need for soldering when connecting collectors

Pipes sized for minimal pressure drop and optimal flow

Double-strength tempered low iron solar glass with anti-glare finish resists potential damage from harsh weather conditions

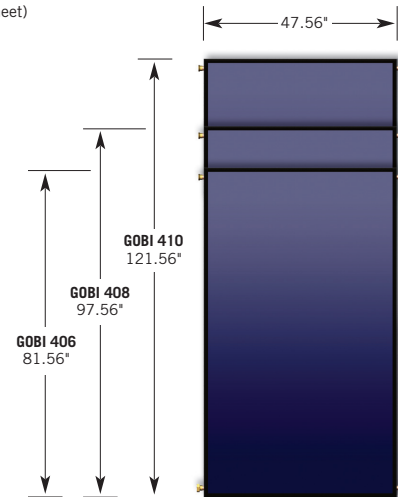
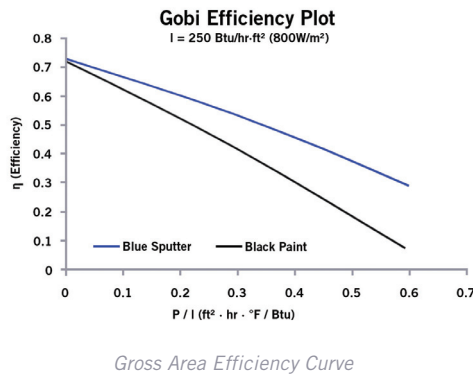
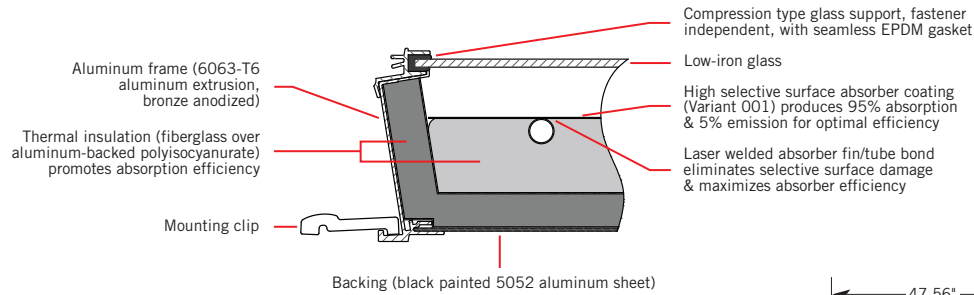
Weep slots minimize condensation

Built-in mounting flange for mounting without collector penetration

Mounting clips reduce penetration points into the roof

 EXCELLENCE
 BY DESIGN™

TECHNICAL SPECIFICATIONS



Note: GOBIs all have a depth of 3.9"

REFERENCE AREA	BLACK PAINT GROSS	BLACK PAINT NET	BLUE SPUTTER GROSS	BLUE SPUTTER NET
$C_0 (-)$	0.7190	0.7783	0.7300	0.7902
$C_1 \text{ (BTU / HR FT}^2 \text{ }^\circ\text{F)}$	0.9358	1.0130	0.6006	0.6501
$C_2 \text{ (BTU / HR FT}^2 \text{ }^\circ\text{F)}$	0.0010	0.0011	0.0010	0.0011

PRODUCT CODE	GOBI 406	GOBI 408	GOBI 410
Dimensions, Weights, Capacities			
Gross Area	26.94 ft ²	32.22 ft ²	40.15 ft ²
Net Area	24.90	29.93	37.47
Dry Weight	102 lbs	126 lbs	153 lbs
Fluid Capacity	1 gal	1.14 gal	1.34 gal
Ratings & Certifications			
Maximum Operating Pressure	150 psi (10.34 Bar)	150 psi (10.34 Bar)	150 psi (10.34 Bar)
Wind Load Certification	50 psf (2.39 kPa)	50 psf (2.39 kPa)	50 psf (2.39 kPa)

PTLS 000 006 042308

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 Information & Support: info@heliodyne.com

END OF SECTION 23 56 00

SECTION 23 62 00
PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL**1.1 SECTION REQUIREMENTS**

- A. Submittals: Product Data.
- B. Verify performance according to [ARI 210/240] [ARI 340/360].
- C. Comply with ASHRAE 15.
- D. Comply with UL 303.
- E. Warranties: Submit a written warranty, signed by the manufacturer, agreeing to repair or replace components that fail within five years after Substantial Completion.

PART 2 - PRODUCTS**2.1 AIR-COOLED CONDENSING UNITS 5 TONS (17.6 kW) AND SMALLER**

- A. Description: Factory assembled and tested, air cooled; consisting of compressors, condenser coils, fans, motors, refrigerant reservoirs, and operating controls.
 - 1. [Available]Products:
 - a. <Insert manufacturer's name; model number, special features, and accessories.>
 - 2. Compressor: Hermetically sealed and isolated for vibration. Include thermal-, current-, and temperature-sensitive overload devices, start capacitor, relay, and contactor.
 - 3. Condenser Coil: Copper-tube, aluminum-fin coil, with liquid subcooler.
 - 4. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated motor with thermal-overload protection.
 - 5. EER or COP: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
 - 6. Accessories: Include the following:
 - a. Valves for service and charging.
 - b. High- and low-pressure safety switches.
 - c. Low-ambient kit to permit operation down to [45 deg F (7 deg C)] <Insert temperature>.
 - d. Crankcase heater.
 - e. Automatic reset timer to prevent compressor rapid cycle.
 - f. Reversing valve.
 - g. Defrost control sequence.

2.2 AIR-COOLED CONDENSING UNITS 6 TONS (21 kW) AND LARGER

- A. Description: Factory assembled and tested, air cooled; consisting of compressors, condenser coils, fans, motors, refrigerant reservoirs, and operating controls.
1. [Available]Products:
 - a. <Insert manufacturer's name; model number, special features, and accessories.>
 2. Compressors: Hermetic or semihermetic and isolated for vibration with [cylinder unloading] [hot gas bypass]. Include thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 3. Condenser: Copper-tube, aluminum-fin coil, with separate circuits for each compressor, plus liquid accumulator and subcooling, and backseating liquid-line service access valves. Factory test to 460 psig (3105 kPa).
 4. Condenser Fans: Direct or belt-drive propeller fans with separate motor for each fan.
 5. Low Ambient Controls: Factory-installed dampers, fan-speed control, or fan cycling.
 6. Operating and safety controls.
 7. Galvanized steel casing with removable panels, gasketed control panel door, and unfused disconnect switch.

2.3 CAPACITIES AND CHARACTERISTICS

- A. Cooling:
1. Capacity: <Insert Btu/h (kW)>.
 2. Ambient-Air Temperature: <Insert deg F (deg C)>.
 3. Power Input: <Insert kW>.
 4. EER: <Insert ratio>.
- B. Heating:
1. Capacity: <Insert Btu/h (kW)>.
 2. Ambient-Air Temperature: <Insert deg F (deg C)>.
 3. Power Input: <Insert kW>.
 4. COP: <Insert ratio>.
- C. Single-Point Electrical Connection:
1. Volts: [120] [240] [277] [480] <Insert number>.
 2. Phase: [Single] [Three].
 3. Hertz: 60.
 4. Full-Load Amperes: <Insert number.>
 5. Minimum Circuit Ampacity: <Insert number.>
 6. Maximum Overcurrent Protection: <Insert number.>



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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb. Maintain recommended clearances.
- B. Install ground-mounted units on 4-inch- (100-mm-) thick reinforced-concrete base. Anchor unit to base using inserts or anchor bolts.
- C. Install roof-mounted units on mechanical equipment curb. Anchor unit to structural frame with removable fasteners.
- D. Install electrical devices according to NFPA 70.

END OF SECTION 236200

SECTION 23 64 23 SCROLL WATER CHILLERS

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data.

1. ARI Certification: Certify chiller according to ARI 590 certification program.
2. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, “Water Chilling Packages Using the Vapor Compression Cycle.”
3. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
4. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
5. Warranties: Submit written warranty agreeing to repair or replace refrigeration components that fail within five years after Substantial Completion.

PART 2—PRODUCTS

2.01 MANUFACTURERS

- ##### A. Basis-of-Design Product: Multi Aqua- MAC036-01-N-407 with CDAX-5030-H or comparable product by one of the following:
1. Carrier; a United Technologies Company.
 2. Dunham-Bush.
 3. McQuay International.
 4. Trane Company (The).
 5. YORK International Corporation.

2.02 PACKAGED WATER CHILLERS

- ##### A. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
1. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure.
 2. Cabinet:
 - a. Base, Frame, and Casing: Galvanized steel with factory-painted finish.
 - b. Acoustical compressor enclosure.
- ##### B. Compressors:
1. Description: Positive-displacement direct drive with hermetically sealed casing.
 2. Capacity Control: On-off compressor cycling.
- ##### C. Compressor Motors: High-torque, four-pole induction type with inherent thermal-overload protection on each phase.
- ##### D. Compressor Motor Controllers: NEMA ICS 2, Class A, full voltage, nonreversing.
- ##### E. Refrigeration:

1. Refrigerant R-407C. Classified as Safety Group A1 according to ASHRAE 34.
 2. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
- F. Evaporator: Direct-expansion shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
1. Steel shell and copper tube assembly, ASME labeled.
 2. Electric trace with thermostat on independent 120-V circuit.
- G. Air-Cooled Condenser:
1. Plate-fin coil with integral subcooling circuit, leak tested at 150 psig (1034 kPa).
 2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
 3. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
- H. Controls: Manufacturer's standard microprocessor-based chiller controls; mounted, and factory wired with a single-point power connection and separate control circuit.
1. Start chiller with water flow and rise in entering temperature over 55 deg F (13 deg C).
 2. Stage cylinder unloaders and compressors based on entering-water temperature.
 3. Automatic pump down sequence at compressor stop when entering-water temperature falls below 50 deg F (10 deg C).
- I. Vibration Control: Rubber mounts with a minimum deflection of 1/4 inch (6 mm).
- J. Insulation: 3/4 inch (19 mm) closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials, factory-applied over cold surfaces of water chiller components.
- K. Water Chiller Characteristics and Capacities:
1. Capacity: 3 tons (10.5kW).
 2. Full-Load Efficiency:
 - a. COP: 2.8
 - b. EER: 9.33.

2.03 DESUPERHEATER

- A. Pressure Drop: 0.5 psi
1. Water Size: 0.5" OD
 2. Water Flow: 1.0 gpm
 3. Heat Recovery: 10,500 BTUH

PART 3-EXECUTION

3.01 INSTALLATION

- A. Install chillers level and plumb, and anchor to base. Maintain recommended clearances.
- B. Install flexible pipe connections for chillers mounted on vibration isolators.
- C. Install shutoff valves at chiller inlet and outlet connections.
- D. Install electrical devices, including remote flow switches and remote chiller control panel. Comply with NFPA 70.

FIGURES:



11/16/2010

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Product Details

Model Number: CDAX-5030-H

Desuperheater Coils

Compact helical design with counterflow fluids for optimum heat transfer
 Four models design to recover heat from 2 through 15 ton air conditioning, refrigeration or heat pump systems

Double-wall inner tube provides isolation of refrigerant from water

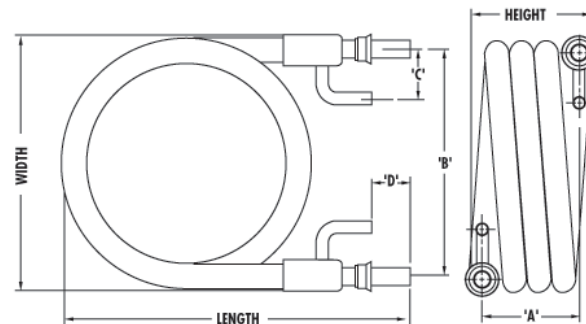
Both U.L. and C.S.A. approved for potable water use

Notes:

1. All dimensions are in inches.
2. Due to a continuous program of product improvement, specification and dimensions are subject to change without notice.



Downloads
[Performance Data & Selection Procedure](#)



Specifications

Product #	CDAX-5030-H
Application Range (tons)	2-4
Height	3-1/2
Width	9-9/16
Length	14-1/16
Refrigerant Connection In/Out	1/2 (I.D.)
Water Connection In/Out	1/2 (O.D.)
A	2-1/4
B	8-3/16
C	1-7/8
D	1-1/2



DESUPERHEATER COILS SELECTION PROCEDURE

1. Choose CDAX model based on system capacity.
2. Enter thermal performance chart for system capacity of CDAX model selected in Step 1 with water flow rate (gpm) and entering water temperature, EWT, and read Heat Recovered in MBtu/hr for either water-cooled or air-cooled operation. Also read refrigerant side pressure drop, ΔPR, from top of same chart.
3. Enter water-side pressure drop data chart of CDAX model selected at water flow rate and read water-side pressure drop.
4. To calculate leaving water temperature, LWT:
 $LWT = EWT + (2 \times \text{Heat Recovered} / \text{Water Flow Rate})$.

Sample:

Select CDAX model for 2 ton water-cooled air conditioning system. Water is available at a flow rate of 0.8 gpm and entering temperature of 90°F.

1. Select CDAX-5030-H for 2 ton system.
2. Entering thermal performance chart for 2 ton water-cooled system using CDAX-5030-H with water flow rate = 0.8 gpm and EWT = 90°F: Heat recovered = 4.75 MBtu/hr. From top of chart, refrigerant-side pressure drop, ΔPR, = 1.4 PSI.
3. Entering water-side pressure drop data chart of CDAX-5030-H with water flow rate = 0.8

gpm: water-side pressure drop = 0.4 PSI by interpolation.

4. Leaving water temperature is calculated to be:
 $LWT = 90 + (2 \times 4.75 / 0.8) = 101.9^\circ\text{F}$.

Notes:

1. Thermal performance charts are based on using refrigerant R-22 at the following conditions:


	Water-Cooled	Air-Cooled
refrigerant flow rate	164 (lb/hr)/ton	180 (lb/hr)/ton
compressor discharge temp.	190°F	220°F
saturated condensing temp.	105°F	125°F

For other refrigerants or design conditions substantially different from above, please consult factory for selection and thermal performance.

2. The shaded area in the thermal performance charts indicates that refrigerant condensing occurs in the desuperheater coil. Any selection or operation that will result in refrigerant condensing in the desuperheater coil requires that system oil circulation be maintained, and system refrigerant charge requirements met, at the various operating conditions. These requirements are the responsibility of the system designer and installer.



Job Name : _____	Location : _____
Purchaser : _____	P.O. No. : _____
Engineer : _____	Architect : _____
Submitted To : _____	Date : _____
Submitted By : _____	For : <input type="checkbox"/> Reference <input type="checkbox"/> Approval <input type="checkbox"/> Construction
Unit Designation : Schedule No.: _____	Model No.: _____


Submittal Data : LMU246HV	Flex Multi-Split Inverter Heat Pump Outdoor Unit
----------------------------------	---






Standard Features :

- Limited Five Year Compressor Warranty
- Limited Two Year Functional Parts Warranty
- Defrost/Deicing
- Restart delay (3-minutes)
- Self diagnosis
- Soft start
- Auto Operation (Artificial intelligence)
- Auto restart operation
- Built-in Low Ambient Standard down to 14°F (cooling mode)
- Gold Fin™ Anti-Corrosion Treatment for Condenser



1

Specification :

Capacity (BTUs)	24,000 Class
Power Supply (V, Hz, Ph)	208-230/60/1
Maximum Overcurrent Protection (A)	28.7
Minimum Circuit Ampacity (A)	16.4
Power Input (Rated)	
Cooling (kW)	1.56
Heating (kW)	3.22
Running Current (Rated)	
Cooling (A)	15.2
Heating (A)	16.2
Compressor (A)	12.3
Fan Motor (A)	0.55
Communication Cable (No. x AWG)	4 x 18
(Outdoor to Indoor Unit)	
Dimension (WxHxD, inches)	34 1/4 x 31 13/16 x 12 9/16
Net Weight (lbs)	143.3
Max. # of Connectable Indoor Units	3
Refrigerant	
Charge (at 24.6ft, oz)	89.95
Type	R 410a
Control	EEV
Sound Level (±3dB(A))	52

Piping Connections	
Liquid (inches)	1/4 x 3EA
Gas (inches)	3/8 x 3EA
Piping length spec.	
Max. total piping (ft.)	246.1
Max. OD-ID piping (ft.)	82.0
Piping length (no add'l refrigerant, ft.)	123.0
Max. Elevation Difference	
Outdoor Unit ~ Indoor Unit (ft.)	49.2
Indoor Unit ~ Indoor Unit (ft.)	24.6
Operating Range (Outdoor)	
Cooling (°F)	14~115
Heating (°F)	5~75

1. Capacities are based on the following conditions :
 Cooling : - Indoor Temperature 80°F DB / 67°F WB
 - Outdoor Temperature 95°F DB / 75°F WB
 Heating : - Indoor Temperature 70°F DB / 60°F WB
 - Outdoor Temperature 47°F DB / 43°F WB
 Piping Length : - Interconnecting Piping Length 24.6ft.
 - Level Difference of Zero

2. Wiring cable size must comply with the applicable local and national code.
 3. The specification may be subject to change without prior notice for purpose of improvement.
 4. For more capacity(*) information, refer to the combination tables.
 5. The data mentioned in the above table are only for non-ducted type of indoor unit.

Combination Performance Table :

System	Combined With	Normal	EER	SEER	Normal	COP	Low	COP	HSPF	Energy Star / Tax Benefit
		Cooling			Heating		Heating			
		Capacity			Capacity		Capacity			
		Btu/h	95°F		Btu/h	47°F	Btu/h	17°F		
LMU246HV	Non-Ducted Indoor Unit	19,500	12.50	16.0	27,000	3.10	20,100	2.5	10.30	Yes
	Ducted Indoor Unit	20,500	11.30	15.5	27,500	3.20	21,100	2.6	9.80	
	Mixed Ducted & Non-Ducted	20,000	11.90	17.1	27,250	3.20	20,600	2.6	10.05	

Note :

1. Expires 12/31/2010

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 1000 Sylvan Avenue, Englewood Cliffs, NJ 07632 / www.lg.com www.lghvac.com

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 Specifications and information in this submittal data are subject to change without notice.

Submittal Data : LMU246HV

Flex Multi-Split Inverter
Heat Pump Outdoor Unit

Dimension :

870(34 1/4)
546(21 1/2) 180(8 5/16)
320(12 9/16) 340(13 3/8) 360(14 3/16)
10(3/22)

No.	Part Name	Remark
1	Air discharge grille	
2	Gas pipe connection	
3	Liquid pipe connection	
4	Power & transmission connection	
5	Earth screw	
6	Main service valve(Liquid)	
7	Main service valve(Gas)	

333(13 3/32) 250(9 5/20 1/32)
808(31 13/16) 782(30 13/16) 509(20 1/22) 393(15 17/16)
26(1 1/22) 50(1 31/32) 50(1 31/32) 198(7 13/16) 50(1 31/32)

320(12 9/16)
4 2 3 7 6 5

Unit:mm(inch)

Compatible Indoor Units :

Standard Wall Mounted Indoor Unit :
LMN095HVT, LMN125HVT, LMN185HVT

Ceiling Concealed Indoor Unit :
LMDN095HV, LMDN125HV, LMDN185HV

Art Cool Wall Mounted Indoor Unit :
LMAN095HVT, LMAN125HVT, LMAN185HVT

Ceiling Cassette Indoor Unit :
LMCN125HV, LMCN185HV

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 Specifications and information in this submittal data are subject to change without notice.

Submittal Data : LMU246HV

**Flex Multi-Split Inverter
Heat Pump Outdoor Unit**



Combination Table.:

■ Non ducted type indoor unit

Cooling

UNIT	Combination of Indoor Unit (kBtu/h Class)					Room Capacity				Total Capacity						Input(W)			Current(A)			EER	SEER
	UN1A	UN1B	UN1C	UN1D	Total	UN1A (Btu/h)	UN1B (Btu/h)	UN1C (Btu/h)	UN1D (Btu/h)	Min		Middle		Max		Min	Middle	Max	Min	Middle	Max		
										Btu/h	KW	Btu/h	KW	Btu/h	KW								
2 UNIT	9	9	-	-	18	9,000	9,000	-	-	10,800	3.2	18,000	5.3	19,800	5.8	900	1,500	2,434	4.2	7.0	11.3	11.4	15.0
	9	12	-	-	21	7,929	10,571	-	-	11,100	3.3	18,500	5.4	20,350	6.0	920	1,500	2,632	4.3	7.0	12.2	11.4	15.0
	12	12	-	-	24	9,500	9,500	-	-	11,400	3.4	19,000	5.6	25,000	7.4	936	1,560	2,830	4.3	7.2	13.1	11.4	15.0
	9	18	-	-	27	6,333	12,667	-	-	11,400	3.4	19,000	5.6	30,000	8.8	936	1,560	3,270	4.3	7.2	15.2	11.6	15.0
	12	18	-	-	30	7,600	11,400	-	-	11,400	3.4	19,000	5.6	30,000	8.8	936	1,560	3,270	4.3	7.2	15.2	11.6	15.0
3 UNIT	9	9	9	-	27	6,500	6,500	6,500	-	11,700	3.4	19,500	5.7	31,000	9.1	936	1,560	3,270	4.3	7.2	15.2	12.5	16.0
	9	9	12	-	30	5,850	5,850	7,800	-	11,700	3.4	19,500	5.7	31,000	9.1	936	1,560	3,270	4.3	7.2	15.2	12.5	16.0
	9	12	12	-	33	5,318	7,091	7,091	-	11,700	3.4	19,500	5.7	31,000	9.1	936	1,560	3,270	4.3	7.2	15.2	12.5	16.0

Heating

UNIT	Combination of Indoor Unit (kBtu/h Class)					Room Capacity				Total Capacity						Input(W)			Current(A)			COP	HSPF
	UN1A	UN1B	UN1C	UN1D	Total	UN1A (Btu/h)	UN1B (Btu/h)	UN1C (Btu/h)	UN1D (Btu/h)	Min		Middle		Max		Min	Middle	Max	Min	Middle	Max		
										Btu/h	KW	Btu/h	KW	Btu/h	KW								
2 UNIT	9	9	-	-	18	10,350	10,350	-	-	12,420	3.7	20,700	6.1	22,770	6.7	1,554	2,590	3,090	7.2	12.0	14.3	2.3	8.5
	9	12	-	-	21	9,118	12,157	-	-	12,765	3.8	21,275	6.3	26,560	7.8	1,608	2,680	3,100	7.5	12.4	14.4	2.3	8.5
	12	12	-	-	24	13,500	13,500	-	-	16,200	4.8	27,000	7.9	32,000	9.4	1,716	2,860	3,300	8.0	13.3	15.3	2.8	8.5
	9	18	-	-	27	9,000	18,000	-	-	16,200	4.8	27,000	7.9	33,000	9.7	1,716	2,860	3,300	8.0	13.3	15.3	2.8	8.7
	12	18	-	-	30	10,800	16,200	-	-	16,200	4.8	27,000	7.9	33,000	9.7	1,932	3,220	3,500	9.0	14.9	16.2	2.5	8.7
3 UNIT	9	9	9	-	27	9,000	9,000	9,000	-	16,200	4.8	27,000	7.9	33,000	9.7	1,932	3,220	3,500	9.0	14.9	16.2	2.5	10.3
	9	9	12	-	30	8,100	8,100	10,800	-	16,200	4.8	27,000	7.9	33,000	9.7	1,932	3,220	3,500	9.0	14.9	16.2	2.5	10.3
	9	12	12	-	33	7,364	9,818	9,818	-	16,200	4.8	27,000	7.9	33,000	9.7	1,932	3,220	3,500	9.0	14.9	16.2	2.5	10.3

Submittal Data : LMU246HV																		Flex Multi-Split Inverter Heat Pump Outdoor Unit					
Combination Table:																							
■ Ducted type indoor unit																							
Cooling																							
UNIT	Combination of Indoor Unit (kBtu/h Class)					Room Capacity				Total Capacity				Input(W)			Current(A)			EER	SEER		
	UNIT-A	UNIT-B	UNIT-C	UNIT-D	Total	UNIT-A (Btu/h)	UNIT-B (Btu/h)	UNIT-C (Btu/h)	UNIT-D (Btu/h)	Min Btu/h	Min kW	Middle Btu/h	Middle kW	Max Btu/h	Max kW	Min	Middle	Max	Min			Middle	Max
2 UNIT	9	9	-	-	18	9,000	9,000	-	-	10,800	3.2	18,000	5.3	19,800	5.8	950	1,580	2,560	4.4	7.3	11.9	10.8	14.0
	9	12	-	-	21	8,571	11,429	-	-	12,000	3.5	20,000	5.9	22,000	6.5	990	1,700	2,760	4.6	7.9	12.8	10.8	14.0
	12	12	-	-	24	10,250	10,250	-	-	12,300	3.6	20,500	6.0	28,800	8.5	1,030	1,770	2,970	4.8	8.2	13.8	10.8	14.0
	9	18	-	-	27	6,833	13,667	-	-	12,300	3.6	20,500	6.0	31,000	9.1	1,030	1,770	3,430	4.8	8.2	15.9	11.0	14.0
	12	18	-	-	30	8,200	12,300	-	-	12,300	3.6	20,500	6.0	31,000	9.1	1,030	1,770	3,430	4.8	8.2	15.9	11.0	14.0
3 UNIT	9	9	9	-	27	6,833	6,833	6,833	-	12,300	3.6	20,500	6.0	31,000	9.1	1,060	1,820	3,430	4.9	8.4	15.9	11.3	15.0
	9	9	12	-	30	6,150	6,150	8,200	-	12,300	3.6	20,500	6.0	31,000	9.1	1,060	1,820	3,430	4.9	8.4	15.9	11.3	15.0
	9	12	12	-	33	5,591	7,455	7,455	-	12,300	3.6	20,500	6.0	31,000	9.1	1,060	1,820	3,430	4.9	8.4	15.9	11.3	15.0

Heating																							
UNIT	Combination of Indoor Unit (kBtu/h Class)					Room Capacity				Total Capacity				Input(W)			Current(A)			COP	HSPF		
	UNIT-A	UNIT-B	UNIT-C	UNIT-D	Total	UNIT-A (Btu/h)	UNIT-B (Btu/h)	UNIT-C (Btu/h)	UNIT-D (Btu/h)	Min Btu/h	Min kW	Middle Btu/h	Middle kW	Max Btu/h	Max kW	Min	Middle	Max	Min			Middle	Max
2 UNIT	9	9	-	-	18	10,350	10,350	-	-	12,420	3.7	20,700	6.1	22,770	6.7	1,400	2,460	2,940	6.5	11.4	13.6	2.5	8.1
	9	12	-	-	21	9,857	13,143	-	-	13,800	4.1	23,000	6.8	26,560	7.8	1,480	2,550	2,950	6.9	11.8	13.7	2.6	8.1
	12	12	-	-	24	13,750	13,750	-	-	16,500	4.9	27,500	8.1	32,000	9.4	1,530	2,720	3,140	7.1	12.6	14.6	3.0	8.1
	9	18	-	-	27	9,167	18,333	-	-	16,500	4.9	27,500	8.1	33,000	9.7	1,630	2,720	3,140	7.6	12.6	14.6	3.0	8.3
	12	18	-	-	30	11,000	16,500	-	-	16,500	4.9	27,500	8.1	33,000	9.7	1,840	3,060	3,330	8.5	14.2	15.4	2.6	8.3
3 UNIT	9	9	9	-	27	9,167	9,167	9,167	-	16,500	4.9	27,500	8.1	33,000	9.7	1,840	3,060	3,330	8.5	14.2	15.4	2.6	9.8
	9	9	12	-	30	8,250	8,250	11,000	-	16,500	4.9	27,500	8.1	33,000	9.7	1,840	3,060	3,330	8.5	14.2	15.4	2.6	9.8
	9	12	12	-	33	7,500	10,000	10,000	-	16,500	4.9	27,500	8.1	33,000	9.7	1,840	3,060	3,330	8.5	14.2	15.4	2.6	9.8

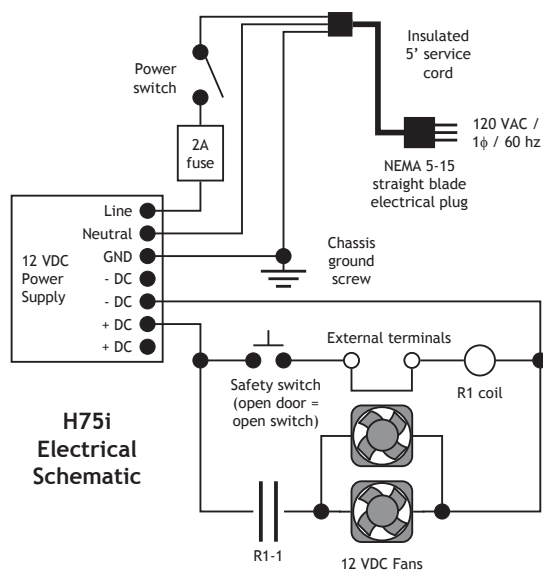
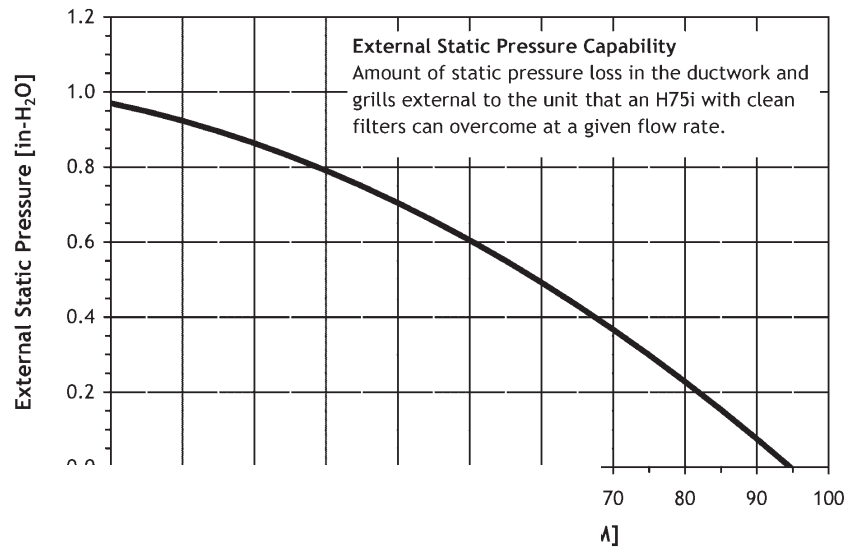
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END OF SECTION 236423

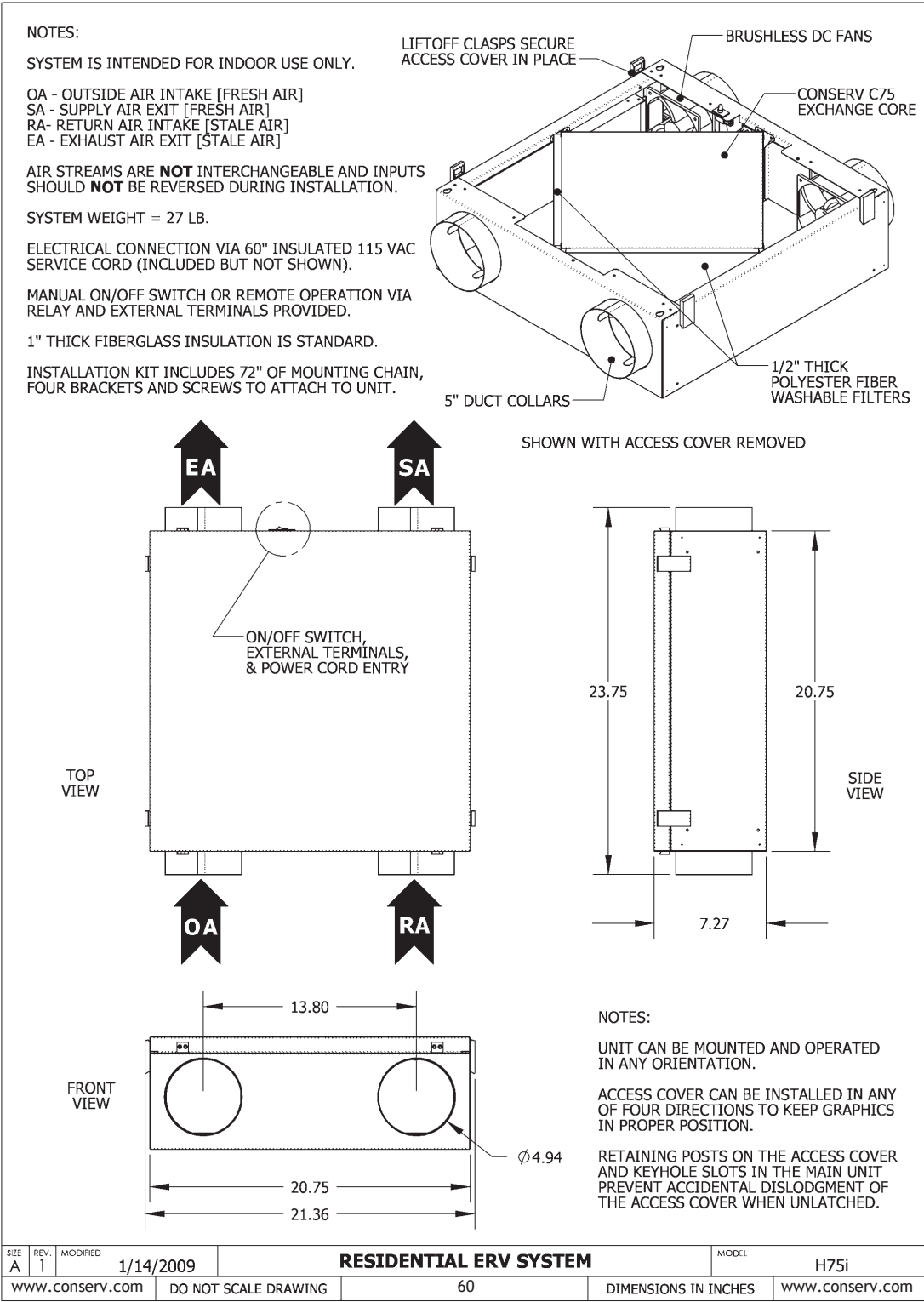
SECTION 23 72 00
AIR TO AIR ENERGY RECOVERY EQUIPMENT

ConsERV H75i Residential System



Specifications	
Weight	27 lb
Air Flow	75 SCFM nominal, 94 SCFM maximum
Voltage	120 VAC
Circuit	60 hz, single phase
Power	90 W
FLA	0.75 A
MCA	1.0 A
MOP	15 A
Cord	5' long, grounded plug
Certification	AHRI 1060 certified ETL listed
Filters	Washable polyester fiber
Insulation	1" fiberglass (4.2 R-value)
Control	Rocker switch and external terminals operate internal relay





ConsERV™ C75 Core

Fixed Plate Enthalpy Exchange Core

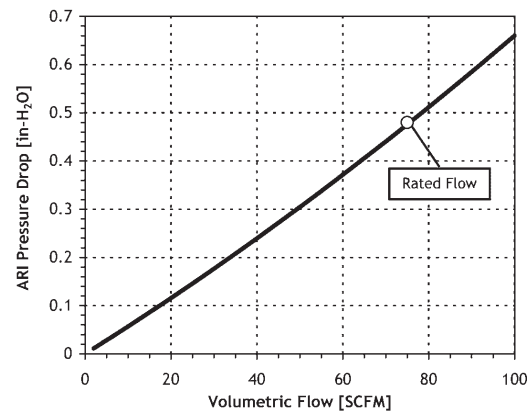
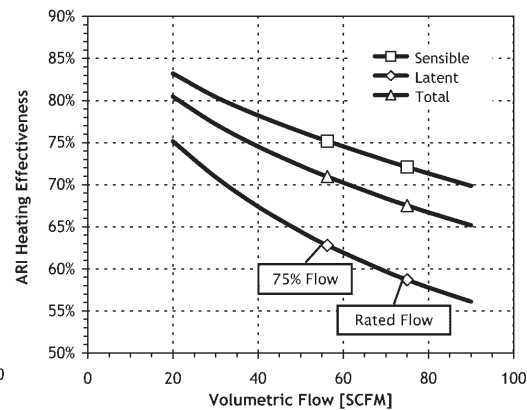
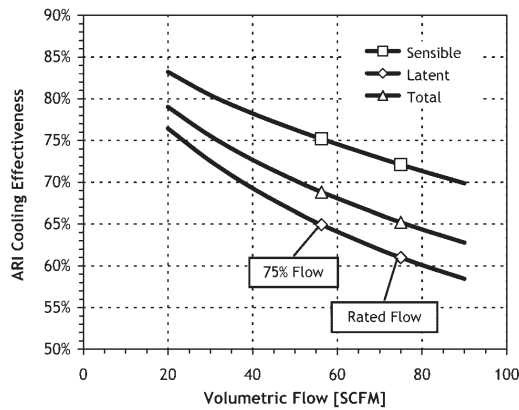
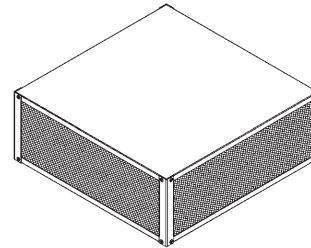
Dimensions: 13 1/16" x 13 1/16" x 5"

Weight: 8 lb

Performance: AHRI 1060 Certified

Safety: Submitted for UL 900 Recognition
 Complies with UL 94 HB and 5V

Warranty: Limited 10 year, refer to Warranty document for details and exclusions



SECTION 23 82 19
FAN COIL UNITS**PART 1–GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data, including color charts for cabinet finishes.
- 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**2.01 FACTORY-ASSEMBLED UNITS**

- A. Basis-of-Design Product: ENVIRO-TEC® HLP 25 ; HPP-06 or comparable products.
- B. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
- C. Coil Section Insulation: 1/2-inch (13-mm) thick, [coated glass fiber] [foil-covered, closed-cell foam] [matte-finish, closed-cell foam] complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - 1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
- D. Main and Auxiliary Drain Pans: Insulated galvanized steel with plastic liner formed to slope from all directions to the drain connection as required by ASHRAE 62.
 - 1. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.
 - 2. Cabinet: Steel with factory prime coating, ready for field painting.
 - 3. Vertical Unit Front Panels: Removable, steel, with [integral stamped] [polyethylene] [steel] discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
 - 4. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with [integral stamped] [cast-aluminum] discharge grilles.
 - 5. Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by Architect from manufacturer's **[standard]** **[custom]** colors. Return grille shall provide maintenance access to fan-coil unit.
 - 6. Steel recessing flanges for recessing fan-coil units into ceiling or wall.
- E. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
- F. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- G. Cabinet Finish: Factory primed, ready for field painting.
- H. Accessories:

-
1. Aluminum wall boxes with integral eliminators and insect screen.
 2. Steel subbase, height as indicated.
 3. Permanently lubricated, multispeed motor, resiliently mounted on motor board.
 4. Steel recessing flanges for recessing fan-coil units into ceiling or wall.
 5. Filters: 1-inch- (25-mm-) thick, throwaway filters in fiberboard frames.
 6. Dampers: Galvanized-steel blades with edge and end seals and nylon bearings; with [electronic] [pneumatic], [two-position] [modulating] actuators.
- I. Basic Unit Controls:
1. Control voltage transformer.
 2. Unit-mounted thermostat with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. Automatic changeover.
 - e. Adjustable deadband.
 - f. Exposed set point.
 - g. Exposed indication.
 - h. Degree F indication.
 3. Wall-mounting temperature sensor.
 4. Unoccupied-period-override push button.
- J. Capacities and Characteristics:
1. Fan:
 - a. Airflow: **340 ; 650 cfm.**
 - b. Motor Horsepower: 1/15 ; 1/3
 2. Water Coil:
 - a. Water Flow: 2.5 ; 3.7 gpm
 - b. Water-Side Pressure Loss: 3.1" ; 1.6" wc
 - c. Entering-Water Temperature: 44 degF
 3. Electrical Characteristics:
 - a. Volts: **230.**
 - b. Phase: **Single.**
 - c. Hertz: 60.

PART 3-EXECUTION

13.01 INSTALLATION

- K. Install units level and plumb and firmly anchored.
- L. Connect to supply and return piping with shutoff valve and union at each connection.
- M. Connect units to wiring systems and to ground.

Job Name : _____ Purchaser : _____ Engineer : _____ Submitted To : _____ Submitted By : _____ Unit Designation : Schedule No.: _____	Location : _____ P.O. No. : _____ Architect : _____ Date : _____ For : <input type="checkbox"/> Reference <input type="checkbox"/> Approval <input type="checkbox"/> Construction Model No.: _____																		
Submittal Data : LMDN125HV																			
Flex Multi-Split Ceiling Concealed Duct																			
<p>Standard Features :</p> <ul style="list-style-type: none"> • Limited Two Year Functional Parts Warranty • Limited Five Year Compressor Warranty • Inverter (Variable speed compressor) • Auto operation (Artificial intelligence) • Auto restart 	<p style="font-size: small;">Wired Wall Thermostat included in indoor unit package</p>																		
<p>Performance</p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <tr><td>Capacity* (BTU/h)</td><td style="text-align: right;">12,000 Class</td></tr> <tr><td>Fan Air Flow Rate (CMM)</td><td style="text-align: right;">9.5/8.5/7.5</td></tr> <tr><td>(CFM)</td><td style="text-align: right;">335/300/265</td></tr> <tr><td>Dehumidification Rate (pts/h)</td><td style="text-align: right;">2.5</td></tr> <tr><td>Sound Level H/M/L (+3dB(A))</td><td style="text-align: right;">33/31/26</td></tr> </table>	Capacity* (BTU/h)	12,000 Class	Fan Air Flow Rate (CMM)	9.5/8.5/7.5	(CFM)	335/300/265	Dehumidification Rate (pts/h)	2.5	Sound Level H/M/L (+3dB(A))	33/31/26	<p>Dimensions (WxHxD)</p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <tr><td>Body (inches)</td><td style="text-align: right;">32 9/32 x 7 1/2 x 22 21/32</td></tr> <tr><td>Decorative Panel (inches)</td><td style="text-align: right;">-</td></tr> <tr><td>Net Weight Body (lbs)</td><td style="text-align: right;">45.2</td></tr> <tr><td>Net Weight Decorative Panel (lbs)</td><td style="text-align: right;">-</td></tr> </table>	Body (inches)	32 9/32 x 7 1/2 x 22 21/32	Decorative Panel (inches)	-	Net Weight Body (lbs)	45.2	Net Weight Decorative Panel (lbs)	-
Capacity* (BTU/h)	12,000 Class																		
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<p>Electrical :</p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <tr><td>Running Current (A)</td><td style="text-align: right;">0.25</td></tr> <tr><td>Power Supply (V, Hz, Ph)</td><td style="text-align: right;">208-230, 60, 1</td></tr> </table>	Running Current (A)	0.25	Power Supply (V, Hz, Ph)	208-230, 60, 1	<p>1. Capacities are based on the following conditions : Cooling : - Indoor Temperature 80°F DB / 67°F WB - Outdoor Temperature 95°F DB / 75°F WB Heating : - Indoor Temperature 70°F DB / 60°F WB - Outdoor Temperature 47°F DB / 43°F WB Piping Length : - Interconnecting Piping Length 24.6ft. - Level Difference of Zero</p> <p>2. Wiring cable size must comply with the applicable local and national code. 3. The specification may be subject to change without prior notice for purpose of improvement. 4. For more capacity(*) information, refer to the combination tables.</p>														
Running Current (A)	0.25																		
Power Supply (V, Hz, Ph)	208-230, 60, 1																		
<p>Piping Connections</p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <tr><td>Liquid (inches)</td><td style="text-align: right;">1/4</td></tr> <tr><td>Gas (inches)</td><td style="text-align: right;">3/8</td></tr> <tr><td>Drain OD, ID (inches)</td><td style="text-align: right;">1 1/4, 1</td></tr> <tr><td>Temperature Sensor</td><td style="text-align: right;">Thermistor</td></tr> <tr><td>Refrigerant</td><td style="text-align: right;">R-410A</td></tr> <tr><td>Power/Transmission Interunit Cable (No.x AWG)</td><td style="text-align: right;">4 x 18</td></tr> <tr><td>Additional Refrigerant (oz./ft)</td><td style="text-align: right;">0.22</td></tr> <tr><td>Max. Length Each Pipe</td><td style="text-align: right;">82'</td></tr> <tr><td>Max. Elevation</td><td style="text-align: right;">49'</td></tr> </table>	Liquid (inches)	1/4	Gas (inches)	3/8	Drain OD, ID (inches)	1 1/4, 1	Temperature Sensor	Thermistor	Refrigerant	R-410A	Power/Transmission Interunit Cable (No.x AWG)	4 x 18	Additional Refrigerant (oz./ft)	0.22	Max. Length Each Pipe	82'	Max. Elevation	49'	<p>Accessory Option :</p> <ul style="list-style-type: none"> • PI485 for LGAP connection – PMNFP14A0 • Wired Wall Thermostat – PQRUSA1, PQRUCS0C
Liquid (inches)	1/4																		
Gas (inches)	3/8																		
Drain OD, ID (inches)	1 1/4, 1																		
Temperature Sensor	Thermistor																		
Refrigerant	R-410A																		
Power/Transmission Interunit Cable (No.x AWG)	4 x 18																		
Additional Refrigerant (oz./ft)	0.22																		
Max. Length Each Pipe	82'																		
Max. Elevation	49'																		
<p>Note :</p>	<p style="font-size: x-small;">PQRUSA1 PQRUCS0C</p>																		
<p>LG Electronics USA, Inc. HVAC Division 1000 Sylvan Avenue, Englewood Cliffs, NJ 07632 / www.lg.com www.lghvac.com</p> <p style="text-align: right;">© LG Electronics USA, Inc. 2010 DFS-SB-AD-009-US 010M02 Specifications and information in this submittal data are subject to change without notice.</p>																			

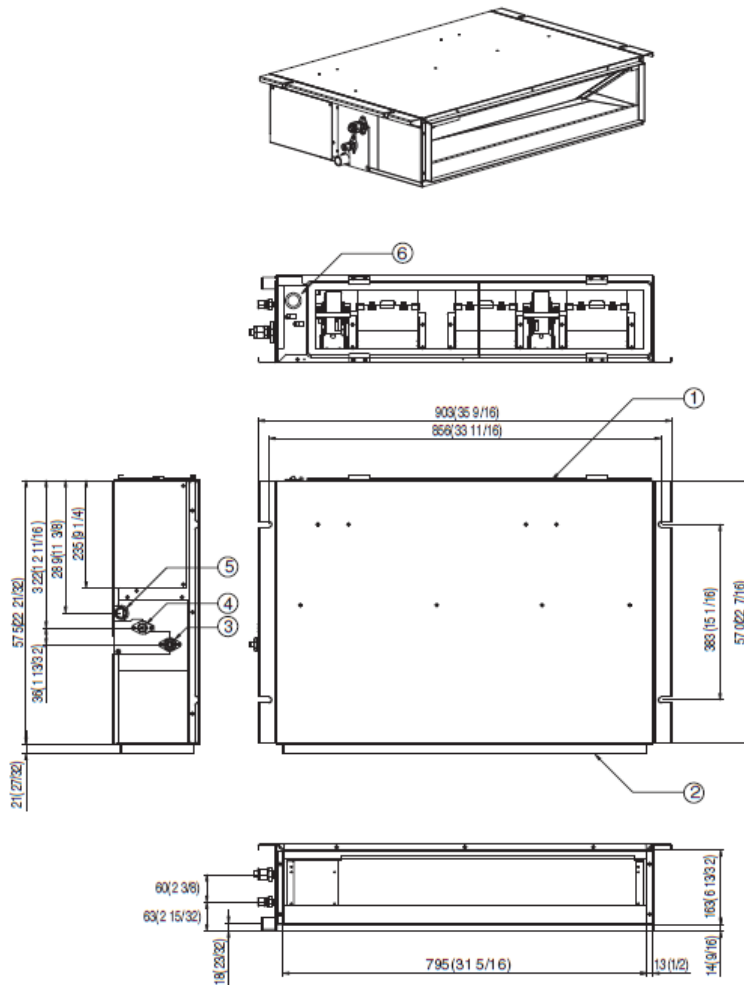
Submittal Data : LMDN125HV

Flex Multi-Split Ceiling Concealed Duct



Model : PRCUCS0C

Dimension



Unit : mm(inch)

- ① Air Suction Flange (Return)
- ② Air Discharge Flange (Supply)
- ③ Gas Pipe Connection
- ④ Liquid Pipe Connection
- ⑤ Drain Pipe Connection
- ⑥ Power Supply Connection

Job Name :	Location :
Purchaser :	P.O. No. :
Engineer :	Architect :
Submitted To :	Date :
Submitted By :	For : <input type="checkbox"/> Reference <input type="checkbox"/> Approval <input type="checkbox"/> Construction
Unit Designation : Schedule No.:	Model No.:

Submittal Data : LMDN185HV

Flex Multi-Split Ceiling Concealed Duct



Standard Features :

- Limited Two Year Functional Parts Warranty
- Limited Five Year Compressor Warranty
- Inverter (Variable speed compressor)
- Auto operation (Artificial intelligence)
- Auto restart



Wired Wall Thermostat included in indoor unit package

Performance

Capacity* (BTU/h)	18,000 Class
Fan Air Flow Rate (CMM)	15/13.5/11.5
(CFM)	530/477/406
Dehumidification Rate (pts/h)	4.2
Sound Level H/M/L (±3dB(A))	34/31/29

Dimensions (WxHxD)

Body (inches)	43 5/16 x 7 15/32 x 22 21/32
Decorative Panel (inches)	-
Net Weight Body (lbs)	58.4
Net Weight Decorative Panel (lbs)	-

Electrical :

Running Current (A)	0.25
Power Supply (V, Hz, Ph)	208~230, 60, 1

- Capacities are based on the following conditions :
 Cooling : - Indoor Temperature 80°F DB / 67°F WB
 - Outdoor Temperature 95°F DB / 75°F WB
 Heating : - Indoor Temperature 70°F DB / 60°F WB
 - Outdoor Temperature 47°F DB / 43°F WB
 Piping Length : - Interconnecting Piping Length 24.6ft.
 - Level Difference of Zero
- Wiring cable size must comply with the applicable local and national code.
- The specification may be subject to change without prior notice for purpose of improvement.
- For more capacity(*) information, refer to the combination tables.

Piping Connections

Liquid (inches)	1/4
Gas (inches)	1/2
Drain OD, ID (inches)	1 1/4 , 1
Temperature Sensor	Thermistor
Refrigerant	R-410A
Power/Transmission interunit Cable (No.x AWG)	4 x 18
Additional Refrigerant (oz./ft)	0.22
Max. Length Each Pipe	82'
Max. Elevation	49'

Accessory Option :

- PI485 for LGAP connection – PMNFP14A0
- Wired Wall Thermostat – PQRCSA1, PQRCS0C



PQRCSA1



PQRCS0C



Note :

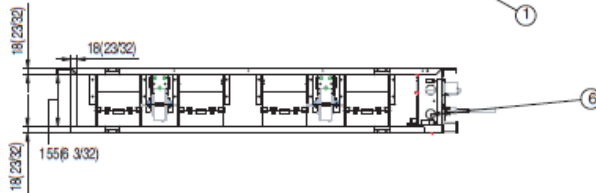
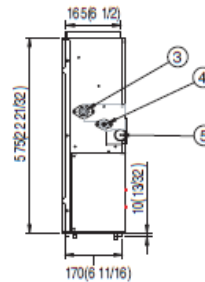
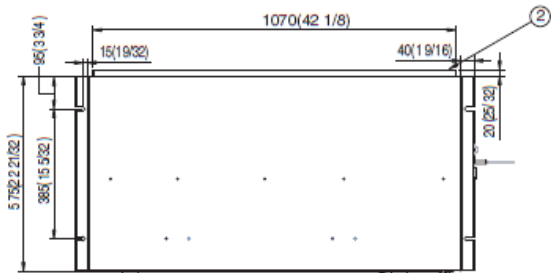
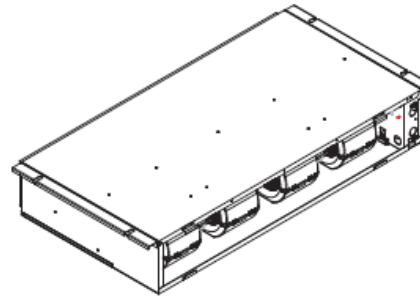
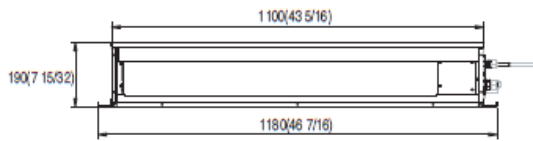
Submittal Data : LMDN185HV

Flex Multi-Split Ceiling Concealed Duct



Model : PQRCUCS0C

Dimensions :



Unit : mm(inch)

- ① Air Suction Flange (Return)
- ② Air Discharge Flange (Supply)
- ③ Gas Pipe Connection
- ④ Liquid Pipe Connection
- ⑤ Drain Pipe Connection
- ⑥ Power Supply Connection

END OF SECTION 23 82 19

**SECTION 23 84 00
HUMIDITY CONTROL EQUIPMENT**

Specifications for liquid desiccant system components. (Rule 8-4)

Casing Material: Clear Acrylic

Minor Parts: ½" NPT fittings, ¼" NPT fittings, Teflon tubing

Air rate: 0.079 m³/s (2.79 ft³/s) continuous for entire house

Flow rate of desiccant: 1 gpm per zone

Total Volume of Desiccant: 15-20 gal for entire house

Liquid Desiccant Storage Tank: <http://www.plastic-mart.com/class.php?item=3288>

Part Number: GRN25-23TT

25 Gallon Plastic Water Tank

23" dia. x 18" H

Liquid Desiccant Pump: http://www.northerntool.com/shop/tools/product_792_792

Wel-Bilt Submersible Pump — 21.13 GPM, 1/8 HP, 1in.

Flow (GPH) 1,268

Volts 110

Amps 2.5

HP 1/8

Max. Suction Lift (ft.) 22.96

Suction Type Bottom

Discharge Port (in.) 1 (1/2", 3/4", and 1" adapters included)

Impeller Shaft Clog-Preventing, Vortex-Style

Power Cord (ft.) 10

Dimensions L x W x H (in.) L x 6 x 10 1/2

Ship Weight 8.0 lbs

Item # 10898

Suggested methods to test liquid desiccant compliance with rules.

1. Check Electrical Conductivity of the solution.
2. Measure Salinity.

Composition of the liquid desiccant:

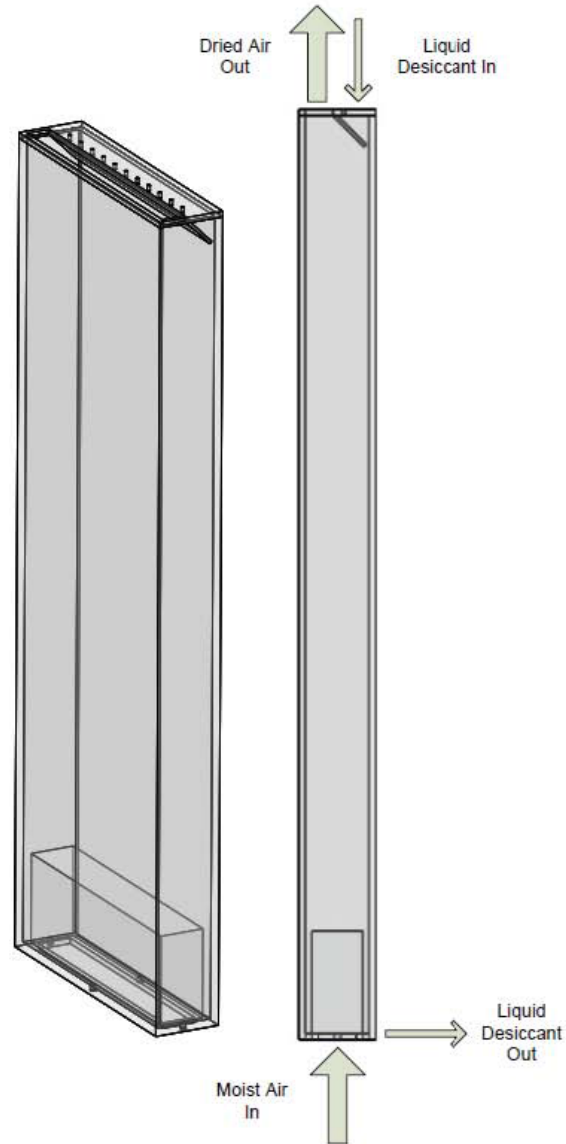
Combine a ratio of 3:1 of calcium chloride to water, by weight, mix well.

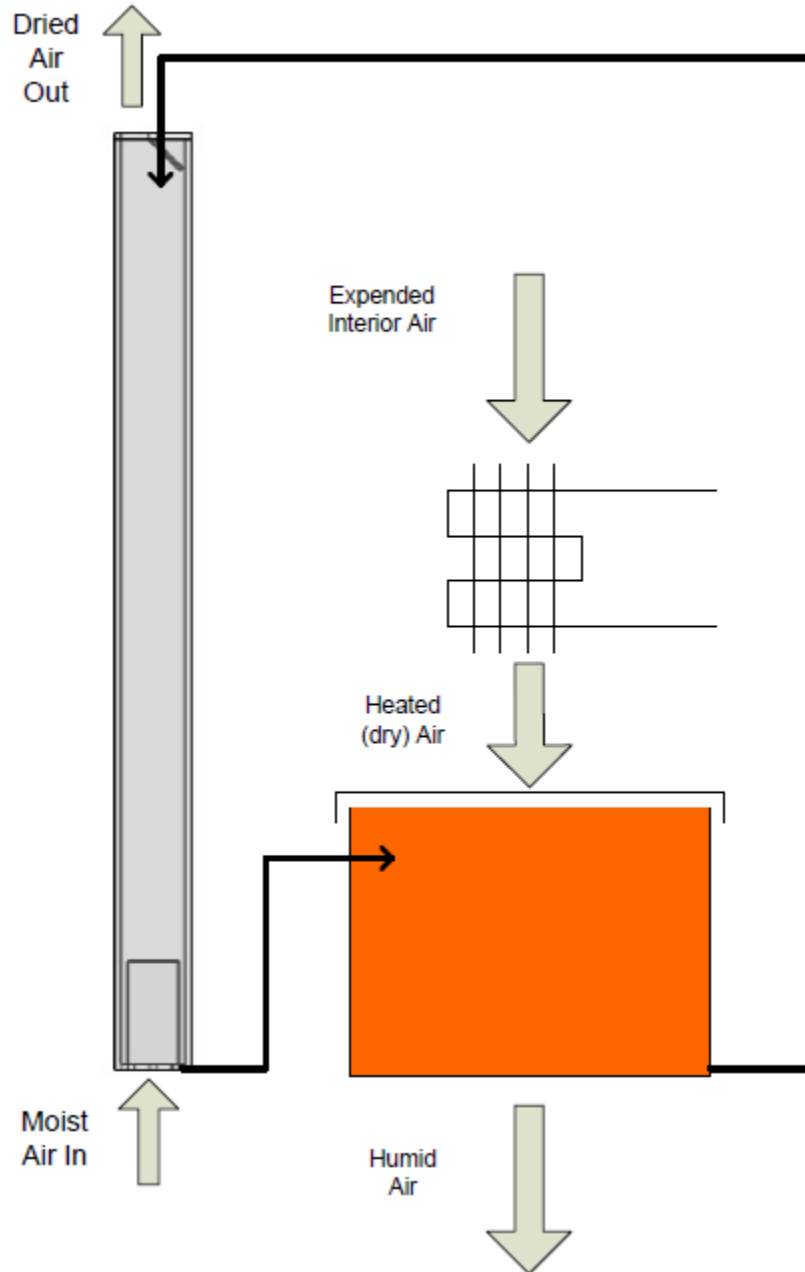
Liquid Desiccant Regeneration:

- Air flows across the desiccant to the desiccant absorbs water from the air.
- The desiccant flows into a storage tank.
- Warm/hot dry air flows into storage tank and absorbs water from desiccant.
- Repeat cycle.

Rule 8-4 Drawings describing the liquid desiccant system and how it works.

The air enters the waterfall system and comes in contact with the liquid desiccant. This draws moisture out of air, lowering the absolute humidity. The air then exits through the top of the casing which is then directed to be conditioned further. The liquid desiccant exits through the bottom of the casing to be regenerated inside the main desiccant storage tank.





END OF SECTION 23 84 00



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DIVISION 26 – ELECTRICAL

SECTION 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install hangers and supports[and seismic restraints] to withstand structural loads specified in “Project Conditions” Paragraph below.
- B. Submittals:
 - 1. Product Data: For sleeve seals.
 - 2. Shop Drawings: For [hangers and supports] [hangers, supports, and seismic restraints] including attachments to the structure, identify hardware and indicate analyses, forces, strengths, materials, and dimensions; signed and sealed by a qualified professional engineer. Professional engineer qualification requirements are specified in Division 01 Section “Quality Requirements.”
- C. Project Conditions:
 - 1. Site Class as Defined in the IBC: [A] [B] [C] [D] [E] [F].
 - 2. Ss, Mapped Maximum Considered Earthquake Spectral Response at Short Periods: <Insert mapped value for Project site from IBC Figures 1615(1) through 1615(15).>
 - 3. S1, Mapped Maximum Considered Earthquake Spectral Response at 1-Second Period: <Insert mapped value for Project site from IBC Figures 1615(1) through 1615(15).>
 - 4. Assigned Seismic Use Group or Building Category as Defined in the IBC: [I] [II] [III] [IV].
- D. Project Conditions:
 - 1. Project Seismic Zone as Defined in the UBC: Zone [1] [2A] [2B] [3] [4].
 - 2. Project Seismic Zone Factor as Defined in the UBC: Zone Factor [0.075] [0.15] [0.20] [0.30] [0.40].
 - 3. Occupancy Category as Defined in the UBC: [I] [II] [III] [IV].
- E. Project Conditions:
 - 1. Soil Profile Type: <Insert value.>
 - 2. Acceleration Factor as Defined in the NBC: <Insert value.>
 - 3. Project Seismic Hazard Exposure Group as Defined in the NBC: [I] [II] [III].
- F. Project Conditions:
 - 1. Soil Profile Type: <Insert value.>
 - 2. Acceleration Factor as Defined in the SBC: <Insert value.>
 - 3. Project Seismic Hazard Exposure Group as Defined in the SBC: [I] [II] [III].

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Raceways:

1. EMT: ANSI C80.3, zinc-coated steel, with set-screw 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, [Type EPC-40-PVC,]with NEMA TC3 fittings.
7. Raceway Fittings: Specifically designed for raceway type used in Project.

B. Wireways: Sheet metal sized and shaped, with [hinged] [screw] covers.

C. Surface Raceways:

1. Metal: Galvanized steel with snap-on covers. [Manufacturer's standard enamel finish in color selected by Architect] [Prime coating, ready for field painting].
2. Plastic: PVC, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

D. Floor Boxes: [Cast metal] [Sheet metal] [Cast or sheet metal], [fully adjustable] [semiadjustable], rectangular.

2.02 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 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 complying with UL 44].

D. Cable Type UF-B: Comply with UL 493 with Type THHN/THWN conductors complying with UL 83.

2.03 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] [Tinned-copper] [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.

20.4 ELECTRICAL IDENTIFICATION MATERIALS

- A. Raceway Identification Materials: [Snap-around, color-coding bands; flexible, preprinted, color-coded acrylic] [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.

2.05 SUPPORT AND ANCHORAGE COMPONENTS

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of [five] <Insert number> times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly, and provide finish suitable for the environment in which installed.
 1. Channel Dimensions: Selected for structural loading[and applicable seismic forces].
- C. Raceway and Cable Supports: As described in NECA 1.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and fittings.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded malleable-iron body and insulating wedging.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components:
 1. Powder-Actuated Fasteners: Threaded-steel stud.

2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless] 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.

2.06 SEISMIC-RESTRAINT COMPONENTS

- A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by [an evaluation service member of the ICC Evaluation Service Program] [the ICBO Evaluation Service] [California OSHPD] [an agency acceptable to authorities having jurisdiction].
 1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least [five] <Insert number> times the maximum seismic forces to which they will be subjected.
- B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.
- C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.
 1. Seismic Mountings, Anchors, and Attachments: Devices as specified in “Support and Anchorage Components” Article, selected to resist seismic forces.
 2. Hanger Rod Stiffener: [Steel tube or steel slotted-support-system sleeve with internally bolted connections] [Reinforcing steel angle clamped] to hanger rod, of design recognized by [an evaluation service member of the ICC Evaluation Program] [the ICBO Evaluation Service] [California OSHPD] [an agency acceptable to authorities having jurisdiction].
 3. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
 4. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.07 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated “wall pipe,” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized-steel sheet.
- D. Sleeve Seals: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Sealing Elements: [EPDM] [NBR] <Insert other> interlocking links shaped to fit surface of cable or conduit.

Include type and number required for material and size of raceway or cable.

2. Pressure Plates: [Plastic] [Carbon steel] [Stainless steel]. Include two for each sealing element.
3. Connecting Bolts and Nuts: [Carbon steel with corrosion-resistant coating] [Stainless steel] of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.08 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.01 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.

3.02 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 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.
- E. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch- (25-mm-) thick concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Install conduit larger than 1-inch (27-mm) trade size, parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- F. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- G. Install pull wires in empty raceways.
- H. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch (1830-mm) maximum length of flexible conduit.
- I. Install raceways and cables conceal within finished walls, ceilings, and floors unless otherwise indicated.
- J. 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.

3.03 WIRING METHODS

- A. Service Entrance: [Type THHN-THWN, single conductors in raceway] [Type XHHW, single conductors in raceway] [Type SE or USE multiconductor cable].
- B. Exposed Feeders, Branch Circuits, and Class 1 Control Circuits, Including in Crawlspace: [Type THHN-THWN, single conductors in raceway] [Nonmetallic-sheathed cable, Type NM or NMC].
- C. Feeders and Branch Circuits Concealed in Ceilings, Walls, Partitions, and Crawlspace: [Type THHN-THWN, single conductors in raceway] [Nonmetallic-sheathed cable, Type NM or NMC].
- D. Feeders and Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: [Type THHN-THWN, single conductors in raceway] [Underground feeder cable, Type UF].
- E. 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.
- F. Class 2 Control Circuits: [Type THHN-THWN, in raceway] [Power-limited cable, concealed in building finishes].

3.04 GROUNDING

- A. Underground Grounding Conductors: Install bare copper conductor, No. [2/0] <Insert size> AWG 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: [Welded] [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] <Insert value> ohms.
 - b. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: [5] <Insert value> ohms.
 - c. Power Distribution Units or Panelboards Serving Electronic Equipment: [1] [3] <Insert value> ohm(s).
 - d. <Insert application and maximum ground-resistance value> ohms.
 - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.05 IDENTIFICATION

- A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, [self-adhesive color coding tape-in bands] [snap-around, color-coding bands]:
1. Fire Alarm System: Red.
 2. Security System: Blue and yellow.
 3. Telecommunication System: Green and yellow.
 4. <Insert system name and identifying colors.>
- 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] [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 2 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. Motor starters.
 - h. Push-button stations.
 - i. Power transfer equipment.
 - j. Contactors.
 - k. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
 - l. <Insert equipment item>.
- 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] [branch-circuit] [service, feeder, and branch-circuit] conductors.
 - 1. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 2. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 3. 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.

3.06 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. Raceway Support Methods: In addition to methods described in NECA 1, [EMT] [IMC] [RMC] [EMT, IMC, and RMC] may be supported by openings through structure members, as permitted in NFPA 70.
- D. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.
- E. Strength of Support[and Seismic-Restraint] Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static[and seismic] loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg). 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: [Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts] [Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69] [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.
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.07 SEISMIC REQUIREMENTS

- A. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.
- B. Install bushing assemblies for anchor bolts for wall- and floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in substrate.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.
- D. Accommodation of Differential Seismic Motion: Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element than the one supporting them as they approach equipment.

3.08 SLEEVE AND SLEEVE SEALS INSTALLATION

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- B. Cut sleeves to length for mounting flush with both wall surfaces.
- C. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- D. 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].
- E. Seal space outside of sleeves with grout for penetrations of concrete and masonry[and with approved joint compound for gypsum board assemblies].
- F. 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."
- G. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- H. 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.
- I. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.



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3.09 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 26 09 23 LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Quality Assurance: Lighting control devices shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 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. Electromechanical-Dial Time Switches: Comply with UL 917.
 - 1. Contact Configuration: [SPST] [DPST] [SPDT] [DPDT] <Insert configuration>.
 - 2. Contact Rating: [30-A inductive or resistive, 240-V ac] [20-A ballast load, 120/240-V ac] <Insert rating>.
 - 3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 - 4. Astronomical time dial.
 - 5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
 - 6. Skip-a-day mode.
 - 7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of [16] <Insert number> hours.
- C. Outdoor Photoelectric Switches: Solid state, with [SPST] [DPST] dry contacts rated for [1800-VA tungsten or 1000-VA inductive] <Insert value>, to operate connected relay, contactor coils, and microprocessor input; complying with UL 773A.
 - 1. [Available]Products:
 - a. <Insert manufacturer's name; product designation.>
 - 2. 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.
 - 3. Time Delay: 15-second minimum.
 - 4. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
- D. Indoor, Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit complying with UL 773A, with separate relay unit[mounted on luminaire] rated for [20] <Insert amperage>-A ballast load at 120- and 277-V ac. Cadmium sulfide photoresistors are not acceptable.

1. [Available]Products:
 - a. <Insert manufacturer's name; product designation.>
2. 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.
3. Time Delay: Adjustable from 5 to 300 seconds.
4. Indicator: Two LEDs.

E. Indoor, Wall-Switch Occupancy Sensors:

1. [Available]Products:
 - a. <Insert manufacturer's name; product designation.>
2. Type: [Passive infrared] [Adaptive technology] [Dual technology (passive infrared and ultrasonic)].
3. Voltage: 120/277 V.
4. Time Delay: Adjustable up to [20] [30] minutes.
5. Field of View: [110] [150] [180] degrees.
6. Minimum Coverage Area: [900 sq. ft. (84 sq. m)] [1200 sq. ft. (111 sq. m)].

F. Outdoor, Weatherproof Motion Sensors:

1. [Available]Products:
 - a. <Insert manufacturer's name; product designation.>
2. Type: Passive infrared.
3. Voltage: 120/277 V.
4. Time Delay: Adjustable up to 15 minutes.
5. Field of View: 180 degree.
6. Detection Range: 110 feet (34 m).
7. Minimum Switch Rating: 1000-W incandescent, 500-VA fluorescent.

G. Lighting Contactors: Electrically operated and [mechanically] [electrically] held, combination type with [fusible switch] [nonfused disconnect], complying with NEMA ICS 2 and UL 508.

H. Emergency Shunt Relay: Normally closed, electrically held relay, arranged for wiring in parallel with manual [or automatic]switching contacts; coil rating of [120] [277] V; and complying with UL 924.

1. [Available]Products:
 - a. <Insert manufacturer's name; product designation.>

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. [18] [22]

[24] 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. [14] [16] [18] AWG, complying with Division 26 Section “Common Work Results for Electrical.”
- D. UTP 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

3.01 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 26 22 00 LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Enclosure: [Ventilated] [Totally enclosed, nonventilated], NEMA 250, Type 2.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- C. Enclosure: [Ventilated] [Totally enclosed, nonventilated], NEMA 250, [Type 3R] [Type 4X, stainless steel].
 - 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.

2.02 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
- B. Enclosure: Ventilated, NEMA 250, Type 2.

PART 3 - EXECUTION

31 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



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- 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 26 24 13 SWITCHBOARDS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals:
 - 1. Product Data: For switchboard, overcurrent protective devices, transient voltage suppression devices, ground-fault protectors, accessories, and components.
 - 2. Shop Drawings: For each switchboard and related equipment.
- B. Comply with NEMA PB 2, "Deadfront Distribution Switchboards."
- C. Comply with NFPA 70.

1.02 EXTRA MATERIALS

- A. Fuses for Fused Switches: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.
- B. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. Front-Connected, Front-Accessible Switchboard: [Panel-mounted] [Fixed, individually mounted] main device, panel-mounted branches, and rear-aligned sections.
- B. Nominal System Voltage: [480Y/277 V] [208Y/120 V] <Insert system voltage>.
- C. Main-Bus Continuous: [1600] [1200] <Insert ampere rating> A.
- D. Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- E. Enclosure: Steel, NEMA 250, Type [1] [3R].
- F. Enclosure Finish: Manufacturer's standard gray finish.
- G. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- H. Hinged Front Panels: Allow access to compartments.
- I. Buses and Connections: Three phase, four wire, unless otherwise indicated.
 - 1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.
 - 2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with copper- or tin-plated, aluminum circuit-breaker line connections.
 - 3. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) minimum-size, hard-drawn copper of 98 percent conductivity.

4. Contact Surfaces of Buses: Silver plated.
 5. Neutral Buses: [50] [100] percent of the ampacity of phase buses.
- J. Future Devices: Fully equip compartments.

2.02 TRANSIENT VOLTAGE SUPPRESSION DEVICES

- A. IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
- B. Minimum single-impulse current rating shall be as follows:
 1. Line to Neutral: [100,000] <Insert value> A.
 2. Line to Ground: [100,000] <Insert value> A.
 3. Neutral to Ground: [50,000] <Insert value> A.
- C. Protection modes shall be as follows:
 1. Line to neutral.
 2. Line to ground.
 3. Neutral to ground.
- D. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
- E. Maximum Category C combination wave clamping voltage shall not exceed [600 V, line to neutral and line to ground on 120/208 V] [1000 V, line to neutral and line to ground on 277/480 V] systems.
- F. Maximum UL 1449 clamping levels shall not exceed [400 V, line to neutral and line to ground on 120/208 V] [800 V, line to neutral and line to ground on 277/480 V] systems.
- G. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
- H. Accessories:
 1. Audible alarm activated on failure of any surge diversion module.
 2. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Electronic trip-unit circuit breakers shall have RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.

-
- d. Ground-fault pickup level, time delay, and I2t response.
 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 1. Lugs: [Mechanical] [Compression] style, suitable for number, size, trip ratings, and conductor material.
 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Ground-Fault Protection: [Integrally mounted] [Remote-mounted] relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - C. Enclosed, Insulated-Case Circuit Breaker: Fully rated, encased-power circuit breaker.
 1. Fixed circuit-breaker mounting.
 2. Two-step, stored-energy closing.
 3. Microprocessor-based trip units with interchangeable rating plug, LED trip indicators, and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments with I2t response.
 - d. Ground-fault pickup level, time delay, and I2t response.
 4. Remote trip indication and control.
 - D. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
 - E. High-Pressure, Butt-Type Contact Switch: Operating mechanism uses butt-type contacts and a spring-charged mechanism to produce and maintain high-pressure contact when switch is closed.
 1. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for closing and opening.
 - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 - b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.
 2. Service-Rated Switches: Labeled for use as service equipment.
 3. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
 - a. Configuration: [Integrally] [Remote-] mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

- b. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
- c. Test Control: Simulates ground fault to test relay and switch (or relay only if “no-trip” mode is selected).
- 4. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- F. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

2.04 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
 - 1. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems, to include the following:
 - 1. Phase Currents, Each Phase: Plus or minus 1 percent.
 - 2. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - 3. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - 4. Megawatts: Plus or minus 2 percent.
 - 5. Megavars: Plus or minus 2 percent.
 - 6. Power Factor: Plus or minus 2 percent.
 - 7. Frequency: Plus or minus 0.5 percent.
 - 8. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
 - 9. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent. Accumulated values unaffected by power outages up to 72 hours.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1 and NECA 400.
- B. Install and anchor switchboards level on concrete bases, 4-inch (100-mm) nominal thickness. Concrete base materials and installation requirements are specified in Division 03.
 - 1. For switchboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 2. Comply with mounting and anchoring requirements specified in Division 26 Sections “Hangers and Supports for Electrical Systems” and “Vibration and Seismic Controls for Electrical Systems.”
- C. Set field-adjustable switches and circuit-breaker trip ranges.

3.02 IDENTIFICATION

- A. Switchboard Nameplates: Label each switchboard compartment.



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3.03 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

END OF SECTION 262413

SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals:
 - 1. Product data for panelboards and overcurrent protective devices.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. [Flush] [Surface] [Flush- and surface]-mounted, NEMA PB 1, Type 1.
 - 1. Front: Secured to box with concealed trim clamps.
 - 2. Doors: With concealed hinges, flush catches, and tumbler locks, all keyed alike.
 - 3. Bus: [Hard-drawn copper, 98 percent conductivity] [Tin-plated aluminum] for each phase [and neutral] [, neutral, and ground].
 - 4. Extra-Capacity Neutral Bus: Rated 200 percent of phase bus, and UL listed as suitable for nonlinear loads.
 - 5. Main and Neutral Lugs: Type suitable for use with conductor material.
 - 6. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs.
 - 7. Equipment Ground Bus: Bonded to box.
 - 8. Feed-through Lugs: Type suitable for use with conductor material.
- B. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Panelboard Short-Circuit Rating: [UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating] [Fully rated to interrupt symmetrical short-circuit current available at terminals].

2.02 LIGHTING AND APPLIANCE PANELBOARDS

- A. Branch Overcurrent Protective Devices: [Plug-in] [Bolt-on] circuit breakers.

2.03 DISTRIBUTION PANELBOARDS

- A. Doors: Omit in fused-switch panelboards.
- B. Main Overcurrent Protective Devices: [Circuit breaker] [Fused switch].
- C. Branch overcurrent protective devices shall be one of the following:
 - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: [Plug-in] [Bolt-on] type.

2. 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.
3. Fused switches.

2.04 LOAD CENTERS

- A. Overcurrent Protective Devices: Plug-in, full-module circuit breaker.

2.05 COMPONENTS

- A. Molded-Case Circuit Breaker: NEMA AB 1 thermal-magnetic type; UL 489 with [series-connected rating] [interrupting capacity] to meet available fault currents.
 1. Appropriate for application; Type SWD for switching; Type HACR for heating, air-conditioning, and refrigerating equipment loads.
 2. GFCI Circuit Breakers: Single- and two-pole type with [5] [30]-mA trip sensitivity.
- B. B. Fused Switches: NEMA KS 1, Type HD, with [rejection] clips to accommodate indicated fuses; handle lockable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessory items according to NEMA PB 1.1. Indicate installed circuit loads on a typed circuit directory after balancing panelboard loads.
- B. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems." for seismic-restraint requirements.
- C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- D. Stub four empty 3/4-inch (19-mm) conduits from panelboard into accessible or designated ceiling space; stub four empty conduits into [raised] [space below] floor.
- E. Arrange conductors into groups; bundle and wrap with wire ties.

END OF SECTION 262416

SECTION 26 27 13 ELECTRICITY METERING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals:
 - 1. Product Data and Shop Drawings:
 - 2. Details, descriptions, and dimensions of individual components.
 - 3. Electrical characteristics, features, and operating sequences.
- B. Comply with NFPA 70.
- C. Coordinate with utility companies for services and components they furnish.

PART 2 - PRODUCTS

2.01 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.
- C. Modular Meter Center: Factory-coordinated assembly of a main service [terminal box with lugs only] [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. Housing: NEMA 250, Type [1] [3R] enclosure.
 - 2. Minimum Short-Circuit Rating: [22,000] [42,000] [65,000] [100,000] <Insert number> amperes symmetrical at rated voltage.
 - 3. Main Disconnect Device: [Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers] [Fusible switch, series-combination rated by breaker manufacturer to protect downstream feeder and branch circuit breakers].
 - 4. Tenant Feeder Circuit Breakers: Series-combination-rated molded case units, rated to protect circuit breakers in downstream tenant and 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.
 - 5. Meter Socket: Type as approved by utility company.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.



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- 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 26 27 26
WIRING DEVICES**PART 1 - GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data.
- B. Quality Assurance: Wiring devices shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS**2.01 DEVICES**

- A. Convenience Receptacles: NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498.
 - 1. [Available]Products:
 - a. <Insert manufacturer's name; product designation.>
- 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.
 - 1. [Available]Products:
 - a. <Insert manufacturer's name; product designation.>
- C. Duplex TVSS Convenience Receptacles: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
 - 1. [Available]Products:
 - a. a<Insert manufacturer's name; product designation.>
- 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.
 - 1. [Available]Products:
 - a. <Insert manufacturer's name; product designation.>
- 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] [toggle switch] [rotary knob]; 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. Fan Speed Controls: Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible

frequency and EMI/RFI filters. Comply with UL 1917.

1. Continuously adjustable [slider] [toggle switch] [rotary knob], [5 A] [1.5 A].
 2. Three-speed adjustable [slider] [rotary knob], 1.5 A.
- G. Telephone Outlet: Single RJ-45 jack for terminating 100-ohm, balanced, 4-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.
1. [Available]Products:
 2. <Insert manufacturer's name; product designation.>
- H. 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.
1. [Available]Products:
 2. <Insert manufacturer's name; product designation.>
- I. Wall Plates, Finished Areas: [Smooth, high-impact thermoplastic,] [Ribbed plastic,] [Satin-finish stainless steel,] [Brushed brass, lacquered;] [Polished brass, lacquered;] fastened with metal screws having heads matching plate color.
- J. Wall Plates, Unfinished Areas: [Galvanized steel] [Smooth, high-impact thermoplastic] with metal screws.
- K. Wall Plates, Damp Locations: [Thermoplastic] [Cast aluminum] with spring-loaded lift cover, and listed and labeled for use in wet locations.
- L. Floor Service Fittings:
1. Modular, [flush-type] [flap-type] [above-floor], dual-service units suitable for wiring method used.
 2. Compartments: Barrier separates power from voice and data communication cabling.
 3. Service Plate: [Rectangular] [Round], [die-cast aluminum] [solid brass] with satin finish.
 4. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
 5. Voice and Data Communication Outlet: [Blank cover with bushed cable opening] [Two modular, keyed, color-coded, RJ-45 Category 5 jacks for UTP cable].
- M. Multioutlet 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] [PVC] raceway with No. 12 AWG wire. One receptacle per [12 inches (300 mm)] <Insert spacing>.
- N. Finishes:
1. Wiring Devices Connected to Normal Power System: [Almond] [Black] [Brown] [Gray] [Ivory] [White] [As selected by Architect] <Insert color> unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: [Red] <Insert color>.
 3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.



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- 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 26 27 26



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SECTION 26 28 13
FUSES**PART 1 - GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals: Product Data for fuses[and spare-fuse cabinets].
- B. Comply with NEMA FU 1.
- C. Comply with NFPA 70.
- D. Project Conditions: Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.
- F. Extra Materials:
 - 1. Fuses: Quantity equal to <Insert number> percent of each fuse type and size, but no fewer than <Insert number> of each type and size.

PART 2 - PRODUCTS**2.01 CARTRIDGE FUSES**

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.02 SPARE-FUSE CABINET

- A. Cabinet: Gray, baked-enamel finish; wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

3.02 FUSE APPLICATIONS

- A. Service Entrance: Class [L, fast acting] [L, time delay] [RK1, fast acting] [RK1, time delay] [J, fast acting] [J, time delay] [T, fast acting].
- B. Feeders: Class [L, fast acting] [L, time delay] [RK1, fast acting] [RK1, time delay] [J, fast acting] [J, time delay] [RK5, time delay].
- C. Motor Branch Circuits: Class [RK1] [RK5], time delay.
- D. Other Branch Circuits: Class [RK1, time delay] [RK5, time delay] [J, fast acting] [J, time delay].



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3.03 INSTALLATION

- A. Install fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

END OF SECTION 262813

SECTION 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Summary: This Section includes individually mounted, enclosed switches, and circuit breakers and their enclosures.
- B. Submittals:
 - 1. Product Data.
- C. Comply with NFPA 70.
- D. Furnish extra materials described below that match products installed.
 - 1. Spares fuses for fusible switches.

PART 2 - PRODUCTS

2.01 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type [GD] [HD], with clips or bolt pads to accommodate specified fuses and lockable handle; interlocked with cover in closed position.
- B. Nonfusible Switch, [600] [1200] A and Smaller: NEMA KS 1, Type [GD] [HD], lockable handle, interlocked with cover in closed position.

2.02 MOLDED-CASE CIRCUIT BREAKERS

- A. Description: NEMA AB 1, 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. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 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] [30]-mA trip sensitivity.
- B. Features and Accessories:
 - 1. Lugs: Mechanical style [with compression lug kits] suitable for number, size, trip ratings, and conductor material.
 - 2. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Ground-Fault Protection: [Integrally mounted] [Remote-mounted] relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage [without intentional] [with field-adjustable 0.1- to 0.6-second] time delay.



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6. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.03 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of 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

3.01 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Division 26 Sections "Hangers and Supports for Electrical Systems" and "Vibration and Seismic Controls for Electrical Systems."

3.02 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 1. Test mounting and anchorage devices according to requirements in Division 26 Sections "Hangers and Supports for Electrical Systems" and "Vibration and Seismic Controls for Electrical Systems."
 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

3.03 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

END OF SECTION 262816

SECTION 26 2913 ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.
- C. Coordinate features, accessories, and functions of each motor controller with ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

PART 2 - PRODUCTS

2.01 CONTROLLERS AND ACCESSORIES

- A. Manual Controller: NEMA ICS 2, general purpose, Class A with toggle action and overload element, in each phase.
- B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated; with integral control transformer.
 - 1. Combination Controller: Factory-assembled combination controller and [fusible] [nonfusible] [circuit-breaker] disconnecting means.
 - 2. Overload Relay: [Ambient-compensated heater-type with inverse-time-current characteristic] [Dip switch selectable for motor running overload protection] and NEMA ICS 2, Class [10] [20] [30] tripping characteristic. Provide with sensors in each phase matched to nameplate full-load current of specific motor to which they connect, adjusted for duty cycle.
 - 3. Multispeed Controller: Match controller to motor type, application, and number of speeds. Provide with compelling, alternating, and decelerating relays.
 - 4. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Enclosures: NEMA 250, Type [1] [4X] [and] [3R].

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems"
- D. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.



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- E. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.
- F. Set field-adjustable switches and circuit-breaker trip ranges.

END OF SECTION 262913

**SECTION 26 31 00
 PHOTOVOLTAIC COLLECTORS**

26 31 00 FIGURE 1A

Version 2.0 and 2.5 Frame

WORLD CLASS QUALITY
 Fully-automated production lines and seamless monitoring of the process and material ensure the quality that the company sets as its benchmark for its sites worldwide.

SOLARWORLD PLUS SORTING
 Plus-sorting guarantees the highest system efficiency. Only modules that achieve the designated nominal performance or greater in performance tests are dispatched.

25 YEARS LINEAR PERFORMANCE GUARANTEE*
 SolarWorld guarantees a maximum degeneration in performance of 0.7% p.a. for more than 25 years – a clear additional benefit compared with the conventional two-stage industry guarantees. In addition there is a product workmanship warranty that covers 5 years.

PHYSICAL CHARACTERISTICS

Cells per module	60	Frame	Anodized aluminum
Cell type	Poly crystalline	Weight	46.7 lbs (21.2 kg)
Cell dimensions	6.34 in x 6.34 in (156 mm x 156 mm)	UL Maximum Test Load**	50 psf (2.4kN/m ²)
Front	Tempered glass (EN 12150)	IEC Maximum Snow Test Load***	113 psf (5.4kN/m ²)

Version 2.5 frame bottom mounting holes

VERSION 2.0 FRAME

- Compatible with "Top-Down" mounting methods
- Grounding locations: 4 corners of the frame

VERSION 2.5 FRAME

- Compatible with both "Top-Down" and "Bottom" mounting methods
- Grounding locations:
 - 4 corners of the frame
 - 4 locations along the length of the module in the extended flange†

* In accordance with the applicable SolarWorld Limited Warranty at purchase. www.solarworld-global.com/service-certificate.

** Please apply the appropriate factors of safety according to the test standards and local building code requirements when designing a PV system.

† www.solarworld.com

SOLARWORLD
 We turn sunlight into power.

U.S. Department of Energy Solar Decathlon 2011
 PHOTOVOLTAIC COLLECTORS

Page 263100-1

26 31 00 FIGURE 1 B

Sunmodule[™]

SW 230 poly

Version 2.0 and 2.5 Frame

09-2011-SW-05-XXXX
09-2011

PERFORMANCE UNDER STANDARD TEST CONDITIONS (STC)*

SW 230		
Maximum power	P_{max}	230 Wp
Open circuit voltage	U_{oc}	36.9 V
Maximum power point voltage	U_{MPP}	29.8 V
Short circuit current	I_{sc}	8.25 A
Maximum power point current	I_{MPP}	7.72 A

*STC: 1000W/m², 25°C, AM 1.5

PERFORMANCE AT 800 W/m², NOCT, AM 1.5

SW 230		
Maximum power	P_{max}	164.4 Wp
Open circuit voltage	U_{oc}	33.4 V
Maximum power point voltage	U_{MPP}	26.7 V
Short circuit current	I_{sc}	6.82 A
Maximum power point current	I_{MPP}	6.15 A

Minor reduction in efficiency under partial load conditions at 25°C: at 200 W/m², 95% (+/-3%) of the STC efficiency (1000 W/m²) is achieved.

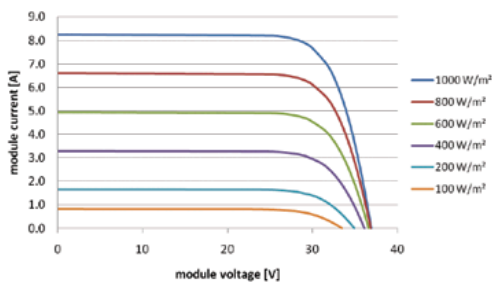
THERMAL CHARACTERISTICS

NOCT		46° C
TC I_{sc}		0.034 %/K
TC U_{oc}		-0.34 %
TC P_{MPP}		-0.48%
Operating range		-40°C to 90°C

SYSTEM INTEGRATION PARAMETERS

Maximum system voltage IEC II		1000 V
Maximum system voltage USA NEC		600 V
Maximum series fusing rating		16 A
Number of bypass diodes		3

I-V CURVE AT 25°C CELL TEMPERATURE



1) The output identified by SolarWorld (P_{nom}) is always higher than the nominal output (P_{max}) of the module.

2) Depending on the market.

ADDITIONAL DATA

Measuring tolerance		+/- 3%
SolarWorld Plus-Sorting ¹⁾		$P_{t,th} \geq P_{max}$
Junction box		IP65
Connector		MC4
Module efficiency		13.72%
Fire rating (UL 790)		Class C

GROUNDING

We recommend using the following components:

FRAME 2.0/2.5 (CORNERS)

Item	Manufacturer/Description	Tightening torque
Grounding lug	ILSCO GBL-4DBT	35 lbf-in, 4-6 AWG str
		25 lbf-in, 8 AWG str
		20 lbf-in, 10-14 AWG sol/str
Socket head cap screw	#10-24, 5/8", SS 18-8	62 lbf-in (7.0 Nm)

FRAME 2.5 (FLANGE)

Item	Manufacturer/Description
Grounding lug	ILSCO GBL-4DBT
Bolt	#10-32, SS
Serrated Washer	#10, SS
Washer	ID 13/64", OD 7/16"
Nut	#10-32, SS

Any PV grounding method and components listed to meet NEC grounding requirements are also acceptable.

SolarWorld AG reserves the right to make specification changes without notice. This data sheet complies with the requirements of EN 50380.

26 31 00 FIGURE 2A

SOLARMOUNT Technical Datasheets



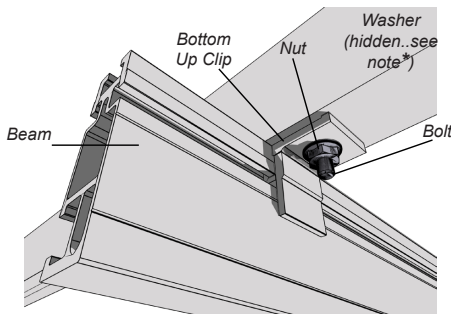
SolarMount Technical Datasheet

Pub 100602-1td V1.0 June 2010

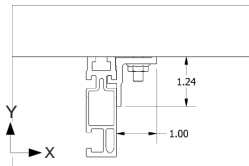
SolarMount Module Connection Hardware 1
 Bottom Up Module Clip..... 1
 Mid Clamp 2
 End Clamp..... 2
SolarMount Beam Connection Hardware..... 3
 L-Foot 3
SolarMount Beams 4

SolarMount Module Connection Hardware

SolarMount Bottom Up Module Clip
 Part No. 321001, 321002



- **Bottom Up Clip material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
 - **Ultimate tensile:** 38ksi, Yield: 35 ksi
 - **Finish:** Clear Anodized
 - **Bottom Up Clip weight:** ~0.031 lbs (14g)
 - Allowable and design loads are valid when components are assembled with SolarMount series beams according to authorized UNIRAC documents
 - Assemble with one 1/4"-20 ASTM F593 bolt, one 1/4"-20 ASTM F594 serrated flange nut, and one 1/4" flat washer
 - Use anti-seize and tighten to 10 ft-lbs of torque
 - Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
 - Module edge must be fully supported by the beam
- * **NOTE ON WASHER:** Install washer on bolt head side of assembly. **DO NOT** install washer under serrated flange nut



Dimensions specified in inches unless noted

Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, Φ
Tension, Y+	1566 (6967)	686 (3052)	2.28	1038 (4615)	0.662
Transverse, X±	1128 (5019)	329 (1463)	3.43	497 (2213)	0.441
Sliding, Z±	66 (292)	27 (119)	2.44	41 (181)	0.619

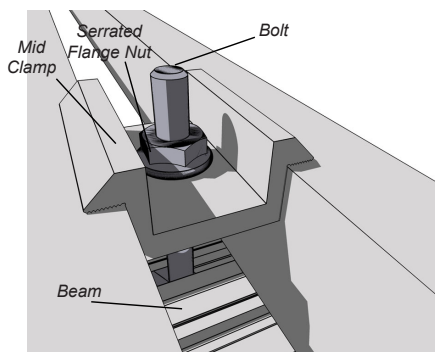
26 31 00 FIGURE 2B

SOLARMOUNT Technical Datasheets

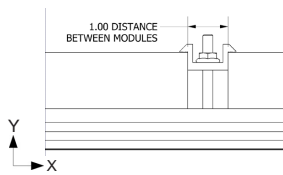


SolarMount Mid Clamp

Part No. 320008, 320009, 320019, 320020, 320021, 320084, 320085, 320086, 320087, 320120, 320122



- **Mid clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **Mid clamp weight:** 0.050 lbs (23g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single mid clamp assembly when used with a SolarMount series beam to retain a module in the direction indicated
- Assemble mid clamp with one Unirac 1/4"-20 T-bolt and one 1/4"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory

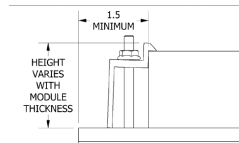
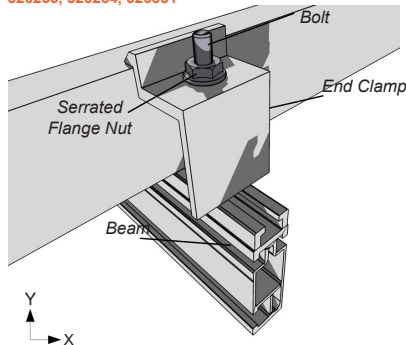


Dimensions specified in inches unless noted

Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, ϕ
Tension, Y+	2020 (8987)	891 (3963)	2.27	1348 (5994)	0.667
Transverse, Z±	520 (2313)	229 (1017)	2.27	346 (1539)	0.665
Sliding, X±	1194 (5312)	490 (2179)	2.44	741 (3295)	0.620

SolarMount End Clamp

Part No. 320002, 320003, 320004, 320005, 320006, 320012, 320013, 320014, 320015, 320016, 320017, 320079, 320080, 320081, 320082, 320083, 320117, 320118, 320123, 320124, 320173, 320185, 320220, 320233, 320234, 320331



Dimensions specified in inches unless noted

- **End clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **End clamp weight:** varies based on height: ~0.058 lbs (26g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single end clamp assembly when used with a SolarMount series beam to retain a module in the direction indicated
- Assemble with one Unirac 1/4"-20 T-bolt and one 1/4"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
- Modules must be installed at least 1.5 in from either end of a beam

Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Loads lbs (N)	Resistance Factor, ϕ
Tension, Y+	1321 (5876)	529 (2352)	2.50	800 (3557)	0.605
Transverse, Z±	63 (279)	14 (61)	4.58	21 (92)	0.330
Sliding, X±	142 (630)	52 (231)	2.72	79 (349)	0.555

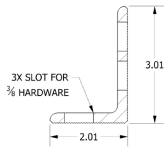
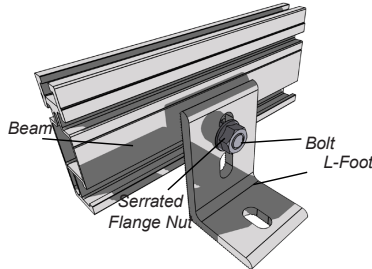
26 31 00 FIGURE 2C

SOLARMOUNT Technical Datasheets



SolarMount Beam Connection Hardware

SolarMount L-Foot
 Part No. 310065, 310066, 310067, 310068



Dimensions specified in inches unless noted

- **L-Foot material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **L-Foot weight:** varies based on height: ~0.215 lbs (98g)
- Allowable and design loads are valid when components are assembled with SolarMount series beams according to authorized UNIRAC documents
- **For the beam to L-Foot connection:**
 - Assemble with one ASTM F593 3/8"-16 hex head screw and one ASTM F594 3/8" serrated flange nut
 - Use anti-seize and tighten to 30 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory

NOTE: Loads are given for the L-Foot to beam connection only; be sure to check load limits for standoff, lag screw, or other attachment method

Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, Φ
Sliding, Z±	1766 (7856)	755 (3356)	2.34	1141 (5077)	0.646
Tension, Y+	1859 (8269)	707 (3144)	2.63	1069 (4755)	0.575
Compression, Y-	3258 (14492)	1325 (5893)	2.46	2004 (8913)	0.615
Traverse, X±	486 (2162)	213 (949)	2.28	323 (1436)	0.664

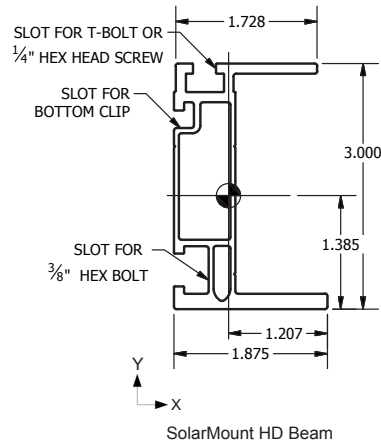
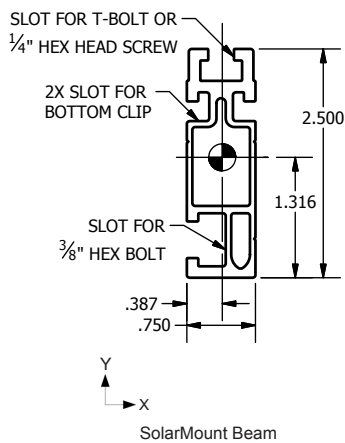
26 31 00 FIGURE 2D

SOLARMOUNT Technical Datasheets



SolarMount Beams

Properties	Units	SolarMount	SolarMount HD
Beam Height	in	2.5	3.0
Approximate Weight (per linear ft)	plf	0.811	1.271
Total Cross Sectional Area	in ²	0.676	1.059
Section Modulus (X-Axis)	in ³	0.353	0.898
Section Modulus (Y-Axis)	in ³	0.113	0.221
Moment of Inertia (X-Axis)	in ⁴	0.464	1.450
Moment of Inertia (Y-Axis)	in ⁴	0.044	0.267
Radius of Gyration (X-Axis)	in	0.289	1.170
Radius of Gyration (Y-Axis)	in	0.254	0.502



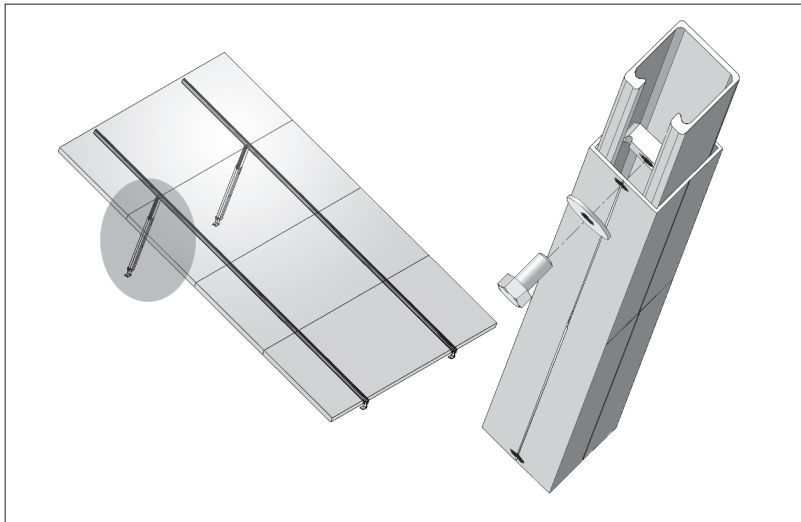
Dimensions specified in inches unless noted

26 31 00 FIGURE 3A

SOLARMOUNT™

TLH High Profile Tilt Legs Installation Supplement 205.4

U.S. Des. Patent No. D496,248S, D496,249S. Other patents pending.



Thank you for purchasing a Unirac. Please review this manual thoroughly before installing your SolarMount system.

The installer is solely responsible for:

- Complying with all applicable local or national building codes, including any that may supersede this manual;
- Ensuring that Unirac and other products are appropriate for the particular installation and the installation environment;
- Ensuring, in roof applications, that the roof, its rafters, connections, and other structural support members can support the array under building live load conditions;
- Using only Unirac parts and installer-supplied parts as specified by UniRac (substitution of parts may void the warranty);
- Ensuring that lag screws have adequate pullout strength and shear capacities as installed;
- In roof applications, maintaining the waterproof integrity of the roof, including selection of appropriate flashing; and
- Ensuring safe installation of all electrical aspects of the PV array.



Unirac welcomes input concerning the accuracy and user-friendliness of this publication. Please write to publications@unirac.com.

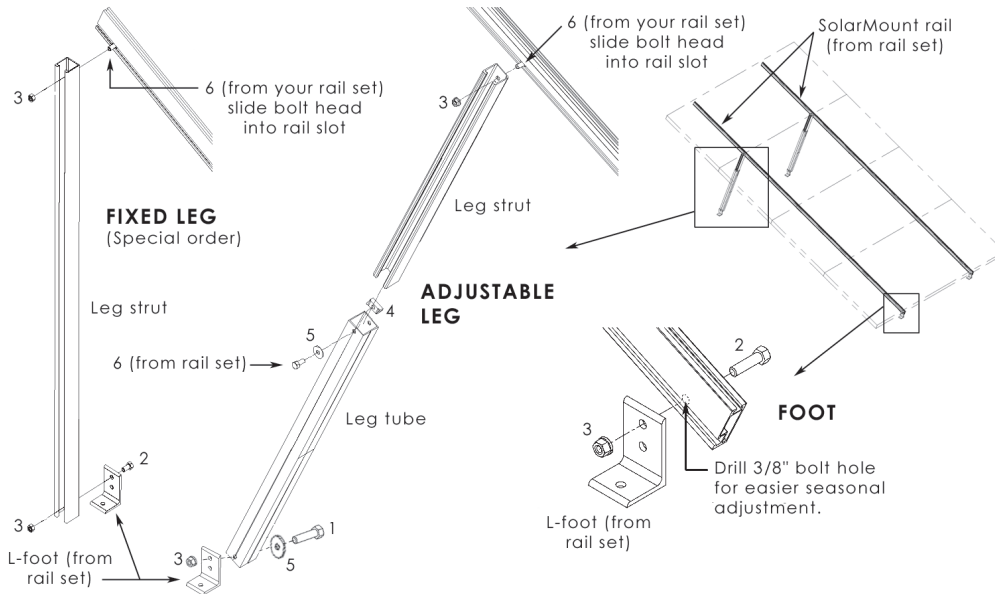
Unirac Installation Manual

Pub 100811-2ii
August 2010

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26 31 00 FIGURE 3B

UNIRAC Installation Manual 205.4 TLH High Profile Leg Kit SolarMount



Adjustable leg parts list

Part	Quantity		Wrench size	Recommended torque (ft-lbs)
	2-leg kits	4-leg kits		
Leg tube	2	4		
Leg strut	2	4		
1. Bolt, 3/8 x 3"	2	4	9/16"	15
2. Bolt, 3/8 x 1 1/4"	2	4	9/16"	15
3. Flange nut, 3/8"	2	4	9/16"	15
4. Strut nut, 3/8"	2	4		
5. Fender washer, 3/8"	4	8		
6. Bolt, 3/8 x 3/4"	4*	8†	9/16"	15

*From your rail set.

†6 from your rail set; 2 from your leg kit.

Adjustable Leg Cross Section

Fixed leg parts list (per pair of legs)

Part	Quantity	Wrench size	Recommended torque (ft-lbs)
Leg strut	1		
2. Bolt, 3/8 x 1 1/4"	2	9/16"	15
3. Flange nut, 3/8"	2	9/16"	15
6. Bolt, 3/8 x 3/4" (from your rail set)	4	9/16"	15

Caution: Stainless steel hardware can seize up, a process called galling. To significantly reduce the likelihood of galling, SAF-T-EZE anti-seize lubricant has been included with your hardware. Apply a very small drop to the threads of all bolts before installation. If more anti-seize is needed, substitute any lubricant.

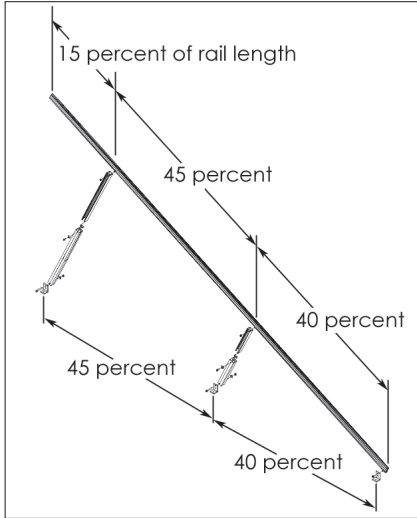


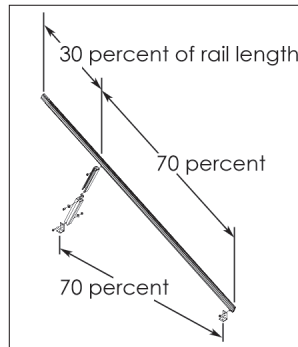
Figure 4. Leg spacing with SolarMount SMR120 to 132 rail sets (two legs per rail).

Spacing of Footing Bolts and L-Feet for Each Rail (inches)

Use this table in conjunction with Figure 3 or Figure 4 to determine footing bolt and L-foot spacing for your SMR Rail Set.

SMR	Rail Length 70% Rail Length		40% Rail		45% Rail	
	Rail Length	Length	Length	Length	Length	Length
SMR48	48	34				
SMR60	60	42				
SMR72	72	50				
SMR84	84	59				
SMR96	96	67				
SMR106	106	74				
SMR120	120	48	48	54		
SMR132	132	53	53	59		
SMR144	144	58	58	65		
SMR156	156	62	62	70		
SMR168	168	67	67	76		
SMR180	180	72	72	81		

Figure 3. Leg spacing with SolarMount SMR48 to 106 rail sets (one leg per rail).





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10 year limited Product Warranty, 5 year limited Finish Warranty

Unirac, Inc., warrants to the original purchaser ("Purchaser") of product(s) that it manufactures ("Product") at the original installation site that the Product shall be free from defects in material and workmanship for a period of ten (10) years, except for the anodized finish, which finish shall be free from visible peeling, or cracking or chalking under normal atmospheric conditions for a period of five (5) years, from the earlier of 1) the date the installation of the Product is completed, or 2) 30 days after the purchase of the Product by the original Purchaser ("Finish Warranty").

The Finish Warranty does not apply to any foreign residue deposited on the finish. All installations in corrosive atmospheric conditions are excluded. The Finish Warranty is VOID if

the practices specified by AAMA 609 & 610-02 – "Cleaning and Maintenance for Architecturally Finished Aluminum" (www.aamanet.org) are not followed by Purchaser. This Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation.

This Warranty shall be VOID if installation of the Product is not performed in accordance with Unirac's written installation instructions, or if the Product has been modified, repaired, or reworked in a manner not previously authorized by Unirac IN WRITING, or if the Product is installed in an environment for which it was not designed. Unirac shall not be liable for consequential, contingent or incidental damages arising out of the use of the Product by Purchaser under any circumstances.

If within the specified Warranty periods the Product shall be reasonably proven to be defective, then Unirac shall repair or replace the defective Product, or any part thereof, in Unirac's sole discretion. Such repair or replacement shall completely satisfy and discharge all of Unirac's liability with respect to this limited Warranty. Under no circumstances shall Unirac be liable for special, indirect or consequential damages arising out of or related to use by Purchaser of the Product.

Manufacturers of related items, such as PV modules and flashings, may provide written warranties of their own. Unirac's limited Warranty covers only its Product, and not any related items.

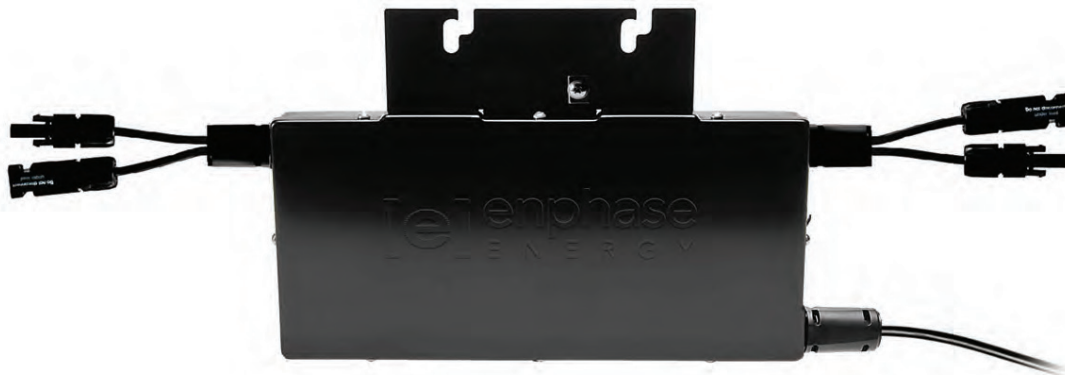


26 31 00 FIGURE 4A



ENPHASE MICROINVERTER

D380



The Enphase Energy Microinverter System improves energy harvest, increases reliability, and dramatically simplifies design, installation and management of solar power systems. The Enphase System includes the microinverter, the Envoy Communications Gateway, and the web-based Enlighten monitoring and analysis website.

- | | | |
|-------------------|---|---|
| PRODUCTIVE | [| <ul style="list-style-type: none"> - Maximum energy production - Resilient to dust, debris and shading - Performance monitoring per module |
| RELIABLE | [| <ul style="list-style-type: none"> - System availability greater than 99.8% - No single point of system failure |
| SMART | [| <ul style="list-style-type: none"> - Quick & simple design, installation and management - 24/7 monitoring and analysis |
| SAFE | [| <ul style="list-style-type: none"> - Low voltage DC - Reduced fire risk |

26 31 00 FIGURE 4B

MICROINVERTER TECHNICAL DATA

60 and 72 Cell Modules

The D380 "TwinPack" microinverters contain 2 independent DC inputs. The Input Data (DC) values below apply to both DC Inputs A and B individually

Input Data (DC)

D380-72-2LL-S12/3 and D380-72-2LL-S12/3-NA

Recommended input power (STC)	230W
Maximum input DC voltage	56V
Peak power tracking voltage	22V – 40V
Min./Max. start voltage	28V/54V
Max. DC short circuit current	12A
Max. input current	10A

Output Data (AC)

@208 Vac

@240 Vac

Maximum output power	380W	380W
Nominal output current	1.8A	1.6A
Nominal voltage/range	208V/183V-229V	240V/211V-264V
Extended voltage/range	208V/179V-232V	240V/206V-269V
Nominal frequency/range	60.0/59.3-60.5	60.0/59.3-60.5
Extended frequency/range	60.0/59.2-60.6	60.0/59.2-60.6
Power factor	>0.95	>0.95
Maximum units per 20A branch	15	10

Efficiency

Peak inverter efficiency	95.5%
CEC weighted efficiency	95.0%
Nominal MPP tracking	99.6%

Mechanical Data

Operating temperature range	-40°C to +65°C
Night time power consumption	50mW
Dimensions (WxHxD)	12.25" x 6.00" x 1.33"
Weight	6.25 lbs
Cooling	Natural Convection – No Fans
Enclosure environmental rating	Outdoor – NEMA 6


Features

Communication	Powerline
Warranty	15 Years
Compliance	UL1741/IEEE1547, FCC Part 15 Class B

Enphase Energy, Inc.

201 1st Street, Suite 300, Petaluma, CA 94952
 877 797 4743 enphaseenergy.com

142-00007 REV 05

 Printed on 100 percent recycled paper.

26 31 00 FIGURE 5A



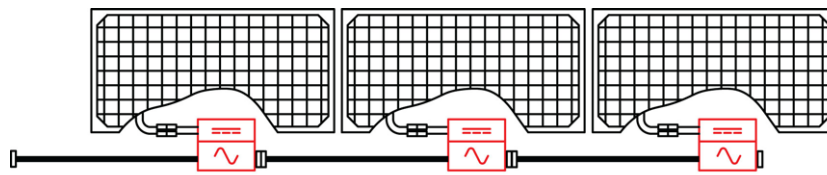
Application Note

D380 "TwinPack" Microinverter Installation

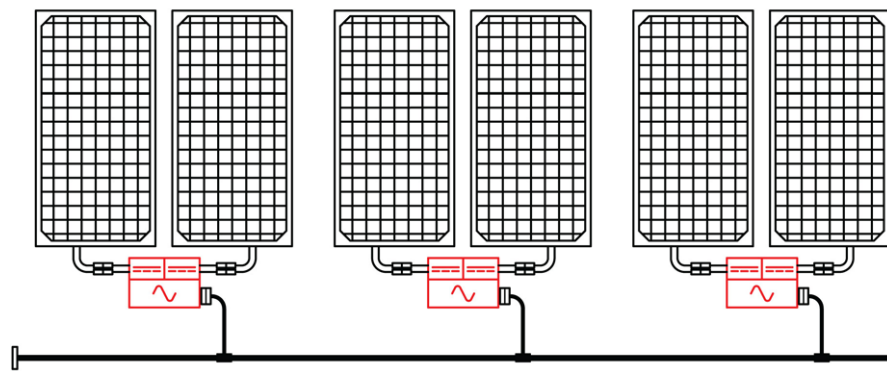
Enphase Microinverter Formats

The Enphase Microinverters are available in two enclosure designs. The M190 and M210 microinverters both use a single enclosure design, which contains one DC input section, one AC input section and one AC output cable per enclosure. For each M190 or M210 enclosure, the DC input section connects to the solar module connectors and the AC output cable connects to the adjacent microinverter's AC input section to create a continuous branch circuit.

The D380 TwinPack microinverter enclosure contains two DC input sections and a single AC connection section. There is no integral AC cable on the D380 TwinPack microinverter enclosure. The AC connection is accomplished with a separate AC trunk cable assembly as shown in the lower diagram below.



M190 Single Enclosure Connections

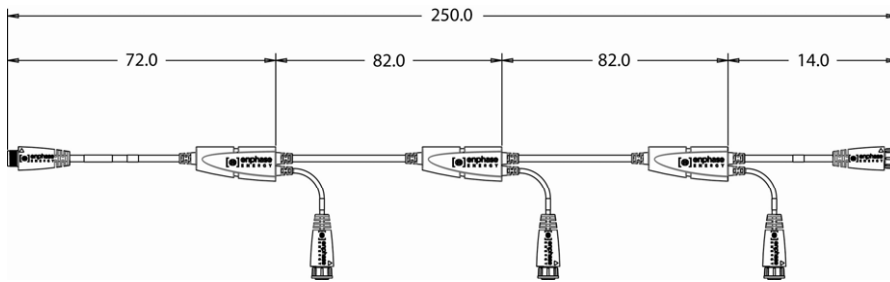


D380 TwinPack Enclosure Connections

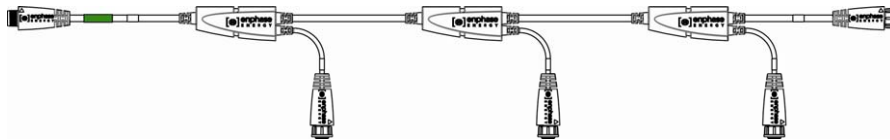
26 31 00 FIGURE 5B

D380 TwinPack Trunk Cable

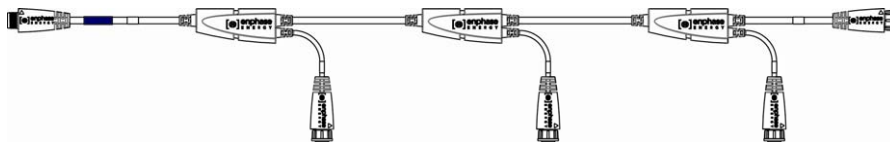
The D380 TwinPack cable assembly is constructed with a 12 gauge trunk cable and three “drop” cables at the inverter locations. The drop cables are spaced at two module-wide intervals. TwinPack cable assemblies are connected end to end to create a branch circuit of the desired length. Dimensions of the cable assembly are shown below in inches.



The 12 gauge trunk cable would be protected with a 20 amp circuit breaker allowing up to 33% more power per branch circuit, compared to branch circuits of the M190 and M210. A single 20 amp branch circuit would allow for up to 10 D380 TwinPack microinverters (20 PV modules) at 240 Vac, or 15 D380 TwinPack microinverters (30 PV modules) at 208 Vac. Different models of trunk cable are used depending on whether the installation is 240 Vac or 208Vac.



ET3R-G2-06 green label trunk cable is used for 208 or 240 Vac single phase installations.



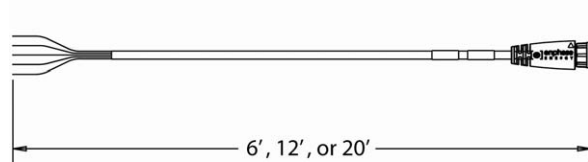
ET3C-G2-06 blue label trunk cable is used for 208 three phase installations.

26 31 00 FIGURE 5C

AC Interconnect Cables and End Caps

Each branch circuit of D380 TwinPack microinverters requires an AC interconnect cable. The AC Interconnect cable is available in 6, 12, or 20 foot lengths. Any unused connectors in the array should be protected from the elements with an end cap. The end cap fits both the female connectors for the trunk portion of the cable and the female connectors for the inverter drops.

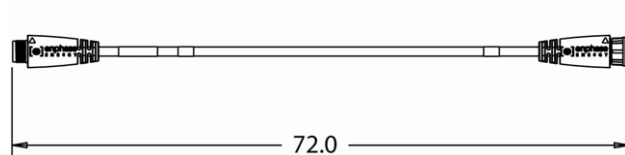
AC Interconnect Cable



Single-Drop Cable

Depending on the number of D380 units in the branch, you may need to use a “single-drop” cable to connect the final D380 microinverter to the branch. The single-drop cable connects to the end of the last trunk cable assembly, and eliminates the need for an end-cap.

Single Drop Trunk Cable



Alternatively, if you have two D380 units to connect to the end of the branch, you will need two end-caps: one to cover the one unused drop on the three-drop cable and one to cover the unused trunk end of the three-drop cable.

26 31 00 FIGURE 5D

This table provides detailed information on the possible branch configurations and the number of end-caps and single-drop cables that would be needed.

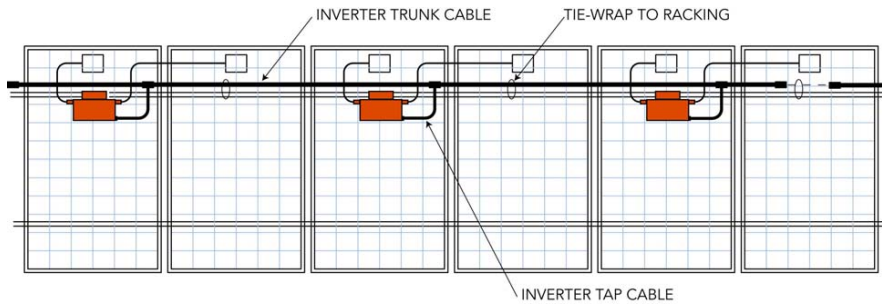
Number of D380's	Number of Modules	Single Drop Cable	Three Drop Cable	End-caps
1	2	1	0	0
2	4	0	1	2
3	6	0	1	1
4	8	1	1	0
5	10	0	2	2
6	12	0	2	1
7	14	1	2	0
8	16	0	3	2
9	18	0	3	1
10	20	1	3	0
11*	22	0	4	2
12*	24	0	4	1
13*	26	1	4	0
14*	28	0	5	2
15*	30	0	5	1

* Only applies to 208 Vac configurations.

26 31 00 FIGURE 5E

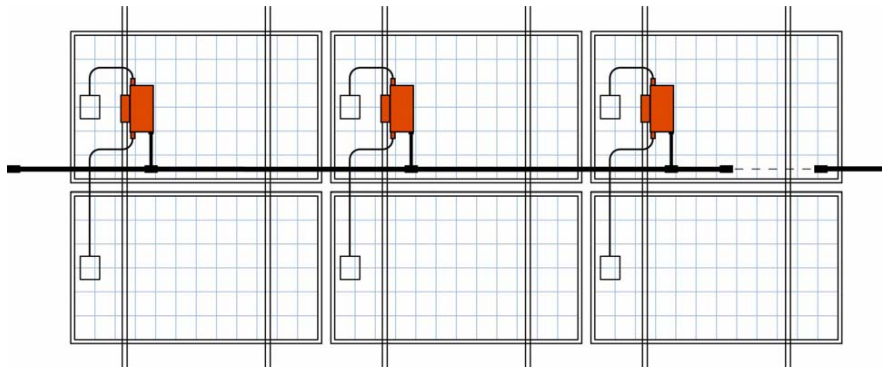
Portrait Module Orientation

D380 TwinPack microinverters mount to the module racking below one of the associated PV modules. The TwinPack cable is fastened to the module racking.



Landscape Module Orientation

For PV modules installed in landscape orientation, the D380 TwinPack microinverters could be mounted to the vertical module supports as shown. The spacing between drops on the cable is intended for two rows of PV modules.



Note on Module Connection

If the branch circuit has an odd number of solar modules, be sure to connect the "A side" of the microinverter to the one remaining module.

SECTION 26 50 00
LIGHTING**PART 1—GENERAL****1.01 SECTION REQUIREMENTS**

- A. Submittals: See attached cut sheets of selected lighting
- 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 luminaries with ceiling construction, mechanical work, and security and fire-prevention features mounted in ceiling space and on ceiling.

PART 2 - PRODUCTS**2.01 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS**

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- C. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- D. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2.02 BALLASTS

- A. Ballasts for Linear Fluorescent Lamps:
 - 1. Electronic: Comply with ANSI C82.11; programmed-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. 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. Internal-Type Emergency Fluorescent Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 - 1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - 2. Night-Light Connection: Operate one fluorescent lamp continuously.

3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
- C. Ballasts for Metal-Halide Lamps:
1. Electronic:
 - a. Lamp end-of-life detection and shutdown circuit.
 - b. Total Harmonic Distortion Rating: Less than 15 percent.
 - c. Transient Voltage Protection: IEEE C62.41, Category A or better.

2.03 LAMPS

- A. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80 and color temperature 4000 K.

2.04 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

- A. Fixture: DL-1

1. Basis-of-Design Product: Subject to compliance with requirements, provide AXO-CLAVIUS-S-100, USCLAVIUBCCRFLE with fluorescent bulb or comparable product by one of the following:
 - a. Axo Light
2. Voltage: 120 V
3. Mounting: Pendant, mounting height TBD
4. Nominal Dimensions: 39.4”L X 5.9”W X 8.7”H
5. Lamps: Fluorescent
6. Ballast for Fluorescent Lamps: TBD
7. Quantity of Ballasts per Fixture: 1 X 39W 120V T5HO ;
8. Lens: TBD
9. External Finish: USCLAVIUBCCRFLE- White
10. Minimum CU for typical RCR shall be as follows (typical cavity reflectance’s are ceiling = 80 percent, wall = 50 percent, and floor = 20 percent): TBD CU.
11. Minimum Spacing to Mounting Height Ratio: TBD
12. Minimum Visual Comfort Probability: TBD for room dimensions 29’-6” length, 15’-0”width, 10’-0” height in feet.
13. Maximum Luminance Ratio: TBD

- B. Fixture: BDL-1

1. Basis-of-Design Product: Subject to compliance with requirements, provide VATE 801.620.03 LED Incandescent Substitute or comparable product by one of the following:
 - a. IKEA

-
2. Voltage: 120 V ac.
 3. Mounting: Bedroom Floor Lamp
 4. Nominal Dimensions: 16" D x 37" H" in inches (mm)>.
 5. Lamps: LED Incandescent Substitute
 6. Ballast for Fluorescent Lamps: TBD
 7. Quantity of Ballasts per Fixture: TBD
 8. Lens: TBD
 9. External Finish: Paper
 10. Minimum CU for typical RCR shall be as follows (typical cavity reflectance's are ceiling = 80 percent, wall = 50 percent, and floor = 20 percent): TBD CU.
 11. Minimum Spacing to Mounting Height Ratio: TBD
 12. Minimum Visual Comfort Probability: TBD for room dimensions 11'-2" length, 15'-0" width, 10'-0" height in feet.
 13. Maximum Luminance Ratio: TBD
- C. Fixture: BL-1
1. Basis-of-Design Product: Subject to compliance with requirements, provide RZK-2SQUARE or comparable product by one of the following:
 - a. Rezek
 2. Voltage: 120 V ac.
 3. Mounting: Surface wall, mounting height TBD
 4. Nominal Dimensions: 2" W X 38" L X 2" D in inches .
 5. Lamps: Fluorescent
 6. Ballast for Fluorescent Lamps: Electronic instant start
 7. Quantity of Ballasts per Fixture: 1 X 14W T5HO
 8. Lens: TBD
 9. External Finish: Aluminum
 10. Minimum CU for typical RCR shall be as follows (typical cavity reflectance's are ceiling = 80 percent, wall = 50 percent, and floor = 20 percent): TBD CU.
 11. Minimum Spacing to Mounting Height Ratio: TBD
 12. Minimum Visual Comfort Probability: TBD for room dimensions 15'-0" length, 5'-7" width, 8'-0" height in feet.
 13. Maximum Luminance Ratio: TBD
- D. Fixture: EL-1
1. Basis-of-Design Product: Subject to compliance with requirements, provide VATE 101.757.73 or comparable

product by one of the following:

- a. IKEA
 2. Voltage: 120 V ac.
 3. Mounting: Pendant. mounting height TBD
 4. Nominal Dimensions: 13" D x 21" H" in inches (mm)>.
 5. Lamps: LED Incandescent Substitute
 6. Ballast for Fluorescent Lamps: TBD
 7. Quantity of Ballasts per Fixture: TBD
 8. Lens: TBD
 9. External Finish: Paper
 10. Minimum CU for typical RCR shall be as follows (typical cavity reflectance's are ceiling = 80 percent, wall = 50 percent, and floor = 20 percent): TBD CU.
 11. Minimum Spacing to Mounting Height Ratio: TBD
 12. Minimum Visual Comfort Probability: TBD for room dimensions 11'-2" length, 15'-0"width, 10'-0" height in feet.
 13. Maximum Luminance Ratio: TBD
- E. Fixture GL-1
1. Basis-of-Design Product: Subject to compliance with requirements, provide Dome 6 recessed LED or comparable product by one of the following:
 - a. Lithonia
 2. Voltage: 120-V ac.
 3. Mounting: Recessed ceiling, mounting height TBD
 4. Nominal Dimensions: 4.5" Diameter
 5. Lamps: HID
 6. Quantity of Ballasts per Fixture: TBD
 7. Lens: TBD
 8. External Finish: 6" recessed housing
 9. Minimum CU for typical RCR shall be as follows (typical cavity reflectance's are ceiling = 80 percent, wall = 50 percent, and floor = 20 percent): TBD CU.
 10. Minimum Spacing to Mounting Height Ratio: TBD
 11. Minimum Visual Comfort Probability: TBD for room dimensions 8'-0" length, 5'-0"width, 8'-0" height in feet.
 12. Maximum Luminance Ratio: TBD
- F. Fixture: UL-1

1. Basis-of-Design Product: Subject to compliance with requirements, provide DIODER 001.194.24 LED disk or comparable product by one of the following:
 - a. IKEA
2. Voltage: 120 V ac.
3. Mounting: Under cabinet, mounting height TBD
4. Nominal Dimensions: TBD
5. Lamps: TBD
6. Ballast for Fluorescent Lamps: TBD
7. Quantity of Ballasts per Fixture: TBD
8. Lens: TBD
9. External Finish: TBD
10. Minimum CU for typical RCR shall be as follows (typical cavity reflectance's are ceiling = 80 percent, wall = 50 percent, and floor = 20 percent): TBD CU.
11. Minimum Spacing to Mounting Height Ratio: TBD
12. Minimum Visual Comfort Probability: TBD for room dimensions 8'-0" length, 5'-0" width, 8'-0" height in feet.
13. Maximum Luminance Ratio: TBD

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set units level, plumb, and square with ceiling and walls, and secure.
- B. Support for Recessed and Semirecessed Grid-Type Fluorescent Fixtures:
 1. Install ceiling support system wires at a minimum of four wires for each fixture, located not more than 6 inches from fixture corners.
 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
- C. Suspended Lighting Fixture Support:
 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. 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.
- D. Air-Handling Fixtures: Install with dampers closed.
- E. Adjust aimable lighting fixtures to provide required light intensities.



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- F. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's written instructions.

Maestro Wireless® Dimmers and Switches

The *Maestro Wireless* solution incorporates *Maestro Wireless* load controls, wireless sensors, and wireless remote controls, which provides a system that delivers energy savings, convenience, and ease of installation.

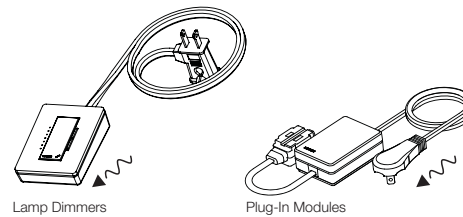
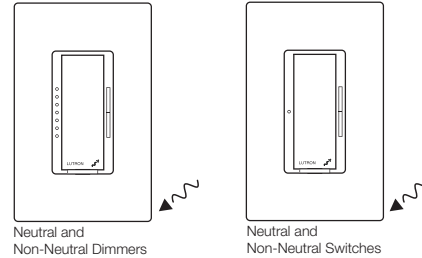
Maestro Wireless dimmers and switches use Lutron patented Clear Connect™ RF Technology, which enables wireless communication with Radio Powr Savr™ sensors and Pico® wireless controls for light control and general switched loads.

Features

- The *Maestro Wireless* solution provides dimming/switching of multiple load types, occupancy/vacancy sensing, daylight harvesting, and high-end trim.
- Lutron patented *Clear Connect* RF Technology works through walls and floors.
- Incorporates advanced features such as fade on/fade off, high-end trim, and rapid full on.
- Controls include Front Accessible Service Switch (FASS™) for safe lamp replacement.
- Two-wire dimmers and switches available for retrofit applications.
- Power failure memory: If power is interrupted, the control will return to its previously set level prior to interruption.

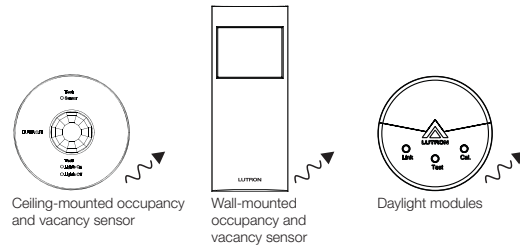
Receiving Devices

Maestro Wireless Controls



Transmitting Devices

Radio Powr Savr Sensors



Pico Wireless Controls



Job Name:	Model Numbers:
Job Number:	

Maestro Wireless® RF Local Controls Designer-style: Maestro®

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Maestro Wireless® Dimmers

Model Numbers

Dimmers

Halogen/Incandescent/Magnetic Low-voltage

- MRF2-600M-XX 600 W Incandescent Dimmer 120 V~
- MRF2-6MLV-XX 600 W/600 VA Incandescent/MLV Dimmer 120 V~
- MRF2-6ND-120-XX* 600 W/600 VA Spec Grade Neutral wire Dimmer 120 V~
- MRF2-10D-120-XX 1000 W/1000 VA Spec Grade Dimmer 120 V~

3-wire Fluorescent

- MRF2-F6AN-DV-XX* 6 A 3-wire Fluorescent Spec Grade Neutral wire Dimmer 120-277 V~

Electronic Low-Voltage Dimmer —

- MRF2-6ELV-120-XX* 600 W ELV Dimmer 120 V~

Dimmer



Companion Dimmer



* NEUTRAL WIRE REQUIRED.

Companion Controls

Claro® Gloss Finishes

- MA-R-XX Companion Dimmer 120 V~
- MA-R-277-XX Companion Dimmer 277 V~

Satin Colors® Satin Finishes

- MSC-AD-XX Companion Dimmer 120 V~
- MSC-AD-277-XX Companion Dimmer 277 V~

"XX" in the model number represents color/finish code.

Job Name:	Model Numbers:
Job Number:	



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Maestro Wireless®

RF Local Controls

Designer-style: Maestro®

369-143k 3 09.30.10

Dimmer Load Type and Capacity

Neutral Required

Control	Voltage	Load Type	Minimum Load	Maximum Load		
				Not Ganged	End of Gang	Middle of Gang
MRF2-6ND-120 ^{1,2,4}	120 V~	Incand.	25 W	600 W	500 W	400 W
		MLV ²	25 W/VA	450 W/ 600 VA	400 W/ 500 VA	300 W/ 400 VA
MRF2-6ELV ²	120 V~	ELV ²	5 W	600 W	500 W	400 W
MRF2-F6AN-DV ^{3,5}	120-277 V~	Lighting	1 ballast 0.05 A	6 A	5 A	3 A

No Neutral Required

Control	Voltage	Load Type	Minimum Load	Maximum Load		
				Not Ganged	End of Gang	Middle of Gang
MRF2-600M ^{1,4}	120 V~	Incand.	50 W	600 W	500 W	400 W
MRF2-6MLV ^{1,2,4}	120 V~	MLV ²	50 VA	450 W/ 600 VA	400 W/ 500 VA	300 W/ 400 VA
MRF2-10D-120 ^{1,2,4}	120 V~	Incand.	50 W	1000 W	800 W	650 W
		MLV ²	50 W/VA	800 W/ 1000 VA	600 W/ 800 VA	500 W/ 650 VA

¹ Dimmer Load Type: -6ND, -6MLV and -10D are designed for use with permanently installed incandescent, magnetic low-voltage, or tungsten halogen only. -600M is designed for use with permanently installed incandescent or tungsten halogen only. -6ELV is designed for use with permanently installed electronic low-voltage only. Do not install dimmers to control receptacles or motor-operated appliances.

² Low-Voltage Applications: Use -6ND, -6MLV and -10D with magnetic (core and coil) low-voltage transformers only. Not for use with electronic (solid-state) low-voltage transformers. Use -6ELV with electronic (solid-state) low-voltage transformers only. Operation of a low-voltage circuit with lamps inoperative or removed may result in transformer overheating and premature failure. Lutron strongly recommends the following:

- Do not operate low-voltage circuits without operative lamps in place.
- Replace burned-out lamps as quickly as possible.
- Use transformers that incorporate thermal protection or fused transformer primary windings to prevent transformer failure due to overcurrent.

³ Can control the following power boosters/load interfaces: Phase-adaptive Power Modules (PHPM-WBX-DV-WH), 3-wire Fluorescent Power Modules (PHPM-3F-DV-WH), Tu-Wire® Fluorescent Power Modules (PHPM-PA-DV-WH), and 0-10 V (GRX-TV).

⁴ Can control the following power booster/load interface: Hi-Power 2•4•6™ Boosters (HP-2, HP-4, HP-6) for control of most popular lighting sources including Lutron® 3-wire line voltage control fluorescent dimming ballasts (Hi-lume®, Hi-lume Compact SE™, Eco-10®, and EcoSystem®).

⁵ Dimmer Load Type: -F6AN is designed for use with permanently installed 3-wire line voltage control fluorescent ballasts or LED drivers only (Hi-lume, Hi-lume Compact SE, Eco-10, and EcoSystem).

LUTRON SPECIFICATION SUBMITTAL

Page

Job Name:	Model Numbers:
Job Number:	

Maestro Wireless®

RF Local Controls

Designer-style: Maestro®

369-143k 4 09.30.10

Maestro Wireless® Switches

Model Numbers

Switches

Lighting and motor loads

- MRF2-6ANS-XX* 6 A Lighting/3 A Fan (1/10 HP motor), Electronic Switch 120 V~
- MRF2-8ANS-120-XX* 8 A Lighting, 5.8 A Fan (1/4 HI motor), Spec Grade Electronic Switch 120 V~
- MRF2-6ANS-277-XX* 6 A Lighting, Spec Grade Electronic Switch 277 V~
- MRF2-8S-DV-XX 8 A Lighting, 3 A Fan (1/10 HF motor, 120 V~ only), Spec Grade Electronic Switch 120-277 V~, NO NEUTRAL WIRE REQUIRED

Switch



Companion Switch



* NEUTRAL WIRE REQUIRED.

Companion Controls

Claro® Gloss Finishes

- MA-AS-XX Companion Switch 120 V~
- MA-AS-277-XX Companion Switch 277 V~

Satin Colors® Satin Finishes

- MSC-AS-XX Companion Switch 120 V~
- MSC-AS-277-XX Companion Switch 277 V~

“XX” in the model number represents color/finish code.

Job Name:	Model Numbers:
Job Number:	



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Maestro Wireless®

RF Local Controls

Designer-style: Maestro®

369-143k 5 09.30.10

Switch Load Type and Capacity

Neutral Required

Control	Voltage	Load Type	Minimum Load	Maximum Load		
				Not Ganged	End of Gang	Middle of Gang
MRF2-8ANS-120 ^{1,3}	120 V~	Lighting	25 W	8 A	6.5 A	5 A
		Fan Motor	0.2 A	1/4 HP 5.8 A	1/4 HP 5.8 A	1/6 HP 4.4 A
MRF2-6ANS ¹	120 V~	Lighting	25 W	6 A	5 A	3.5 A
		Fan Motor	0.2 A	1/10 HP 3 A	1/10 HP 3 A	1/10 HP 3 A
MRF2-6ANS-277 ²	277 V~	Lighting	25 W	6 A	5 A	3.5 A

No Neutral Required

Control	Voltage	Load Type	Minimum Load	Maximum Load		
				Not Ganged	End of Gang	Middle of Gang
MRF2-8S-DV ²	120-277 V~	Incandescent/ Halogen	25 W	8 A	8 A/7 A ⁴	7 A
	120-277 V~	Fluorescent/ LED/CFL	40 W (LUT-MLC) ⁵	8 A	8 A/7 A ⁴	7 A
	120 V~	Fan Motor	0.4 A	1/10 HP 3 A	1/10 HP 3 A	1/10 HP 3 A

- ¹ Switch Load Type: -8ANS-120 is designed for use with permanently installed lighting loads and with fan motor loads up to 1/4 HP (5.8 A).
 -6ANS is designed for use with permanently installed lighting loads and with fan motor loads up to 1/10 HP (3 A).
 -8S-DV is designed for use with permanently installed lighting loads and with fan motor loads up to 1/10 HP (3 A, 120 V~ only).
- ² Switch Load Type: -6ANS-277 and -8S-DV are designed for use with permanently installed lighting loads.
- ³ For loads larger than 8 A @ 120 V~, the -8ANS-120 switch can be used with the PHPM-SW-DV-WH power booster. For loads larger than the MRF2-6ANS-277 capacity of 6 A @ 277 V~, the -8ANS-120 can also be used with the PHPM-SW-DV-WH power booster to switch 277 V~ loads. Please note that in this application, the -8ANS-120 switch is providing an input at 120 V~ and the power booster is switching 277 V~.
- ⁴ Maximum load for double gang application is 8 A. Triple gang application derates maximum load to 7 A.
- ⁵ The LUT-MLC ensures proper function with certain fluorescent, CFL, and LED load types.

LUTRON SPECIFICATION SUBMITTAL

Page

Job Name:	Model Numbers:
Job Number:	



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Maestro Wireless®

RF Local Controls

Designer-style: Maestro®

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Specifications

Regulatory Approvals

- UL Listed.
- CSA Certified.
- FCC Approved. Complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.
- Industry Canada Certified.

Power

Operating voltage:
 120 V~ 50/60 Hz
 277 V~ 50/60 Hz (-6ANS-277, -8S-DV, -F6AN-DV)

Key Design Features

Dimmers

- On a single-tap, lights fade UP or DOWN.
- On a double-tap, lights go to full ON.
- When ON, press and hold to engage 20-second fade to OFF.
- Light levels can be fine-tuned by pressing and holding the dimming rocker until the desired light level is reached.
- Two-wire dimmers available.

Switch

- On a single-tap, lights turn ON or OFF.
- Two-wire switches available.

All RF Local Controls

- Tested to withstand electrostatic discharge without damage or memory loss, in accordance with IEC 61000-4-2.
- Tested to withstand surge voltages without damage or loss of operation, in accordance with IEEE C62.41-1991 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

- Controls always operate locally and do not require system control.
- Power failure memory: should power be interrupted, the control will return to its previously set level prior to the interruption when power is restored.
- Uses conventional 3-way and 4-way wiring.
- Multiple location control from Dimmer/Switch and up to 9 Companion Dimmer(s)/Switch(es).
- Use Lutron® Designer (Claro® and Satin Colors®) wallplates or designer-style wallplates from other manufacturers. Wallplates are sold separately.
- Lutron *Claro* and *Satin Colors* wallplates snap on with no visible means of attachment.
- Requires a 1-gang U.S. wallbox. 3½ in (89 mm) deep recommended, 2¼ in (57 mm) deep minimum.
- Green indicator lights.

System Communications and Capacity

- *Maestro Wireless* controls communicate with the Pico™ wireless controls and Radio Power Savr™ sensors through radio frequency (RF).
- *Maestro Wireless* local controls must be located within 60 ft (18 m) line of sight or 30 ft (9 m) through walls, of *Radio Power Savr* sensors.
- *Maestro Wireless* local controls must be located within 100 ft (30 m) line of sight or 30 ft (9 m) through walls, of a *Pico* wireless control.
- Up to 10 *Maestro Wireless* controls can be configured to work together.

Environment

- Ambient operating temperature: 32 °F to 104 °F (0 °C to 40 °C), 0%-90% humidity, non-condensing. Indoor use only.

LUTRON SPECIFICATION SUBMITTAL

Page

Job Name:	Model Numbers:
Job Number:	

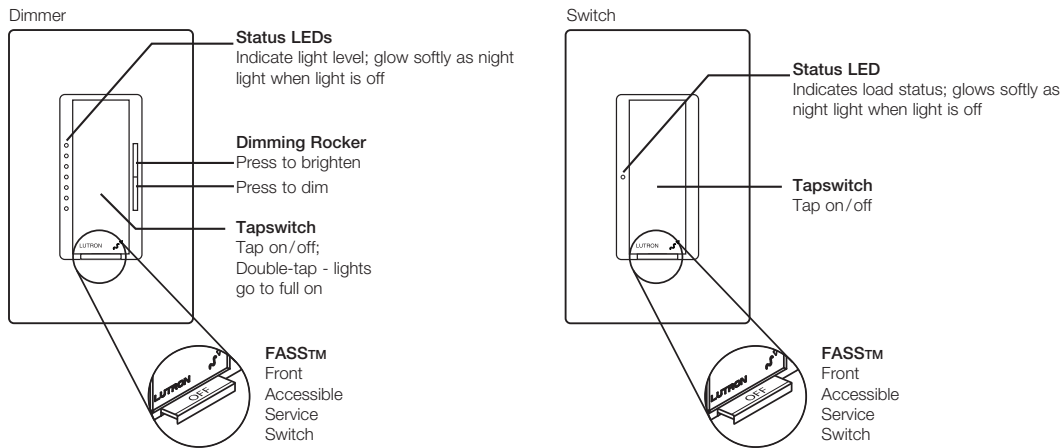
Maestro Wireless®

RF Local Controls

Designer-style: Maestro®

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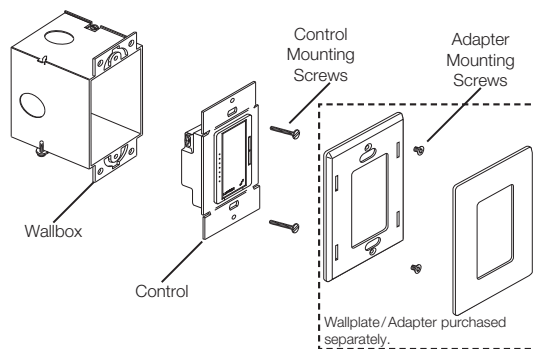
Operation



IMPORTANT NOTICE:

FASS - Front Accessible Service Switch - to service load, remove power by pulling the FASS switch out completely on either the Dimmer/Switch or Companion Dimmer/Switch. After servicing load, push the FASS switch back in fully to restore power to the control.

Mounting



Job Name:	Model Numbers:
Job Number:	

Maestro Wireless®

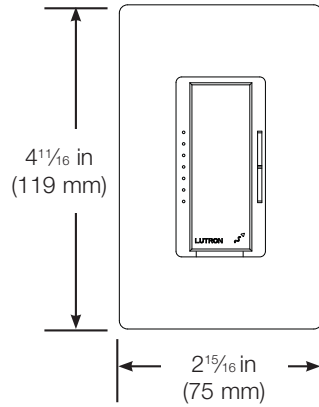
RF Local Controls

Designer-style: Maestro®

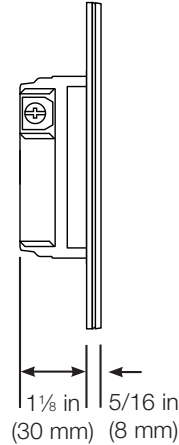
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Dimensions

Front View

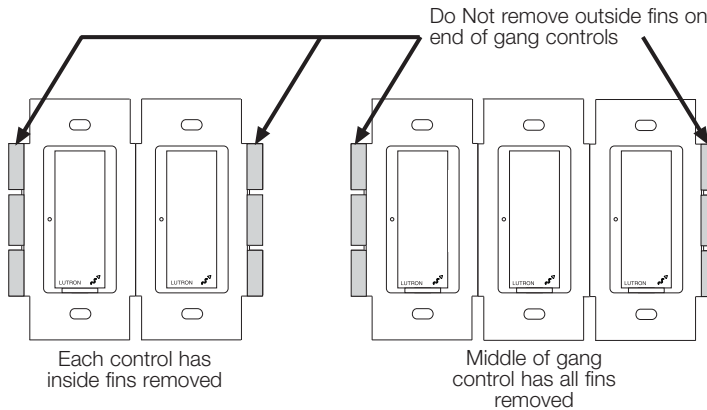


Side View



Gangging and Derating

When gangging with other controls in the same wallbox, derating is required. See Load Type and Capacity chart. Only -8ANS controls have fins that need to be removed for multigang installations. No other controls have fins, but they must still be derated in multigang installations.



Job Name:	Model Numbers:
Job Number:	

Maestro Wireless®

RF Local Controls

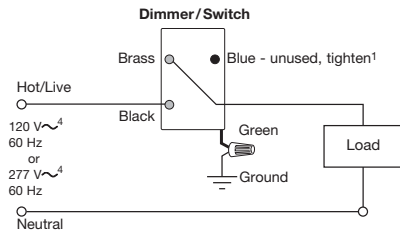
Designer-style: Mae

369-143k 9 (

Wiring Diagrams

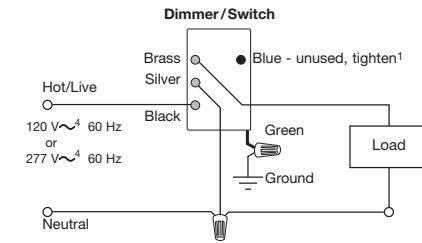
Single Location Installation

-600M, -6MLV, -10D



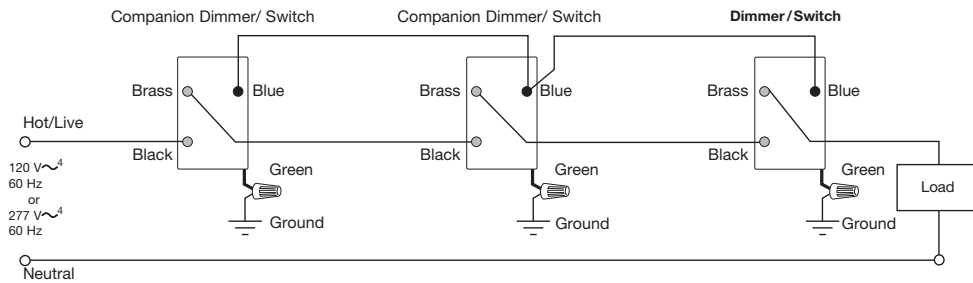
Single Location Installation with Neutral

-6ND, -6ELV, -6ANS-120, -8ANS-120, -6ANS-2



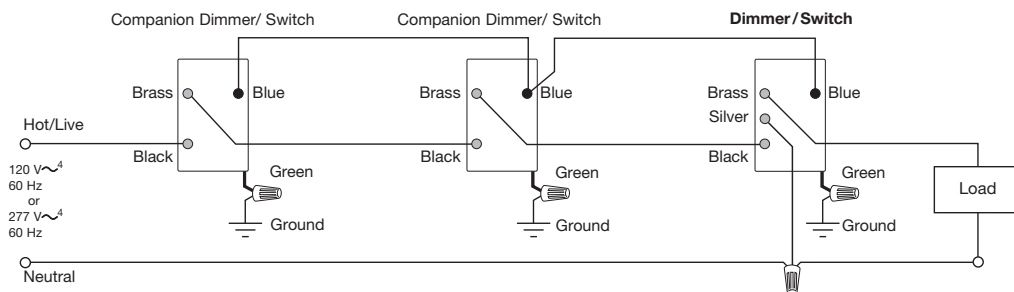
Multi-Location Installation²

-600M, -6MLV, -10D with MA-R/MSC-AD



Multi-Location Installation with Neutral^{2,3}

-6ND, -6ELV with MA-R/MSC-AD; -6ANS-120, -8ANS-120 with MA-AS/MSC-AS; -6ANS-277 with MA-AS-277/MSC



¹ When using controls in single location installations, tighten the blue terminal without any wires attached. **DO NOT** connect the blue terminal to any other wire to ground.

² Up to 9 *Maestro* Companion Dimmers/Switches may be connected to the *Maestro Wireless* Dimmer/Switch. Total blue terminal wire length may be up to 250 ft (76 m).

³ Neutral wire Dimmers/Switches must be connected on the Load side of a multi-location installation.

⁴ 120 V~ : -6ND, -6ANS-120, -8ANS-120, -6ELV-120
 277 V~ : -6ANS-277, 8S-DV

⁵ Requires MA-AS/MSC-AS for 120 V~ applications, and MA-AS-277/MSC-AS-277 for 277 V~ applications.

LUTRON SPECIFICATION SUBMITTAL

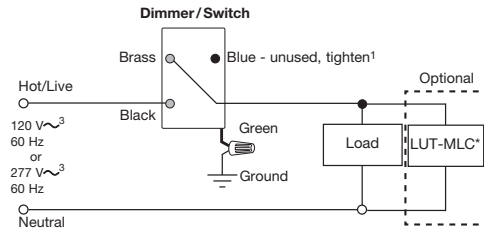
Pa

Job Name:	Model Numbers:
Job Number:	

Wiring Diagrams

Single Location Installation

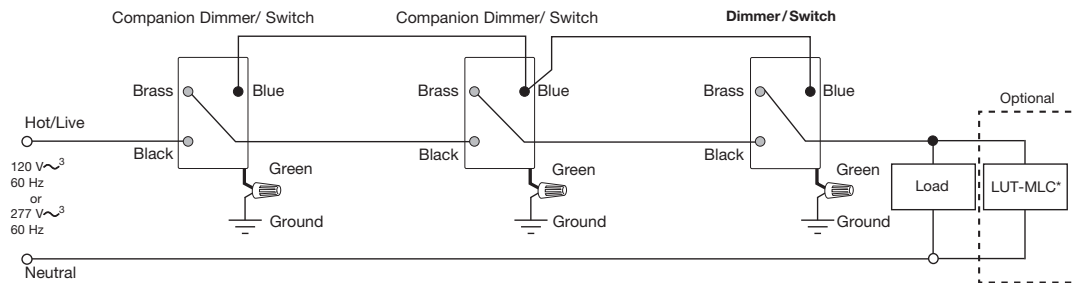
-8S-DV¹



* A LUT-MLC ensures proper function when fluorescent, CFL, or LED loads are used. Install the LUT-MLC inside a load fixture or in a separate J-box of the circuit.

Multi-Location Installation²

-8S-DV⁴: with MA-AS/MA-AS-277 or MSC-AS/MS-AS-277



¹ When using controls in single location installations, tighten the blue terminal without any wires attached. DO NOT connect the blue terminal to any other wiring or to ground.

² Up to 9 Maestro Companion Dimmers/Switches may be connected to the Maestro Wireless Dimmer/Switch. Total blue terminal wire length may be up to 250 ft (76 m).

³ 120 V~ : -6ND, -6ANS-120, -8ANS-120, -6ELV-120
 277 V~ : -6ANS-277, -8S-DV

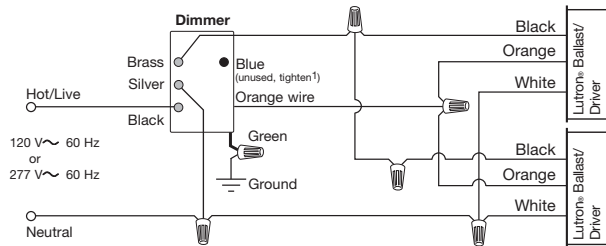
⁴ Requires MA-AS/MS-AS for 120 V~ applications, and MA-AS-277/MS-AS-277 for 277 V~ applications.

Job Name:	Model Numbers:
Job Number:	

Wiring Diagrams

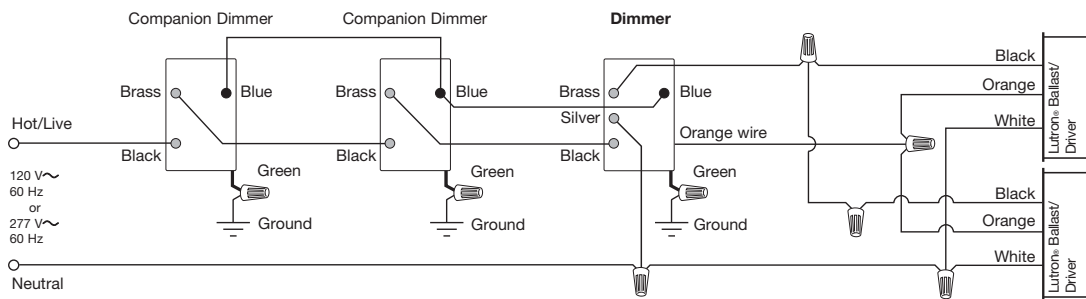
Single Location Installation with Neutral

-F6AN-DV



Multi-Location Installation with Neutral^{2,3}

-F6AN-DV with MA-R/MA-R-277 or MSC-AD/MS-AD-277⁴



¹ When using controls in single location installations, tighten the blue terminal. **DO NOT** connect the blue terminal to any other wiring or to ground.

² Up to 9 *Maestro* Companion Dimmers may be connected to the *Maestro Wireless* Dimmer. Total blue terminal wire length may be up to 250 ft (76 m).

³ Neutral wire Dimmers must be connected on the Load side of a multi-location installation.

⁴ Requires MA-R/MS-AD for 120 V applications, and MA-R-277/MS-AD-277 for 277 V applications.

Job Name:	Model Numbers:
Job Number:	

Maestro Wireless®

RF Local Controls

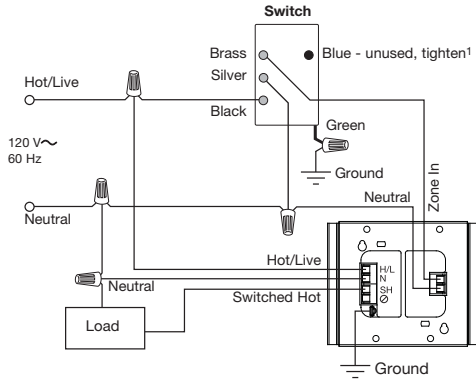
Designer-style: Maestro®

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Wiring Diagrams

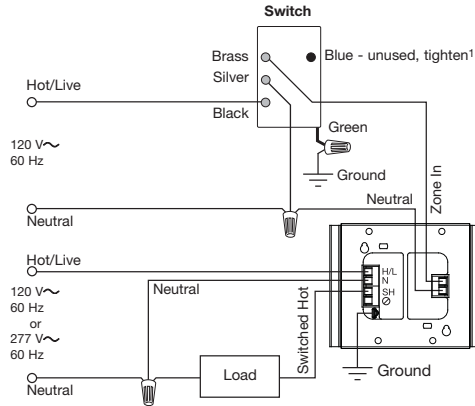
**Single Location Installation with Power Booster
 Single Feed**

-6ANS-120, -8ANS-120 with PHPM-SW-DV-WH



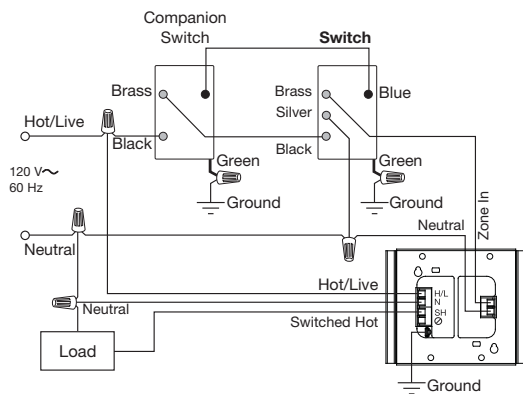
**Single Location Installation with Power Booster
 Dual Feed**

-6ANS-120, -8ANS-120 with PHPM-SW-DV-WH



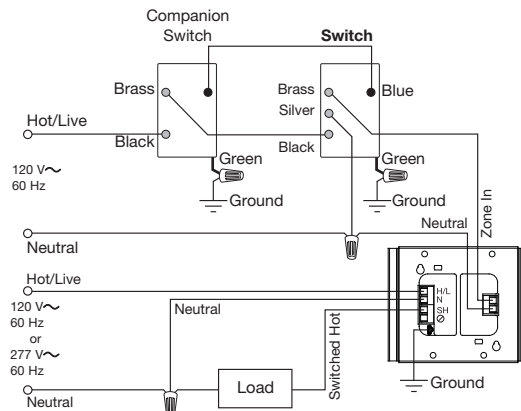
**Multi-Location Installation with Power Booster^{2,3}
 Single Feed**

-6ANS-120, -8ANS-120 with MA-AS/MSC-AS and PHPM-SW-DV-WH



**Multi-Location Installation with Power Booster^{2,3}
 Dual Feed**

-6ANS-120, -8ANS-120 with MA-AS/MSC-AS and PHPM-SW-DV-WH



¹ When using controls in single location installations, tighten the blue terminal. **DO NOT** connect the blue terminal to any other wiring or to ground.

² Up to 9 *Maestro* Companion Switches may be connected to the *Maestro Wireless* Switch. Total blue terminal wire length may be up to 250 ft (76 m).

³ Neutral wire Switches must be connected on the Load side of a multi-location installation.

Job Name:	Model Numbers:
Job Number:	

Maestro Wireless®

RF Local Controls

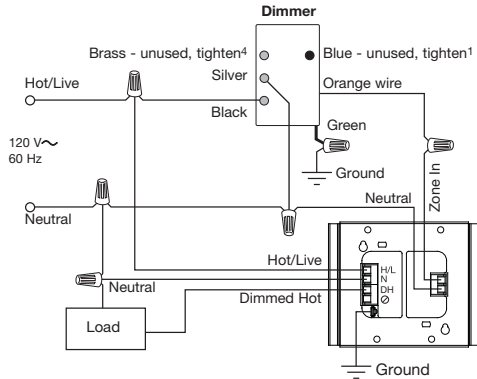
Designer-style: Maestro®

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Wiring Diagrams

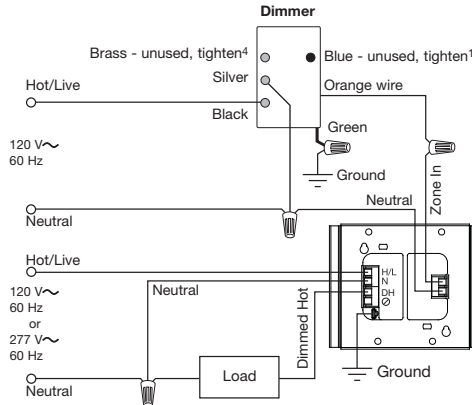
**Single Location Installation with Power Booster
 Single Feed**

-F6AN-DV with PHPM-3F-DV-WH, PHPM-PA-DV-WH, or PHPM-WBX-DV-WH



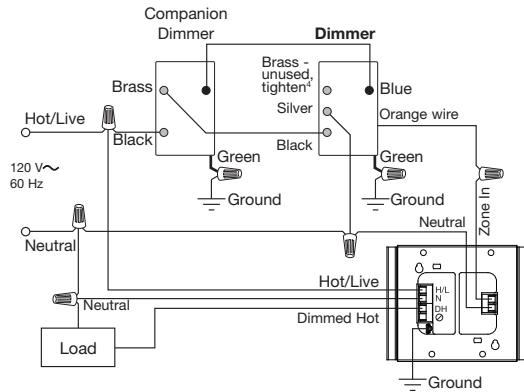
**Single Location Installation with Power Booster
 Dual Feed**

-F6AN-DV with PHPM-3F-DV-WH, PHPM-PA-DV-WH, or PHPM-WBX-DV-WH



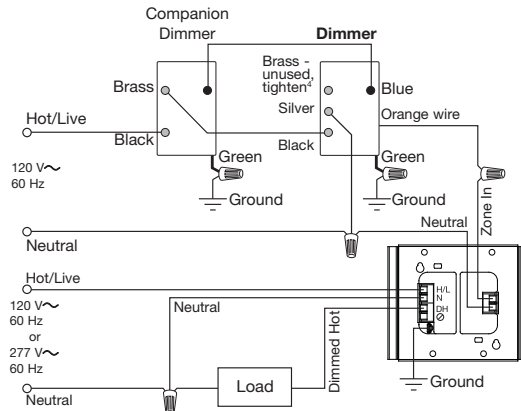
**Multi-Location Installation with Power Booster^{2,3}
 Single Feed**

-F6AN-DV with MA-R/MS-C-AD and PHPM-3F-DV-WH, PHPM-PA-DV-WH, or PHPM-WBX-DV-WH



**Multi-Location Installation with Power Booster^{2,3}
 Dual Feed**

-F6AN-DV with MA-R/MS-C-AD and PHPM-3F-DV-WH, PHPM-PA-DV-WH, or PHPM-WBX-DV-WH



¹ When using controls in single location installations, tighten the blue terminal. **DO NOT** connect the blue terminal to any other wiring or to ground.

² Up to 9 *Maestro* Companion Dimmers may be connected to the *Maestro Wireless* Dimmer. Total blue terminal wire length may be up to 250 ft (76 m).

³ Neutral wire Dimmers must be connected on the Load side of a multi-location installation.

⁴ When using a PHPM, tighten the brass (Sw Hot) terminal of the -F6AN-DV. **DO NOT** connect the brass terminal to any other wiring or to ground.

Job Name:	Model Numbers:
Job Number:	

Maestro Wireless®

RF Local Controls

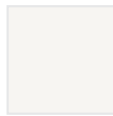
Designer-style: Maestro®

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Colors and Finishes

Gloss Finishes

Satin Finishes



White
WH



Ivory
IV



Hot
HT



Merlot
MR



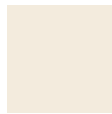
Plum
PL



Turquoise
TQ



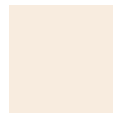
Almond
AL



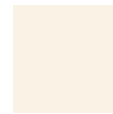
Light
Almond
LA



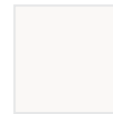
Taupe
TP



Eggshell
ES



Biscuit
BI



Snow
SW



Gray
GR



Brown
BR



Palladium
PD



Midnight
MN



Sienna
SI



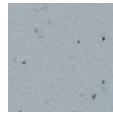
Terracotta
TC



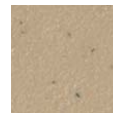
Black
BL



Greenbriar
GB



Bluestone
BG

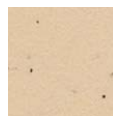


Mocha
Stone
MS



Goldstone
GS

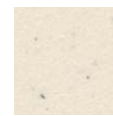
Due to printing limitations, colors and finishes shown cannot be guaranteed to perfectly match actual product colors.



Desert Stone
DS



Stone
ST



Limestone
LS

Metal Finish (wallplate only)



Stainless
Steel SS

When using Stainless Steel wallplates, it is recommended to order the controls in Black (BL) or Midnight (MN).

Job Name:	Model Numbers:
Job Number:	

Pico Wireless Control and Pedestal

The *Pico* Wireless Control is a flexible and easy to use device that allows the user to control *Maestro Wireless* dimmers, lamp dimmers, and switches. The *Pico* wireless control can function as a tabletop control on a pedestal, a lightweight handheld remote, a control clipped to a car visor, or it can be wall-mounted with or without a Lutron® Claro® faceplate, to mimic a traditional keypad. The battery operated control requires no external power or communication wiring.

Features

- Provides control for *Maestro Wireless* dimmers and switches, allowing users to:
 - Raise and lower lighting levels (MRF2-3BRL-L, MRF2-2BRL-L)
 - Recall favorite lighting levels
- Control available in 8 colors to suit a variety of applications
- Easy configuration for use as a handheld control, car visor control, wall-mount control, or table top control with use of the optional pedestal
- Simply installed in a 1-gang, 2-gang or multi-gang installation with the included wall mount adapter and mounting template
- Tabletop pedestal available in black and white
- Battery powered control requires no wiring
- Control provided with the battery included
- Can provide control to up to ten (10) *Maestro Wireless* dimmers, switches and lamp dimmers within a 100 ft (30 m) line of sight, or 30 ft (9 m) through walls, range

Model Numbers

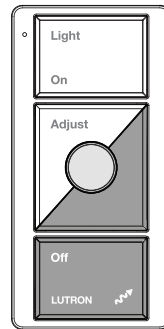
Pico wireless controls

- MRF2-3BRL-L-XX 3 buttons with Raise/Lower
- MRF2-3B-L-XX 3 buttons with Preset Button
- MRF2-3B-L-XX-E01 3 buttons with Welcome Button
- MRF2-2BRL-L-XX 2 buttons with Raise/Lower
- MRF2-2B-L-XX 2 buttons

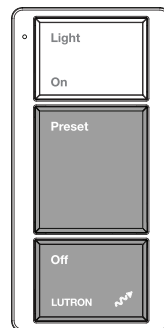
Pedestals

- L-PED1-XX Single pedestal
- L-PED2-XX Double pedestal

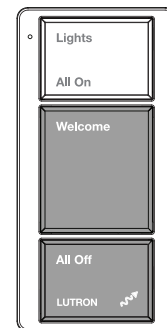
“XX” in the model number represents color/finish code.



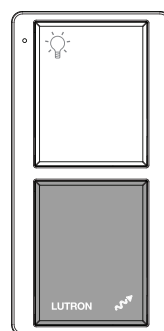
MRF2-3BRL-L-XX



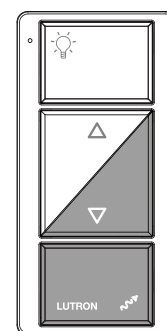
MRF2-3B-L-XX



MRF2-3B-L-XX-E01
Available Q2



MRF2-2B-L-XX
Available Q2



MRF2-2BRL-L-XX
Available Q2

Job Name:	Model Numbers:
Job Number:	



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USF School of Architecture & Community Design • 4202 E. Fowler Avenue, HMS 301 • Tampa, FL 33620

Maestro Wireless®

Pico™ Wireless Control and Pedestal

Control Specification

369-144 2 03.16.10

Specifications

Standards

- FCC Approved. Complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.
- Industry Canada Certified.

Power

- Operating Voltage 3 V_{DC}
- (1) CR2032 Battery (included)

Key Design Features

- Configurable for use as a handheld control, car visor control, wall-mount control, or table top control, with the use of the optional pedestal
- Fits inside a Lutron® Claro® wallplate or standard designer wallplate opening
- Can be wall mounted in a variety of configurations
 - Alone without a wallplate
 - Alone within a 1-gang wallplate
 - With another Pico wireless control in a 2-gang or multi-gang wallplate
 - With other designer style devices in a 2-gang or multi-gang wallplate
- For easy mounting to a wall use PICO-FP-ADAPT.
- Optional pedestal is available for converting the Pico wireless control to a tabletop control.
- 5-year battery life.

System Communication and Capacity

- Pico wireless controls communicate with Maestro Wireless dimmers and switches with radio frequency (RF) at 434 MHz FM
- Unique serial number prevents interference between systems
- Pico wireless controls can be assigned to control up to ten (10) Maestro Wireless dimmers, switches and lamp dimmers that are within a 100 ft (30 m) line of sight or 30 ft (9 m) through walls range

Environment

- Ambient operating temperature: 32 °F to 140 °F (0 °C to 60 °C)

Warranty

- 1-year limited warranty

Color / Finish Codes

Pico wireless control

Gloss Colors	Code
White/Gray*	WG
White	WH
Ivory	IV
Almond	AL
Light Almond	LA
Black	BL
Gray	GR
Brown	BR

* **Note:** On the MRF2-3BRL-L White/Gray Pico wireless controls, the preset button is silver, the top and raise button are white, and the bottom and lower buttons are gray. On the MRF2-2BRL-L White/Gray Pico wireless controls, the top and raise button are white, and the bottom and lower buttons are gray. On the MRF2-3B-L and MRF2-2B-L White/Gray Pico wireless controls, the top button is white and the preset and/or bottom buttons are gray. All other offerings have uniform button colors.

Pedestal

Gloss Colors	Code
White	WH
Black	BL

LUTRON® SPECIFICATION SUBMITTAL

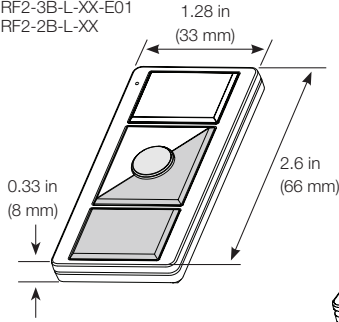
Page 2

Job Name:	Model Numbers:
Job Number:	

Dimensions

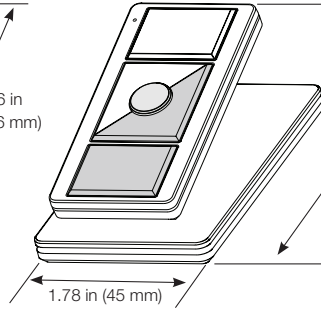
Pico wireless control

MRF2-3BRL-L-XX (shown)
 MRF2-3B-L-XX
 MRF2-3B-L-XX-E01
 MRF2-2B-L-XX



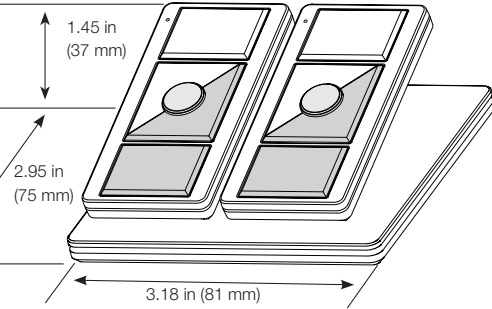
Single Pedestal

L-PED1-XX

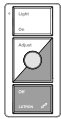


Double Pedestal

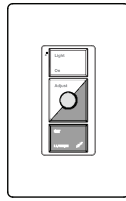
L-PED2-XX



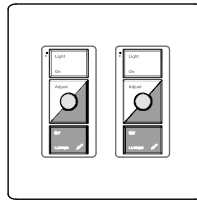
Wall Mounting Configurations:



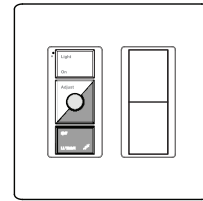
Pico wireless control without a wallplate



Pico wireless control with a 1-gang wallplate



Two Pico wireless controls with a 2-gang wallplate



Pico wireless control and existing device with a 2-gang wallplate

Claro® Wallplate Models

Model	Configuration
CW-1-XX	1-gang
CW-2-XX	2-gang
CW-3-XX	3-gang
CW-4-XX	4-gang

Claro Wallplate Colors

Color	Color Code
White	WH
Ivory	IV
Almond	AL
Light Almond	LA
Black	BL
Gray	GR
Brown	BR

Job Name:	Model Numbers:
Job Number:	

Wireless Wall-Mount Sensor

Lutron® wall-mounted occupancy and vacancy sensors are wireless battery-powered passive infrared (PIR) sensors that automatically control lights via RF communication to compatible dimming or switching devices. These sensors detect the heat from people moving within an area to determine when the space is occupied. The sensors then wirelessly transmit the appropriate commands to the associated dimming or switching devices to turn the lights on or off automatically. They combine both convenience and exceptional energy savings along with ease of installation.

Features

- Wireless occupancy sensor has 2 settings available: Auto-On/Auto-Off, and Manual-On/Auto-Off
- Vacancy model available to meet CA Title 24 requirements
- 10-year battery life design
- Passive infrared motion detection with exclusive Lutron XCT™ Technology
- 180° field of view:
 - Minor motion = 1500 ft² (139.4 m²)
 - Major motion = 3000 ft² (278.7 m²)
- 90° field of view:
 - Minor motion = 1225 ft² (113.8 m²)
 - Major motion = 2500 ft² (232.3 m²)
- Hallway version with long, narrow field of view:
 - Major motion = coverage of up to 150 ft (45.7 m)
- RoHS compliant
- Simple and intuitive adjustments available for Timeout, Activity, and Auto-On settings
- Accessible test buttons make setup easy
- Lens illuminates during test mode to verify ideal locations
- Up to 3 sensors can be added to each RF dimming or switching device for extended coverage
- Each sensor may be added to up to 10 compatible RF dimming and switching devices for spaces with multiple zones of lighting
- The sensor should be mounted within 60 ft (18.3 m) line of sight or 30 ft (9.1 m) through walls, of the associated dimming and switching receiving devices



Compatible RF Devices:

Communicates to the following wireless Lutron systems:

- Maestro® Wireless (MRF2)
- GRAFIK Eye® QS Wireless

Models Available:

- LRF2-OWLB-P-WH 434 MHz
180° Wall-Mount Occupancy/Vacancy Sensor
- LRF2-VWLB-P-WH 434 MHz
180° Wall-Mount Vacancy Sensor
- LRF2-OKLB-P-WH 434 MHz
90° Corner-Mount Occupancy/Vacancy Sensor
- LRF2-VKLB-P-WH 434 MHz
90° Corner-Mount Vacancy Sensor
- LRF2-OHLB-P-WH 434 MHz
Hallway Occupancy/Vacancy Sensor
- LRF2-VHLB-P-WH 434 MHz
Hallway Vacancy Sensor

LUTRON® SPECIFICATION SUBMITTAL

Page

Job Name:	Model Numbers:
Job Number:	

Radio Powr Savr™

Wireless Wall-Mount Occupancy and Vacancy Sensors

369-268 2 06.29.10

Specifications

Standards

- FCC IC
- Meets CA Title 24 requirements
- COFETEL

Environment

- Temperature: 32 °F - 104 °F (0 °C - 40 °C)
- For indoor use only

Power

- Operating voltage: 3 V⁻⁻⁻
- Operating current: 14 µA nominal
- Requires one CR 123 lithium battery
- 10-year battery life design
- Non-volatile memory (saved changes are stored during power loss)

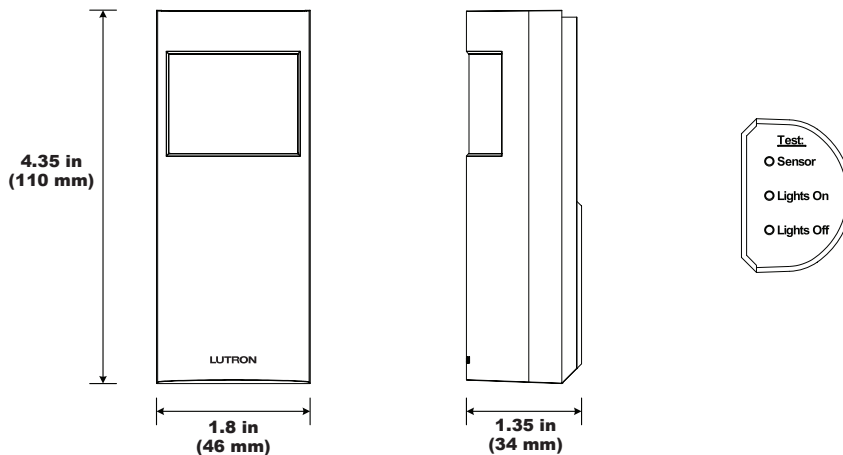
Sensor Coverage Test

- Dedicated test button
- Lens illuminates orange in response to motion during test mode and is visible from 150 ft (45.7 m)

Wireless Communication Test

- Dedicated test buttons
- Turn loads on and off

Dimensions



Timeout Options

- 1 minute
- 5 minutes
- 15 minutes *
- 30 minutes

Auto-On Options (Occupancy Version Only)

- "Enabled" * - Sensor turns lights ON and OFF automatically.
- "Disabled" - Lights must be turned ON manually from dimming or switching device. Sensor turns lights OFF automatically.

Sensitivity Options

- Low Activity* (⌘)
- Medium Activity (⌘)
- High Activity (⌘)

*-Default Settings

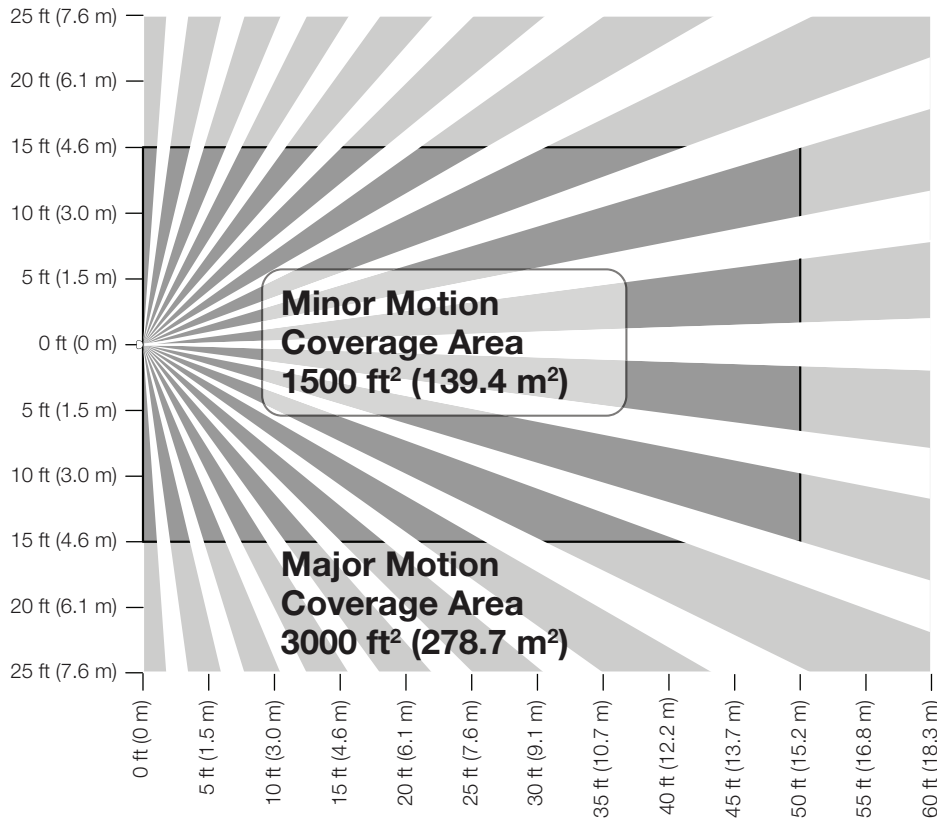
Job Name:	Model Numbers:
Job Number:	

Coverage Diagrams

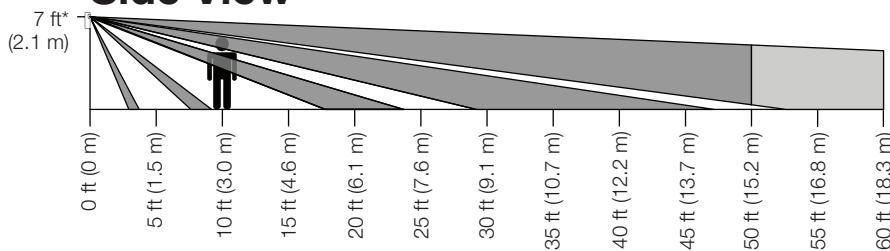
180° Wall-Mount Sensors

(Models: LRF2-OWLB-P-WH and LRF2-VWLB-P-WH)

Top View



Side View



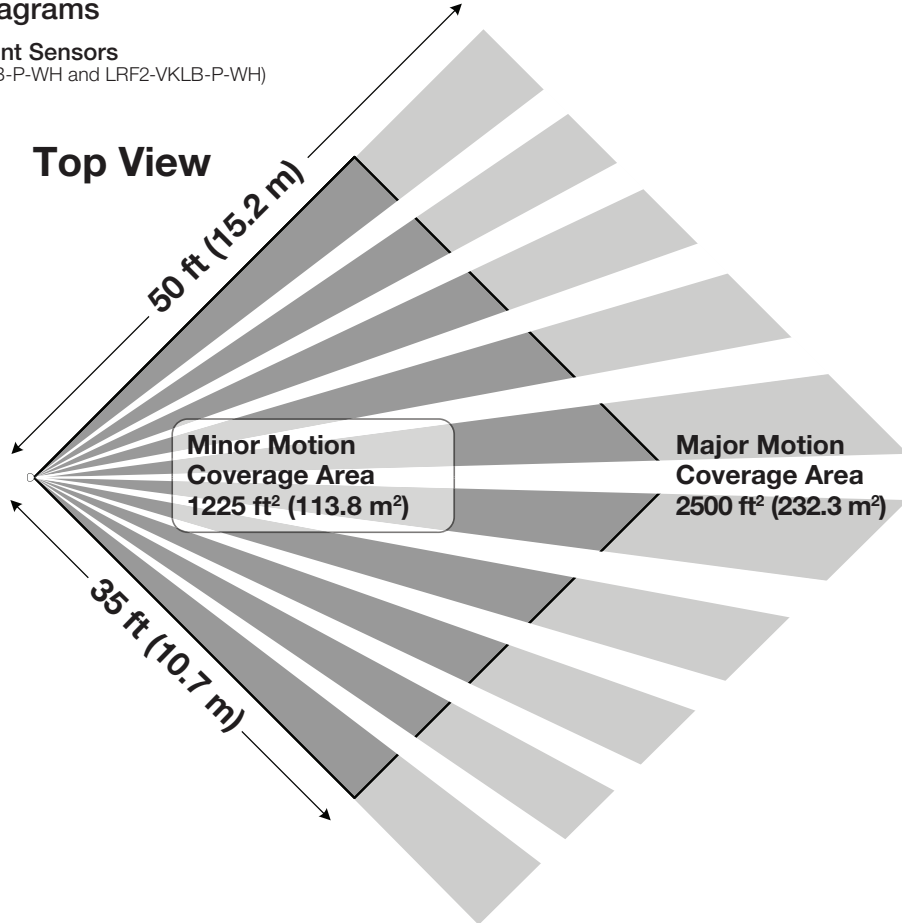
* Sensor mounting shown at 7 ft (2.1 m). Mounting height should be between 6 and 8 ft (1.6 and 2.4 m).

Job Name:	Model Numbers:
Job Number:	

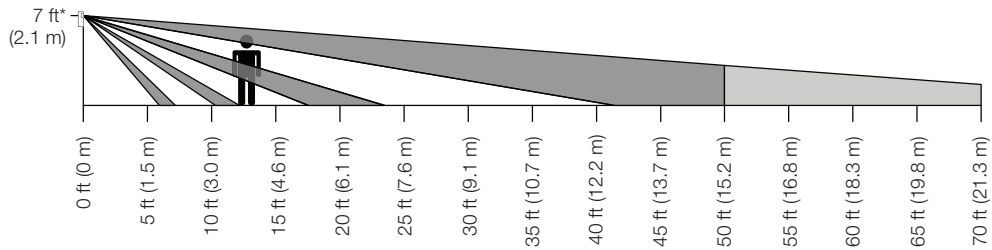
Coverage Diagrams

90° Corner-Mount Sensors
 (Models: LRF2-OKLB-P-WH and LRF2-VKLB-P-WH)

Top View



Side View



* Sensor mounting shown at 7 ft (2.1 m). Mounting height should be between 6 and 8 ft (1.6 and 2.4 m).

Job Name:	Model Numbers:
Job Number:	

Coverage Diagrams

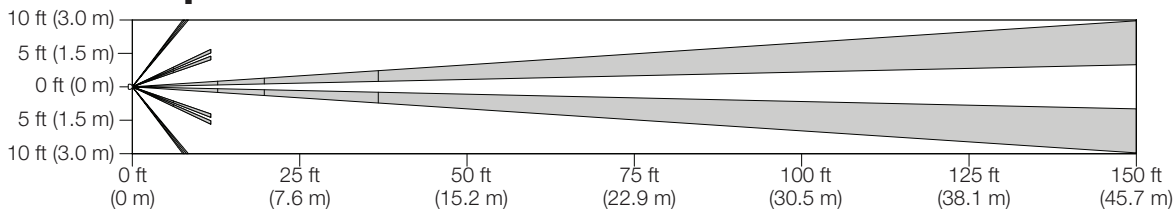
Hallway Sensors

(Models: LRF2-OHLB-P-WH and LRF2-VHLB-P-WH)

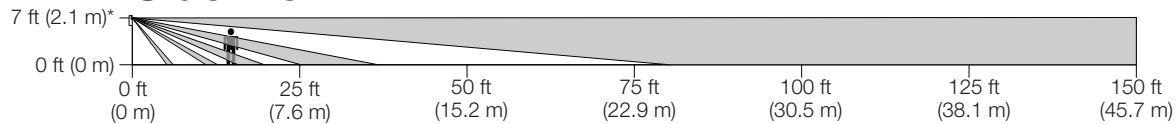
Maximum Recommended Hallway Length

Width of Hall	Length of Hall
6 ft (1.6 m) or less	50 ft (15.2 m)
8 ft (2.4 m)	100 ft (30.5 m)
10 ft (3.0 m) or more	150 ft (45.7 m)

Top View



Side View



* Sensor mounting shown at 7 ft (2.1 m). Mounting height should be between 6 and 8 ft (1.6 and 2.4 m) and centered within hallway.

- Designed for mounting at end of hallway with view down length of hall.
- Detection at longer distances is best for motion occurring at right angles to the sensor.
- Up to three sensors can be used for additional coverage.

Job Name:	Model Numbers:
Job Number:	

Installation Overview

Sensor Placement

- The sensor's mounting height should be between 6 and 8 ft (1.6 and 2.4 m)
- The sensor's ability to detect motion requires line-of-sight of room occupants. The sensor must have an unobstructed view of the room. **DO NOT** mount behind or near tall cabinets, shelves, hanging fixtures, etc. The sensor cannot see through glass objects such as patio or shower doors.
- Hot objects and moving air currents can affect the sensor's performance. To ensure proper operation, the sensor should be mounted at least 4 ft (1.2 m) away from light bulbs and HVAC vents.
- The sensor's performance depends on a temperature differential between the ambient room temperature and that of room occupants. Warmer rooms may reduce the sensor's ability to detect occupants.
- The sensor should be mounted within 60 ft (18.3 m) line of sight or 30 ft (9.1 m) through walls, of the associated dimming and switching receiving devices.

Set Up Sensor with Receiving Device

GRAFIK Eye® QS Wireless

- Press and hold "Lights On" and "Lights Off" buttons on sensor simultaneously for 3 seconds to enter set-up
- Press and hold on/off button on receiving device for 3-6 seconds
- Load will flash 3 times upon successful association
- Press and hold "Lights On" and "Lights Off" buttons simultaneously for 3 seconds to exit set-up

Maestro Wireless®

- Press and hold on/off button on receiving device for 6 seconds
- Press and hold "Lights Off" button on sensor for 6 seconds
- Load will flash 3 times upon successful association

Advanced Set-Up

(Adjusting Timeout, Activity and Auto-On)

Check Settings:




- Press and release desired button;
- LED indicates current setting

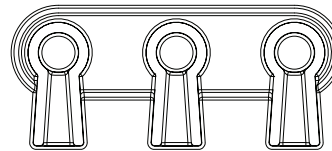
Change Settings:

- Press and hold desired button until LED flashes
- Press button again to select setting
- Press and hold button until LED turns on solid to save setting

Change Settings (1-minute timeout):

- Press and hold timeout button (~10 sec) until all 3 LEDs flash
- Press and hold button until all 3 LEDs turn on solid to save 1-minute timeout setting

	Timeout	Activity	Auto-On
<input type="radio"/>	30 min		Enabled
<input type="radio"/>	15 min		
<input type="radio"/>	5 min		Disabled



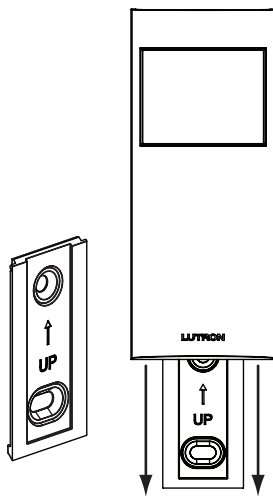
Default Settings	
Timeout	15 Minutes
Activity	Low Activity (♣)
Auto-On	Enabled

Job Name:	Model Numbers:
Job Number:	

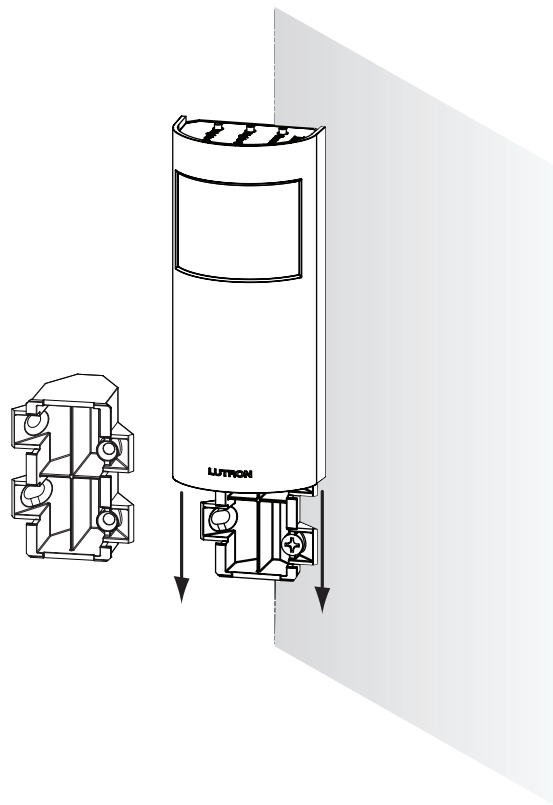
Mounting

- 180° and hallway sensors mount directly to wall with mounting bracket (included). See figure below.
- 90° sensors mount directly in corner or on wall offset away from corner with mounting bracket (included). See figure below.
- Temporary mounting is recommended to test sensor coverage and wireless communication before permanently installing the sensor.
 - Temporary mounting: 3M™ Command™ adhesive strips are provided for temporarily mounting and testing the sensor. These strips are designed for easy, damage-free removal and are not reusable.
 - Permanent mounting: Mounting bracket, screws and anchors provided to mount sensor.

180° Wall-Mount Sensor & Hallway Sensor



90° Corner-Mount Sensor



3M and Command are trademarks of 3M Company.

LUTRON® SPECIFICATION SUBMITTAL

Page

Job Name:	Model Numbers:
Job Number:	



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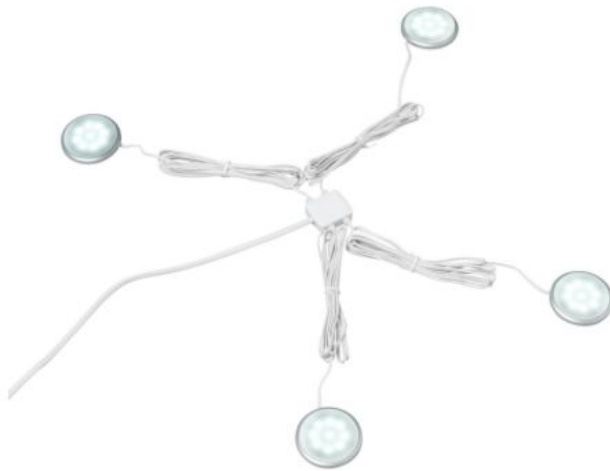
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DIODER

Multipurpose lighting, white

\$39.99 / 4 pack

Article Number: 001.194.24

Uses LEDs, which consumes up to 80% less energy and last 20 times longer than incandescent bulbs. [Read more](#)

Buy online Save to list

Buy at your local store

Choose Ok

Store selection may vary and prices may differ from those online.

Assembly instructions

[DIODER Multipurpose lighting](#) (PDF)

Product information



DIODER
Multipurpose lighting
\$39.99

Package measurement and weight

Packages: 1
Article Number: 001.194.24
Width: 4 3/4"
Height: 1 3/4"
Length: 11"
Weight: 1lb
Quantity: 1

Article Number: 001.194.24
Width: 12 cm
Height: 4 cm
Length: 28 cm
Weight: 0.4 kg
Quantity: 1

Good to know

Transformer electronic, fixed plug-in.
Mounting screws and double-sided tape included.
Includes: 4 light disc (dia. 2 1/4") with wires (length 2.5 yds) for connection between light disc and junction box, 1 junction box and 1 connection cord (length 2.5 yds).
Energy consumption: 8.0W.
Built-in LED light bulb.
LED life time approx. 20,000 hours.
Light colour; warm white (2700 Kelvin).

Why the low price?

Lighting is more fun when the price is lower

DIODER is a series of decorative lighting that you can put, well, anywhere you like and however you like. You can put strips and spotlights with built-in diodes that change color in your bookshelves or around the frames of your pictures and mirrors. Our

More Bookcase lighting



[Go to Bookcase lighting](#)

DIODER Multipurpose lighting - IKEA

8/2/11 3:18 PM

Key features

- Uses LEDs, which consumes up to 80% less energy and last 20 times longer than incandescent bulbs.
- LED emits low heat and can be used in narrow spaces such as drawers, shelves and wardrobes.

Designer:

IKEA of Sweden

Product dimensions

Diameter: 2 "
 Package quantity: 4 pack

Diameter: 5.8 cm
 Package quantity: 4 pack

This product requires assembly
[Download assembly instructions.](#)


Environment

Special waste handling may be required. Please contact your local authorities for more information.


idea was to make it playful and fun for you to create atmosphere and personality in your home. That's why we lowered the price substantially on DIODER. It becomes even more fun that way.

Product description


Polycarbonate plastic



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Home / Bathroom / Bathroom lighting

GODMORGON

Vanity light, aluminum

\$69.99

Article Number: 901.921.70

Provides an even light. Good for lighting the area around the mirror and the sink.

[Read more](#)



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Buy at your local store

 Ok

Store selection may vary and prices may differ from those online.

Assembly instructions

[GODMORGON Vanity light](#) (PDF)

Product information



GODMORGON
Vanity light
\$69.99

Package measurement and weight

Packages: 1
Article Number: 901.921.70
Width: 5 1/2"
Height: 1 5/8"
Length: 39 5/8"
Weight: 4lb
Quantity: 1

Article Number: 901.921.70
Width: 14 cm
Height: 4 cm
Length: 101 cm
Weight: 2 kg
Quantity: 1

Good to know

Bulb included.
Use an authorized electrician for consultation and installation.
Approved for IP44.
Grounded.
Designed for GODMORGON bathroom series.
Tested and approved for bathroom use.

Care instructions

Fluorescent tube T5 Max 21W

Product description

Main parts/ Bracket: Aluminum
Diffuser: Polycarbonate plastic

More Bathroom lighting



[Go to Bathroom lighting](#)

GODMORGON Vanity light - IKEA

8/2/11 3:14 PM

Key features

- Provides an even light. Good for lighting the area around the mirror and the sink.

Designer:

C Martin/M Elebäck

Product dimensions


Length: 39 ¼ "
 Max load/shelf: 141 oz

Length: 100 cm
 Max load/shelf: 4 kg


This product requires assembly
[Download assembly instructions.](#)

Environment


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HEMMA

Cord set, white

\$3.99

Article Number: 101.758.10

[Read more](#)

In compliance with California Title 20 regulations, product prices and features may vary in the state of California. Please see your local store for details
[More information](#)

1

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Complementary Products



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Assembly instructions

[HEMMA Cord set](#) (PDF)

Matching Products

Complementary Products

Product information



HEMMA
Cord set
\$3.99

Good to know

Light bulb sold separately.
Shade is sold separately.
2 ceiling hooks are included.
Can be connected to the IKEA 365+ SÅNDA track system.

Package measurement and weight

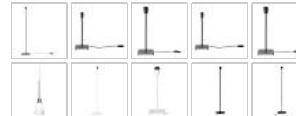
Packages: 1
Article Number: 101.758.10
Width:
Height:
Length:
Weight: 1lb
Quantity: 1

Article Number: 101.758.10
Width: cm
Height: cm

Product description

Ceiling cord set: PVC
Bracket: Polyamide

More Bases & cords



[Go to Bases & cords](#)

Find the Style

[Show matching products](#)

HEMMA Cord set - IKEA

8/2/11 3:19 PM

Length: cm
 Weight: 0.4 kg
 Quantity: 1

Designer:
 IKEA of Sweden

Product dimensions
 Cord length: 15 ' 5 "
 Max. load: 4 lb

Cord length: 4.7 m
 Max. load: 2 kg

This product requires assembly
[Download assembly instructions.](#)

Environment

Special waste handling may be required.
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Home / Living room / Ceiling lamps / Pendants



IKEA 365+ LUNTA

Pendant lamp, glass, white

\$39.99

Article Number: 101.411.46

The pleated shape of the shade provides a glare free light. Gives a diffused light; good for spreading light into larger areas of a room. [Read more](#)

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Assembly instructions

[IKEA 365+ LUNTA Pendant lamp](#) (PDF)

Matching Products

Product information



IKEA 365+ LUNTA
Pendant lamp
\$39.99

Good to know

Also available in dia. 4 3/8".
Can be connected to the IKEA 365+ SÅNDA track system.
Light bulb sold separately. IKEA recommends SPARSAM low-energy bulb E26 11W.

Package measurement and weight

Packages: 1
Article Number: 101.411.46
Width: 8 1/4"
Height: 8 1/4"
Length: 17 3/8"
Weight: 7lb
Quantity: 1

Article Number: 101.411.46
Width: 21 cm
Height: 21 cm
Length: 44 cm
Weight: 3.2 kg
Quantity: 1

Product description

Ceiling cup: Polycarbonate plastic
Shade: Glass

More Pendants



[Go to Pendants](#)

Find the Style

[Show matching products](#)

IKEA 365+ LUNTA Pendant lamp – IKEA

8/2/11 3:19 PM

Key features

- The pleated shape of the shade provides a glare free light.
- Gives a diffused light; good for spreading light into larger areas of a room.

Designer:

A Nilsson/H Preutz/T Eliasson

Product dimensions


Diameter: 8 "
Total height: 79 "
Cord length: 59 "

Diameter: 20 cm
Total height: 200 cm
Cord length: 150 cm


This product requires assembly
[Download assembly instructions.](#)

Environment


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INREDA

Spotlight, silver color

\$44.99 / 4 pack

Article Number: 101.921.07

LED emits low heat and can be used in narrow spaces such as drawers, shelves and wardrobes. [Read more](#)

Save to list

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Complete the product



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Store selection may vary and prices may differ from those online.

Assembly instructions
[INREDA Spotlight](#) (PDF)

More Models



Complementary Products

Product information



INREDA
Spotlight
\$44.99

Package measurement and weight

Packages: 1
Article Number: 101.921.07
Width: 7 5/8"
Height: 1 5/8"
Length: 9 3/4"
Weight: 1lb
Quantity: 1

Article Number: 101.921.07
Width: 19 cm

Good to know

Frame for easy surface mounting included. Can be mounted on all shelves. Toolkit for recessed installation in BESTÅ shelf included. **WARNING!** Toolkit for recessed installation is only for use with BESTÅ! Fits all BESTÅ frames that are 15 3/4" deep. May be completed with other lamps in the same series. To be used with ANSLUTA cord system, sold separately; possible to connect together into a system of up to 10 units. Energy consumption: 7.5W. LED life time approx. 20,000 hours. Light colour; warm white (2700 Kelvin). Built-in LED light bulb.

More INREDA lighting series



[Go to INREDA lighting series](#)

More Bookcase lighting



[Go to Bookcase lighting](#)

INREDA Spotlight – IKEA

8/2/11 3:18 PM

Height: 4 cm
Length: 25 cm
Weight: 0.6 kg
Quantity: 1

Product description

Bracket: Steel, Paint
Cover: Aluminum
Diffuser: Polycarbonate plastic

Key features


- LED emits low heat and can be used in narrow spaces such as drawers, shelves and wardrobes.
- Uses LEDs, which consumes up to 80% less energy and last 20 times longer than incandescent bulbs.

Designer:


Mikael Warnhammar

Environment


Special waste handling may be required. Please contact your local authorities for more information.



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Home / Living room / Wall lamps / Wall spotlights



JANSJÖ

Clamp spotlight, black ~~\$29.99~~

\$14.99

Article Number: 801.696.36

Slim and lightweight. Easy to place in small spaces and move to wherever you need light. [Read more](#)

Save to list

Sorry, this product is not for sale on our website, check if it is available in your local store.

Buy at your local store

Choose Ok

Store selection may vary and prices may differ from those online.

Assembly instructions

[JANSJÖ Clamp spotlight](#) (PDF)

More Models



Matching Products

Product information



JANSJÖ
Clamp spotlight
\$14.99

Package measurement and weight

Packages: 1
Article Number: 801.696.36
Width: 4 3/4"
Height: 1 3/4"
Length: 6 1/4"
Weight: 1lb
Quantity: 1

Article Number: 801.696.36
Width: 12 cm

Good to know

Clamping range up to 1 1/4".
Energy consumption: 4.2W.
Built-in LED light bulb.
May be completed with other lamps in the same series.
LED life time approx. 20,000 hours.
Light colour; warm white (2700 Kelvin).

Product description

Arm: Steel, Paint
Shade: Aluminum, Paint
Base: ABS plastic
Weight: EVA plastic, Cast iron

More JANSJÖ series



[Go to JANSJÖ series](#)

More Wall spotlights



[Go to Wall spotlights](#)

Find the Style

JANSJÖ Clamp spotlight – IKEA

8/2/11 3:16 PM

Height: 5 cm
Length: 16 cm
Weight: 0.3 kg
Quantity: 1

Key features

- Slim and lightweight. Easy to place in small spaces and move to wherever you need light.
- Adjustable arm for easy directing of light.
- Uses LEDs, which consumes up to 80% less energy and last 20 times longer than incandescent bulbs.

Designer:

A Eferlund/J Jelinek

Product dimensions

Height: 16 "
Cord length: 16 ' 3 "

Height: 40 cm
Cord length: 495 cm

This product requires assembly
[Download assembly instructions.](#)

Environment

Special waste handling may be required.
Please contact your local authorities for more information.

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Home / Workspace / Work lamps



JANSJÖ

Work lamp, silver color

\$12.99

Article Number: 101.287.34

Gives directional light; good focus light.
Adjustable arm for easy directing of light.

[Read more](#)

Save to list

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Choose

Store selection may vary and prices may differ from those online.

Assembly instructions

[JANSJÖ Work lamp](#) (PDF)

Matching Products

Product information



JANSJÖ
Work lamp
\$12.99

Good to know

Energy consumption: 4.2W.
Built-in LED light bulb.
May be completed with other lamps in the same series.
LED life time approx. 20,000 hours.
Light colour; warm white (2700 Kelvin).

Package measurement and weight

Packages: 1
Article Number: 101.287.34
Width: 4 7/8"
Height: 1 3/4"
Length: 10 5/8"
Weight: 2lb
Quantity: 1

Article Number: 101.287.34
Width: 12 cm
Height: 5 cm
Length: 27 cm
Weight: 1.1 kg
Quantity: 1

Product description

Arm: Steel, Paint
Shade: Aluminum, Paint
Base: ABS plastic
Weight: EVA plastic, Cast iron

More JANSJÖ series



[Go to JANSJÖ series](#)

More Work lamps



[Go to Work lamps](#)

Find the Style

[Show matching products](#)

JANSJÖ Work lamp – IKEA

8/2/11 3:15 PM

Key features

- Gives directional light; good focus light.
- Adjustable arm for easy directing of light.
- Uses LEDs, which consumes up to 80% less energy and last 20 times longer than incandescent bulbs.

Designer:

A Eferlund/J Jelinek

Product dimensions

Height: 24 "
 Base diameter: 5 "
 Cord length: 6 ' 7 "


Height: 60 cm
 Base diameter: 12 cm
 Cord length: 2.0 m

This product requires assembly
[Download assembly instructions.](#)

Environment

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FEATURES & SPECIFICATIONS

INTENDED USE — For use with housings L7X, L7XR, and LC6.

LED module for use in retrofit / remodel or new construction applications where energy savings, long-life, and functional delivered light levels are required. The Reality LED module provides 80% energy savings over the 65W BR30 and replicates the beam pattern and useful light levels of these fixtures. It will maintain at least 70% light output for 50,000 hours in a typical IC environment. The Reality LED module fits most common 6" cans for retrofit applications and can be ordered with L7X, L7XR, or LC6 for new construction. The Reality LED module is the most economical means to create a well lit environment with exceptional energy efficiency and near zero maintenance.

CONSTRUCTION — Rugged, one-piece, die-cast heat sink design for optimal thermal management.

Wet location rated lens is tightly fitted to the housing to reduce the ingress of dust.

Twin torsion springs ensure easy installation.

Utilizes 3000K color temperature.

OPTICS — Precisely designed elliptical upper reflector and a patented micro prism lens provides a 38 degree full width half max (FWHM) beam angle. Lower splay recesses optical system into the ceiling to prevent glare and provide a traditional look.

ELECTRICAL — Utilizes high-brightness LEDs on a metal core circuit board, ensuring cool-running operation. On-board circuitry to ensure protection against wiring errors.

High-efficiency driver mounted on the module. Primary power disconnect provided for simple connection to a standard Edison (E26) base socket.

Full range dimming is standard; dimming down to 25%. Optimal dimming performance is achieved when connected to an electronic low-voltage (ELV) dimmer; See page 2 for recommended dimmers.

Standard input wattage is 12.0 W, 50 lumens per watt.

INSTALLATION — Suitable for installation in standard-height rough-in sections. Fits into most popular 6" housings.

LISTINGS — CSA certified for use in the US and Canadian safety standards. Wet location listed.

WARRANTY — Three year limited warranty covering defects in materials and workmanship, including LED and driver.

Note: Specifications subject to change without notice.

Catalog Number
Notes
Type

6" LED Module

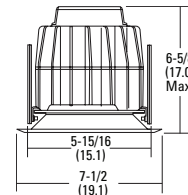


IC/Non-IC
Retrofit



Specifications

- Aperture: 4-3/8 (11.1)
 - Ceiling opening: As rough-in
 - Overlap trim: 7-1/2 (19.1)
 - Height: 6-5/8 (17.0) max.
 - Weight (module only): 2.8 lbs.
 - Weight (module and carton): 3.96 lbs.
- All dimensions are inches (centimeters) unless otherwise noted.



ORDERING INFORMATION

For shortest lead times, configure products using **bolded options**.

Example: REAL6 D6MW

Series/Finish	Lumen output ¹	Color temperature	Voltage	Options ²
Series	(blank) 600 lumens	(blank) 3000K	(blank) 120V	PFMW Matte white plastic flange ring
REAL6 D6 6" retrofit module		27K 2700K		PFBL Black plastic flange ring
Finish		35K 3500K		
MW Matte white		40K 4000K		
A Clear diffuse				
AZ Clear specular				
BN Brushed nickel				
BLZ Black specular				
BZA Antique bronze				
ORB Oil-rubbed bronze				
WT Wheat diffuse				

Accessories: Order as separate catalog number.

TSA6	Makes non-bracket housings compatible with the LED module ships as units, J6 or J25
FL2LED	Makes L7XF housings compatible with the LED module
REAL HW Kit	Enables a permanent conversion to an LED source and Title 24 compliant
CTR6	6" goof ring, white



TSA6
Torsion spring adapter



REAL HW Kit
REAL HW Hardware Kit



FL2LED
Fluorescent Adapter Kit

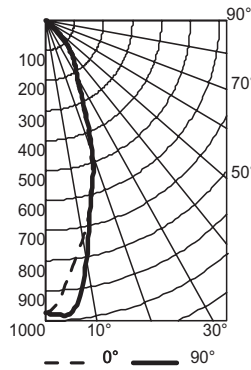
Notes

- 1 Total system delivered lumens.
- 2 See Real6 New Construction/Remodel Spec Sheets for use with dedicated LED Housings.

6 Series REALITY™ 6" LED

PHOTOMETRICS

REAL6 D6MW, 3000K LEDS, 600 delivered lumens, 12.0 input watts, test no. LTL 18880



CP Summary

Beam Angle	0°	90°
0°	974	974
5°	868	981
15°	616	608
25°	296	311
35°	178	175
45°	88	84
55°	15	13
65°	5	5
75°	3	3
85°	0	0
90°	0	0

Coefficients of Utilization

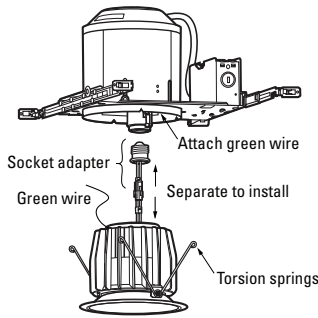
pc	pw	20%								50%									
		80%			70%			50%			80%			70%			50%		
0	119	119	119	116	116	116	111	111	111	111	111	111	111	111	111	111	111	111	111
1	113	110	108	108	106	104	104	102	101	101	101	101	101	101	101	101	101	101	101
2	108	103	98	101	97	94	98	94	92	92	92	92	92	92	92	92	92	92	92
3	102	95	90	94	89	85	91	87	84	84	84	84	84	84	84	84	84	84	84
4	97	89	83	88	83	79	86	81	78	78	78	78	78	78	78	78	78	78	78
5	92	83	77	82	77	73	81	76	72	72	72	72	72	72	72	72	72	72	72
6	87	78	72	77	72	68	76	71	67	67	67	67	67	67	67	67	67	67	67
7	83	74	67	73	67	63	72	66	63	63	63	63	63	63	63	63	63	63	63
8	79	69	63	69	63	59	68	63	59	59	59	59	59	59	59	59	59	59	59
9	75	66	60	65	60	56	64	59	55	55	55	55	55	55	55	55	55	55	55
10	72	62	57	62	56	53	61	56	52	52	52	52	52	52	52	52	52	52	52

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	400	66.6	66.6
0° - 40°	510	84.9	84.9
0° - 60°	592	98.6	98.6
0° - 90°	600	100.0	100.0
90° - 180°	0	0.0	0.0
0° - 180°	600	100.0	100.0

Efficiency: 100.0%

INSTALLATION, DIMMING AND ENERGY DATA



Retrofit installation with Edison base socket adapter

ENERGY DATA*	
Min. starting temp	-30°C (-22°F)
EMI/RFI	FCC Title 47 CFR, Part 15, Class B
Sound rating	Class A standards
Input voltage	120V
Min. power factor	0.95
Input frequency	50/60 Hz
Max. THD	30%
Rated wattage	12.0W
Input power	12.0W
Input current	125ma

*Values at non-dimming line voltage.

COMPATIBLE DIMMER SWITCHES

MANUFACTURER	PART NO.
LUTRON	DVELV-300
	DVELV-303
	MAELV-600
	MIRELV-600
	NTELV-300
	NTELV-600
	SELV-300
	VTELV-600M
LEVITON	6615-P
	ATE04-1L
	ATE06-1L
	VPE04-1L
VPE06-1L	
SYNERGY	ISD ELV



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**SECTION 262726
WIRING DEVICES
Wireless Maestro**

This specification is dated **March 31, 2010** and supersedes all previous Wireless Maestro specifications.

This section includes editing notes to assist the user in editing the section to suit project requirements. These notes are included as hidden text, and can be revealed or hidden by one of the following methods:

- Microsoft Word: From the pull-down menus select TOOLS, then OPTIONS. Under the tab labeled VIEW, select or deselect the HIDDEN TEXT option.
- Corel WordPerfect: From the pull-down menus select VIEW, then select or deselect the HIDDEN TEXT option.

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PART 1 – GENERAL

PART 1.1SUMMARY

- A. Section Includes:
 1. Wiring Devices
 - a. Dimmers
 - b. Switches
 - c. Wireless Occupancy/Vacancy Sensor Controls
 - d. Wireless Daylight Sensors
 - e. Wireless Controllers
- B. Related Sections:
 1. Section [260923 – Lighting Control Devices] [_____ - _____]

PART 1.2REFERENCES

- A. 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.
- B. ASTM International (ASTM)
 1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.
- C. Canadian Standards Association (CSA) .
 1. CSA C22.2 # 14 Industrial Control Equipment
 2. CSA C22.2 # 184 Solid-State Lighting Controls
 3. CSA C22.2 #184.1 Solid State Dimming Controls.
 4. CSA C22.2 # 156 Solid-State Speed Controls
 5. CSA C22.2 # 42.1-00 Cover Plates for Flush Mounted Wiring Devices
 6. CSA C22.2 # 42-99 General Use Receptacles

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Maestro Wireless

WIRING DEVICES
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- D. International Organization for Standardization (ISO)
 - 1. 9001:2000 – Quality Management Systems.
- E. National Electrical Manufacturers Association (NEMA)
 - 1. WD1 (R2005) – General Color Requirements for Wiring Devices.
 - 2. WD6 – Dimensional Specifications
- F. Norma Oficial Mexicana (NOM).
 - 1. NOM-003-SCFI Productos eléctricos - Especificaciones de seguridad (Electrical products - Safety Specifications)
- G. Underwriters Laboratories, Inc. (UL) :
 - 1. UL20 – Standard for Safety for General-Use Snap Switches.
 - 2. UL244A – Standard for Solid-state Controls for Appliances.
 - 3. UL508 (1999) - Standard for Industrial Control Equipment.
 - 4. UL514C – Standard for Non-metallic Outlet Boxes, Flush Device Boxes, and Covers.
 - 5. UL1472 (1996) - Solid-State Dimming Controls.
- H. Federal Communications Commission (FCC) rules – Part 15: Radio Frequency Devices.

PART 1.3 SYSTEM DESCRIPTION

- A. Wall box mounted: dimmers, switches, and screwless, seamless wall plates.
- B. Plug-in modules.
- C. Wireless devices: wireless controllers, occupancy/vacancy sensors, and daylight sensors.

PART 1.4 SUBMITTALS

- A. Submit under provisions of Section [013300.] [_____.]
- B. Specification Conformance Document: Indicate whether the submitted equipment:
 - 1. Meets specification exactly as stated.
 - 2. Meets specification via an alternate means and indicate the specific methodology used.
- C. Shop Drawings; include:
 - 1. Manufacturer's wiring and installation information for wired devices and wall plate kits.
- D. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

PART 1.5 QUALITY ASSURANCE

- A. Manufacturer: Minimum [10] [] years experience in manufacture of wall box lighting control products.

- B. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
- C. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.
- D. Wiring Devices and Wall Box Lighting Control:
 - 1. Listed and certified by [UL] [CSA] [NOM] specifically for the required loads. Provide evidence of compliance upon request.
- E. Wireless occupancy/vacancy, daylight sensors and plug-in modules shall be tested and comply with the limits for a Class B device, pursuant to part 15 of the FCC rules.
- F. Wireless occupancy/vacancy, daylight sensors and plug-in modules shall comply with Canadian ICES-003.

PART 1.6PROJECT CONDITIONS

- A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 - 1. Ambient temperature: 0 degrees to 40 degrees C (32 degrees to 104 degrees F).
 - 2. Relative humidity: Maximum 90 percent, non-condensing.
 - 3. Lighting controls must be protected from dust during installation.

PART 1.7WARRANTY

- A. Provide manufacturer's full 1 year warranty.
- B. [Provide Manufacturer's 8 Year Limited Parts Warranty and 2 Year Labor Coverage:
 - 1. 8-year limited parts warranty for the replacement of defective Lutron Lighting System Components from the date of system startup completion and 2-year 100 percent labor coverage from the date of the system startup completion.]
- C. [Provide Manufacturer's Support and Maintenance Plan for [8] [] years covering 100 percent parts and 100 percent labor and additional benefits as described below beginning 2 years after system startup completion.]
 - 1. Silver Level Support and Maintenance Plan, Includes:
 - a. 100 Percent Parts for Lutron Lighting System Components
 - b. 100 Percent Labor Coverage for Troubleshooting and Diagnosis of Lighting Issues
 - c. 24 Hours Per Day, 7 Days Per Week Telephone Technical Support, Excluding Lutron Holidays
 - d. Remote Diagnostics for Applicable Systems
 - e. 4-Hours of Remote Programming for Applicable Systems
 - 2. Gold Level Support and Maintenance Plan, Includes:
 - a. 100 Percent Parts for Lutron Lighting System Components
 - b. 100 Percent Labor Coverage for Troubleshooting and Diagnosis of Lighting Issues



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- c. 24 Hours Per Day, 7 Days Per Week Telephone Technical Support, Excluding Lutron Holidays
 - d. 72-Hour On-Site Response Time
 - e. Annual Scheduled Preventative Maintenance Visit
 - f. Remote Diagnostics for Applicable Systems
 - g. 4-Hours Remote Programming for Applicable Systems
 - h. Includes Service Coverage Upgrade of the Initial 2-year 100 Percent Labor Coverage to Gold Level Coverage.
3. Platinum Level Support and Maintenance Plan, Includes:
- a. 100 Percent Parts for Lighting System Components and Lutron Fluorescent Ballasts
 - b. 100 Percent Labor Coverage for Troubleshooting and Diagnosis of Lighting Issues
 - c. 24 Hours Per Day, 7 Days per Week Telephone Technical Support, excluding Lutron Holidays
 - d. 24-Hour On-Site Response Time
 - e. Annual Scheduled Preventative Maintenance Visit
 - f. Remote Diagnostics for Applicable Systems
 - g. 4-Hours Remote Programming for Applicable Systems

PART 1.8H. INCLUDES SERVICE COVERAGE UPGRADE OF THE INITIAL 2-YEAR 100 PERCENT LABOR COVERAGE TO PLATINUM LEVEL COVERAGE. MAINTENANCE MATERIAL SUBMITTALS

- A. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
- B. Make new replacement parts available for minimum of 10 years from date of manufacture.

PART 2 - PRODUCTS

PART 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Lutron Electronics Co., Inc. – Maestro Wireless
- B. [Basis of design product: Lutron Maestro Wireless. Subject to compliance and prior approval with specified requirements of this section, one of the following:]
 - 1. <Insert manufacturer's name>
- C. Substitutions: [Not permitted.] [Under provisions of Division 1.]
 - 1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders.
 - 2. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
 - 3. Any substitutions provided by the contractor shall be reviewed at the contractor's expense by the electrical engineer at a rate of [\$200.00] per hour.
 - 4. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.
 - 5. Provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

PART 2.2 GENERAL

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Maestro Wireless

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- A. Provide dimmer, switch, table lamp dimmer, wireless controller, wireless occupancy/vacancy sensor, wireless daylight sensor and wall plate kits that are designed, tested, manufactured, warranted, and provided by a single manufacturer unless otherwise noted.
- B. Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.
- C. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.
- D. Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption for a minimum period of [2] years.
- E. Dimmers:
 - 1. Dimmers provide full range, continuously variable control of light intensity.
 - 2. Operate at the rated capacity across the full ambient temperature range including modified capacities for ganging configurations which require the removal of fins.
 - 3. Provide Radio Frequency Interference Suppression on dimming controls.
 - 4. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply eliminating any leakage current.
 - 5. Design and test dimmers to withstand line-side surges without impairment to performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41C.
 - 6. Capable of operating at the rated capacity; this includes modified capacities for ganging configurations which require the removal of fins. Operation at rated capacity shall be possible across the full ambient temperature range, without shortening design lifetime.
 - 7. Load Specific Requirements
 - a. Incandescent Dimmers
 - 1) High end to be a minimum of 92 percent of line voltage
 - b. Magnetic Low Voltage (MLV) Transformer Dimmers & Neon-Cold Cathode
 - 1) High end to be a minimum of 92 percent of line voltage
 - 2) Contain circuitry specifically designed to control and provide symmetrical AC waveforms to the input of the MLV transformers per UL1472.
 - 3) MLV transformers to operate below rated current or temperature.
 - 4) Dimmers using back-to-back SCR construction that could fail open causing DC power to flow into magnetic low voltage loads are not acceptable.
 - c. Fluorescent Dimmers
 - 1) Direct control of fluorescent dimming ballasts up to the ballast manufacturer's specified rating.
 - 2) Provide ballasts and dimmers from a single manufacturer.
 - d. Switches to be listed to UL 20, UL 508, UL1472, CSA C22.2 #14, NOM-003-SCFI
- F. Wireless Devices shall:

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Maestro Wireless

WIRING DEVICES
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1. Be capable of diagnosing system communications.
 2. Have addresses automatically assigned to them.
 3. Receive signals from other wireless devices and provide feedback to user.
 4. Have ability to determine what devices have been addressed.
 5. Determine which system components are within range of receiving radio frequency communications by providing feedback.
 6. Work in conjunction with wireless occupancy sensors, wireless vacancy sensors, wireless daylight sensors, and wireless controllers.
 7. Use proprietary Radio Frequency (RF) protocol.
 8. Use RF communication in compliance with FCC Part 15.231.
- G. Provide seamless faceplates with no visible means of attachment.
- H. Color
1. [Match NEMA WD1, Section 2.] [Non-NEMA Standard Color] [Custom color to be selected by Architect.]
 2. Color variation in same product family: Maximum $\Delta E=1$, CIE L*a*b color units.
 3. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

PART 2.3 WALL BOX SMART DIMMERS

- A. Product: Lutron Maestro Wireless style dimmers as defined in the wall box dimmer schedule on the project drawings.
- B. Provide frequency compensation to assure dimming capability on 50 or 60 Hz lines.
- C. Provide multi-location dimming control.

PART 2.4 WALL BOX SWITCHES

- A. Electronic Switches
 1. Maestro Wireless: [120 Volts 6 amps Lighting / 3 Amp Fan loads] [120 Volts 8 Amps Lighting / 5.8 Amps Fan loads] [277 Volts 6 Amps Lighting] [120/277 Volts 8 amps Lighting / 3 Amp Fan Loads with no neutral]

PART 2.5 PLUG-IN MODULES

- A. Lamp Dimmer
 1. Product: MRF2-3LD
 2. Provide dimmer capable of integrating single incandescent plug-in lamp loads with wireless sensors and controls.
- B. Plug-In Dimmers

1. Product: [MRF2-3PD-3] [MRF2-3PD-1]
 2. Provide dimmer/switch capable of integrating [up to 3] [single] incandescent plug-in lamp loads with wireless sensors and controls.
 3. Standby power draw must be less than 0.5 watts.
- C. Plug-In Switching Module
1. Product: [MRF2-15APS-3] [MRF2-15APS-1]
 2. Provide switch capable of integrating [up to 3] [single] general purpose switching loads with wireless sensors and controls.
 3. Standby power draw must be less than 0.5 watts.
 4. Relay:
 - a. Rated life of relay: Minimum 1,000,000 cycles.
 - b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to load circuits.
 - c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

PART 2.6 POWER INTERFACES

- A. Provide remote dimming modules as defined on project drawings [PHPM-PA-DV], [PHPM-PA-120], [PHPM-3F-DV], [PHPM-3F-120], [PHPM-WBX-120], [PHPM-WBX-DV], [GRX-TVI], [HP-2], [HP-4], [HP-6]
- B. Provide high power module and dimmer from a single manufacturer.
- C. Electrical:
 1. Phase independent of control input.
 2. Dimmer to meet limited short circuit test as defined in UL 20.
 3. High power module listed to UL 508 for control of incandescent, magnetic low voltage, electronic low voltage, fluorescent, and neon/cold cathode loads. Provide high power modules as defined on project drawings
- D. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.

PART 2.7 WIRELESS CONTROLLER

- A. Product: Pico™ Wireless Controller
- B. Electronics:

1. Communicate via radio frequency to dimmers, switches, and **plug-in modules**.
- C. Functionality:
1. Upon button press, LEDs to immediately illuminate.
 2. Allow for easy reprogramming without replacing unit.
 3. Provide wireless remote control capable of controlling up to 9 dimmers, switches, or lamp dimmers
- D. Mounting:
1. Controller shall be capable of being mounted with a car visor clip, table stand or directly to a wall under a Claro screwless faceplate.
 2. Provide faceplates with concealed mounting hardware.
- E. **Power:**
1. **Provide battery operated control with minimum 5-year battery life.**

PART 2.8SENSORS

A. Wireless Ceiling Occupancy/Vacancy Sensors

1. Product: [LRF2-OCRB-P], [LRF2-VCRB-P]
2. General
 - a. Up to 3 wireless occupancy/vacancy sensors can communicate to a single compatible RF receiving device (dimmer, switch) to accommodate all conditions of space utilization and all irregular work hours and habits.
3. Wireless Ceiling Sensors shall:
 - a. Have an operational lifetime of 10 years without the need to replace batteries when installed per manufacturer's instructions.
 - b. Communicate directly to compatible RF receiving devices through use of a radio frequency communications link.
 - c. Not require external power packs, power wiring, or communication wiring.
 - d. Provide a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices (dimmers and switches).
 - e. Have a multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - f. Utilize Infrared as its sensing mechanism coupled with Lutron XCT™ Technology for sensing fine motions. Signal processing technology detects fine-motion, passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
 - g. Have optional, readily accessible, user adjustable controls for timeout, automatic/manual-on, and sensitivity.
 - h. Have the ability to be placed in test mode to verify correct coverage and operation from the face of the unit.
 - i. Have a radio frequency range of up to 60' (18.3 m) between sensor and compatible RF receiving device(s).
 - j. Turn off lighting automatically after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area.
 - k. Comply with the limits for a Class B device, pursuant to part 15 of the FCC rules.
 - l. Communicate with up to 10 compatible RF receiving devices (dimmers and switches).

- m. Be capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range shall be selectable on the dimmer from 1 percent to 100 percent.
- 4. Mounting:
 - a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, compressed fiber ceilings.
 - b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
 - c. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method shall be designed for easy, damage-free removal.
 - d. Ceiling-mount wireless occupancy/vacancy sensors using passive infrared technology shall have a customizable mask to block off unwanted viewing areas.
 - e. Sensor lens shall illuminate during test mode when motion is detected to allow installer to verify coverage prior to permanent mounting.
- 5. Wireless occupancy/vacancy sensor can be programmed to operate as an occupancy sensor (automatic-on and automatic-off functionality), an occupancy sensor with low light feature (automatic-on when less than 1 fc (10 lux) of ambient light available and automatic-off functionality), or a vacancy sensor (manual-on and automatic-off functionality).
- 6. A vacancy-only model shall be available to meet California Title 24 Energy Efficiency Standard requirements.

B. Wireless Daylight Sensors

- a. Product: LRF2-DCRB
 - 1) Open-loop basis for daylight sensor control scheme
 - 2) Stable output over temperature from 0 degrees to 40 degrees C
 - 3) Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection
 - 4) Provide linear response from 0 to 10,000 foot-candles
- b. Wireless Daylight Sensors shall:
 - 1) Have an operational lifetime of 10 years without the need to replace batteries when installed per manufacturer's instructions.
 - 2) Communicate directly to compatible RF receiving devices through use of a radio frequency communications link.
 - 3) Not require external power packs, power wiring, or communication wiring.
 - 4) Have the ability to be placed in test mode to verify correct operation from the face of the unit.
 - 5) Have a radio frequency range of up to 18.3 meters (60 feet) between sensor and compatible RF receiving device(s).
 - 6) Comply with the limits for a Class B device, pursuant to part 15 of the FCC rules.
 - 7) Color:
 - a) Match NEMA WD1, Section 2 White
- c. Mounting:
 - 1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, compressed fiber ceilings.
 - 2) Provide all necessary mounting hardware and instructions for both temporary and



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- permanent mounting.
- 3) Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method shall be designed for easy, damage-free removal.
- d. Shall meet California Title 24 Energy Efficiency Standard requirements.

PART 2.9WALL BOX ACCESSORIES

- A. Wall Plates
 - 1. Listed to UL 514C, CSA C22.2 #42.1-00
 - 2. Provide an adapter plate for proper device alignment and wall plate attachment.
 - 3. Architectural style face plates: Claro Gloss, Matte Finish, Designer style face plates: Claro Satin Color as selected by the Architect. Wall plate styles and colors to be provided as defined on the project drawings and schedules

PART 2.10SOURCE QUALITY CONTROL

- A. Perform full-function testing on completed assemblies at end of line. Statistical sampling is not acceptable.

PART 3 - EXECUTION

PART 3.1INSTALLATION

- A. Install equipment in accordance with manufacturer's installation instructions.
- B. Provide complete installation of system in accordance with Contract Documents.
- C. Define each dimmer's load type, assign each load to a zone, and set control functions.
- D. Provide equipment at locations and in quantities indicated on drawings. Provide any additional equipment required to provide control intent.
- E. No additional wiring shall be required between the wireless occupancy/vacancy sensor and compatible RF receiving devices (dimmers, switches).
- F. It shall be the contractor's responsibility to locate and aim sensor in the correct location required for a complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms that are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- G. Contractor shall furnish all equipment, labor, system setup and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
- H. Proper judgment shall be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitation or interference of structural components. The contractor shall also provide at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy/vacancy sensing devices and systems.
- I. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling

Lutron
Maestro Wireless

WIRING DEVICES
3/31/10

262726 -

mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

PART 3.2 SERVICE AND SUPPORT

A. Startup and Programming

1. Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:
 - a. Qualifications for factory-certified field service engineer:
 - 1) Minimum experience of 2 years training in the electrical/electronic field.
 - 2) Certified by the equipment manufacturer on the system installed.
 - b. Make a visit upon completion of installation of lighting control system:
 - 1) Verify connection of power feeds and load circuits.
 - 2) Verify connection and location of controls.
 - 3) Obtain sign-off on system functions.
 - 4) User to be trained on system operation.

2. After Hours Start-up (LSC-AH-SU)
 - a. Provide factory certified Field Service Engineer to perform manufacturer's start-up procedures outside normal working hours (Monday through Friday, 7a.m. to 5 p.m.)

B. Tech Support

1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

PART 3.3 FIELD QUALITY CONTROL

A. Manufacturer Services

1. Aim and Focus Visit (LSC-AF-VISIT)
 - a. Facility Representative [] to coordinate on-site meeting with Lighting Control System Manufacturer and Lighting Design Consultant to make required lighting adjustments to the system for conformance with the Lighting Design Consultant's original design intent.]

PART 3.4 CLOSEOUT ACTIVITIES

A. Training Visit (LSC-TRAINING)

1. Lighting Control System Manufacturer to provide [1] [] day additional on-site system training to site personnel.]

B. On-site Walkthrough (LSC-WALK)

1. Lighting Control System Manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.]

PART 3.5 MAINTENANCE



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- A. Capable of providing on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.
- B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup.

END OF SECTION


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Home / Living room / Floor lamps



SAMTID

Floor/reading lamp, nickel plated, white

\$39.99

Article Number: 801.521.17

Diffuser makes the light more agreeable for the eyes. Highly mobile arm, easy to adjust. [Read more](#)

In compliance with California Title 20 regulations, product prices and features may vary in the state of California. Please see your local store for details [More information](#)

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Store selection may vary and prices may differ from those online.

Matching Products

Product information



SAMTID
Floor/ reading lamp
\$39.99

Good to know

May be completed with other lamps in the same series.
Light bulb sold separately. IKEA recommends SPARSAM low-energy bulb E26 11W.

Package measurement and weight

Packages: 1
Article Number: 801.521.17
Width: 13 3/8"
Height: 3 3/8"
Length: 38 1/4"
Weight: 12lb
Quantity: 1

Product description

Base weight: Concrete, Polyethylene
Base plate/ Tube: Steel, Nickel plated
Shade: Polypropylene

Article Number: 801.521.17
Width: 34 cm
Height: 9 cm
Length: 97 cm
Weight: 5.6 kg
Quantity: 1

More Floor lamps



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SAMTID Floor/reading lamp – IKEA

8/2/11 3:23 PM

Key features

- Diffuser makes the light more agreeable for the eyes.
- Highly mobile arm, easy to adjust.
- Gives both directed and diffused light.

Designer:

IKEA of Sweden




Product dimensions

Height: 60 "
 Base diameter: 10 "
 Shade diameter: 10 "
 Cord length: 5' 11 "

Height: 152 cm
 Base diameter: 26.5 cm
 Shade diameter: 25 cm
 Cord length: 1.8 m

Environment

Special waste handling may be required.
 Please contact your local authorities for more information.

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FEATURES & SPECIFICATIONS

INTENDED USE — For use with housings L7X, L7XR, and LC6.

LED module for use in retrofit / remodel or new construction applications where energy savings, long-life, and functional delivered light levels are required. The Reality LED module provides 80% energy savings over the 65W BR30 and replicates the beam pattern and useful light levels of these fixtures. It will maintain at least 70% light output for 50,000 hours in a typical IC environment. The Reality LED module fits most common 6" cans for retrofit applications and can be ordered with L7X, L7XR, or LC6 for new construction. The Reality LED module is the most economical means to create a well lit environment with exceptional energy efficiency and near zero maintenance.

CONSTRUCTION — Rugged, one-piece, die-cast heat sink design for optimal thermal management.

Wet location rated lens is tightly fitted to the housing to reduce the ingress of dust.

Twin torsion springs ensure easy installation.

Utilizes 3000K color temperature.

OPTICS — Precisely designed elliptical upper reflector and a patented micro prism lens provides a 38 degree full width half max (FWHM) beam angle. Lower splay recesses optical system into the ceiling to prevent glare and provide a traditional look.

ELECTRICAL — Utilizes high-brightness LEDs on a metal core circuit board, ensuring cool-running operation. On-board circuitry to ensure protection against wiring errors.

High-efficiency driver mounted on the module. Primary power disconnect provided for simple connection to a standard Edison (E26) base socket.

Full range dimming is standard; dimming down to 25%. Optimal dimming performance is achieved when connected to an electronic low-voltage (ELV) dimmer; See page 2 for recommended dimmers.

Standard input wattage is 12.0W, 50 lumens per watt.

INSTALLATION — Suitable for installation in standard-height rough-in sections. Fits into most popular 6" housings.

LISTINGS — CSA certified for use in the US and Canadian safety standards. Wet location listed.

WARRANTY — Three year limited warranty covering defects in materials and workmanship, including LED and driver.

Note: Specifications subject to change without notice.

Catalog Number
Notes
Type

6" LED Module

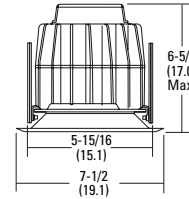


IC/Non-IC
Retrofit



Specifications

- Aperture: 4-3/8 (11.1)
- Ceiling opening: As rough-in
- Overlap trim: 7-1/2 (19.1)
- Height: 6-5/8 (17.0) max.
- Weight (module only): 2.8 lbs.
- Weight (module and carton): 3.96 lbs.
- All dimensions are inches (centimeters) unless otherwise noted.



ORDERING INFORMATION

For shortest lead times, configure products using **bolded options**.

Example: REAL6 D6MW

Series/Finish	Lumen output ¹	Color temperature	Voltage	Options ²
Series REAL6 D6 6" retrofit module	(blank) 600 lumens	(blank) 3000K 27K 2700K 35K 3500K 40K 4000K	(blank) 120V	PFMW Matte white plastic flange ring PFBL Black plastic flange ring
Finish MW Matte white A Clear diffuse AZ Clear specular BN Brushed nickel BLZ Black specular BZA Antique bronze ORB Oil-rubbed bronze WT Wheat diffuse				

Accessories: Order as separate catalog number.

TSA6	Makes non-bracket housings compatible with the LED module ships as units, J6 or J25
FL2LED	Makes L7XF housings compatible with the LED module
REAL HW Kit	Enables a permanent conversion to an LED source and Title 24 compliant
CTR6	6" goof ring, white



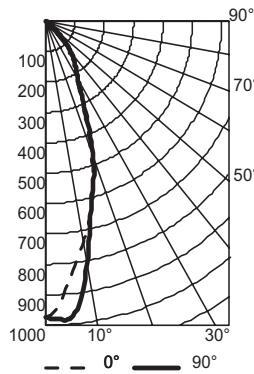
Notes

- 1 Total system delivered lumens.
- 2 See Real6 New Construction/Remodel Spec Sheets for use with dedicated LED Housings.

6 Series REALITY™ 6" LED

PHOTOMETRICS

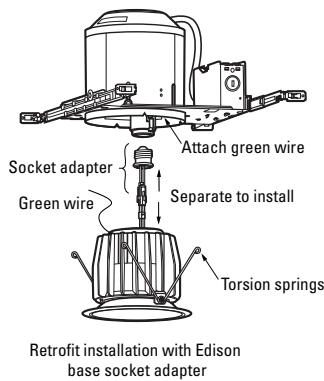
REAL6 D6MW, 3000K LEDS, 600 delivered lumens, 12.0 input watts, test no. LTL 18880



CP Summary		Coefficients of Utilization												Zonal Lumen Summary				
0° 90		pf	20%						50%						Zone	Lumens	% Lamp	% Fixture
		pc	80%			70%			50%			10%						
		pw	70%	50%	30%	50%	30%	10%	50%	30%	10%	50%	30%	10%				
0°	974	974	0	119	119	119	116	116	116	111	111	111	0° - 30°	400	66.6	66.6		
5°	868	981	1	113	110	108	108	106	104	104	102	101	0° - 40°	510	84.9	84.9		
15°	616	608	2	108	103	98	101	97	94	98	94	92	0° - 60°	592	98.6	98.6		
25°	296	311	3	102	95	90	94	89	85	91	87	84	0° - 90°	600	100.0	100.0		
35°	178	175	4	97	89	83	88	83	79	86	81	78	90° - 180°	0	0.0	0.0		
45°	88	84	5	92	83	77	82	77	73	81	76	72	0° - 180°	600	100.0	100.0		
55°	15	13	6	87	78	72	77	72	68	76	71	67						
65°	5	5	7	83	74	67	73	67	63	72	66	63						
75°	3	3	8	79	69	63	69	63	59	68	63	59						
85°	0	0	9	75	66	60	65	60	56	64	59	55						
90°	0	0	10	72	62	57	62	56	53	61	56	52						

Efficiency: 100.0%

INSTALLATION, DIMMING AND ENERGY DATA



COMPATIBLE DIMMER SWITCHES	
MANUFACTURER	PART NO.
LUTRON	DVELV-300
	DVELV-303
	MAELV-600
	MIRELV-600
	NTELV-300
	NTELV-600
	SELV-300
	VTELV-600M
LEVITON	6615-P
	ATE04-1L
	ATE06-1L
	VPE04-1L
	VPE06-1L
SYNERGY	ISD ELV

ENERGY DATA*	
Min. starting temp	-30°C (-22°F)
EMI/RFI	FCC Title 47 CFR, Part 15, Class B
Sound rating	Class A standards
Input voltage	120V
Min. power factor	0.95
Input frequency	50/60 Hz
Max. THD	30%
Rated wattage	12.0W
Input power	12.0W
Input current	125ma

*Values at non-dimming line voltage.



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SPARSAM

Low-energy bulb E26, globe

\$4.99

Article Number: 700.403.71

Energy efficient. Has 10 times longer life than an incandescent bulb. [Read more](#)

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Product information



SPARSAM
Low-energy bulb E26
\$4.99

Good to know
Bulb life approx. 10,000 hours.
Not dimmable.
Energy Star classified.

Product description
Glass

Package measurement and weight

Packages: 1
Article Number: 700.403.71
Width:
Height:
Length:
Weight: 1lb
Quantity: 1

Article Number: 700.403.71
Width: cm
Height: cm
Length: cm
Weight: 0.3 kg
Quantity: 1

More Low-energy bulbs



[Go to Low-energy bulbs](#)

SPARSAM Low-energy bulb E26 - IKEA

8/2/11 3:17 PM

Key features

- Energy efficient. Has 10 times longer life than an incandescent bulb.


Product dimensions

Power: 20 W

Power: 20 W

Environment


Special waste handling may be required. Please contact your local authorities for more information.



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VÄTE

Floor lamp, white

\$29.99

Article Number: 801.620.03

Diffused light; gives a good general light.

[Read more](#)

In compliance with California Title 20 regulations, product prices and features may vary in the state of California. Please see your local store for details

[More information](#)

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Store selection may vary and prices may differ from those online.

Assembly instructions

[VÄTE Floor lamp](#) (PDF)

More Models



Matching Products

Product information



VÄTE
Floor lamp
\$29.99

Package measurement and weight

Packages: 1
Article Number: 801.620.03
Width: 17 3/4"
Height: 3 1/2"
Length: 19 1/4"
Weight: 5lb
Quantity: 1

Article Number: 801.620.03
Width: 45 cm

Good to know

May be completed with other lamps in the same series.
Light bulbs sold separately. IKEA recommends SPARSAM low-energy bulb E26 11W (2 pcs).

Care instructions

Dust the lamp with a dust cloth.

Product description

Shade: Rice paper
Tube: Steel, Powder coating
Base weight: Concrete, Polyethylene

More VÄTE series



[Go to VÄTE series](#)

More Floor lamps



[Go to Floor lamps](#)

VÅTE Floor lamp – IKEA

8/2/11 3:17 PM

Height: 9 cm
 Length: 49 cm
 Weight: 2.5 kg
 Quantity: 1

Key features

- Diffused light; gives a good general light.

Designer:

M Vinka/S Heimis

Product dimensions

Diameter: 16 "
 Height: 37 "
 Cord length: 87 "

Diameter: 40 cm
 Height: 93 cm
 Cord length: 220 cm

This product requires assembly
[Download assembly instructions.](#)


Environment

Special waste handling may be required.
 Please contact your local authorities for more information.


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Home / Living room / Ceiling lamps / Pendants



VÄTE

Pendant lamp shade

\$11.00

Article Number: 101.757.73

Diffused light; gives a good general light.

[Read more](#)

Save to list

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Assembly instructions

[VÄTE Pendant lamp shade](#) (PDF)

Matching Products Complementary Products **Product information**



VÄTE
Pendant lamp shade
\$11.00

Good to know
Light bulb sold separately.
Use with HEMMA cord set.

Care instructions
Dust the lamp with a dust cloth.

Product description
Shade: Rice paper
Frame: Steel, Powder coating

Package measurement and weight

Packages: 1
Article Number: 101.757.73
Width:
Height:
Length:
Weight: 0lb
Quantity: 1

Article Number: 101.757.73
Width: cm
Height: cm
Length: cm
Weight: 0.2 kg
Quantity: 1

More VÄTE series



[Go to VÄTE series](#)

More Pendants



[Go to Pendants](#)

Find the Style

VÅTE Pendant lamp shade - IKEA

8/2/11 3:22 PM

Key features

- Diffused light; gives a good general light.

Designer:

Maria Vinka

Product dimensions

Diameter: 13 "
 Height: 21 "


Diameter: 32 cm
 Height: 54 cm

This product requires assembly
[Download assembly instructions.](#)


Environment

The material in this product MAY BE recyclable. Please check the recycling rules in your community and if recycling facilities exist in your area.


[Show matching products](#)



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Wireless Daylight Sensor

Lutron's wireless daylight sensor is a battery-powered sensor that automatically controls lights via RF communication to compatible dimming or switching devices. This sensor mounts to the ceiling and measures light in the space. The sensor then wirelessly transmits the light level to the associated dimming or switching devices that automatically control the lights to balance light level in the space. The sensor combines both convenience and exceptional energy savings along with ease of installation.



Features

- Lutron's reliable proportional daylight open loop control
- Light range (0–10,000 fc)
- Photopic response matches human eye
- Designed to give a linear response to changes in viewed light level
- Wireless daylight sensor has simple calibration
- One sensor is capable of switching, stepped dimming, and continuous dimming of multiple zones
- Intuitive test mode provides instant system verification
- 10-year battery life
- Multiple ceiling mount methods available for different ceiling materials
- Works seamlessly with Radio Powr Savr™ Occupancy and Vacancy Sensors and Pico™ wireless controls
- Front accessible test buttons make setup easy
- Each sensor can be added to up to 10 compatible RF dimming and switching devices for spaces with multiple zones of lighting
- RoHS compliant
- Capable of override for a maximum of 2 hours

Models Available:

- LRF2-DCRB-WH 434 MHz *Daylight Sensor*

Compatible RF Devices:

- For use with Lutron® products only
- Communicates to the following wireless Lutron systems:
 - Maestro Wireless®
 - GRAFIK Eye® QS Wireless

Job Name: Job Number:	Model Numbers:
--	-----------------------

Radio Powr Savr™

LRF2-DCRB-WH

Wireless Daylight Sensor

rpswds 2 01.18.10

Specifications

Standards

- FCC Approved. Complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.
- IC (RSS-210)
- SCT
- Meets CA Title 24 requirements

Power / Performance

- Operating voltage: 3 V_{DC}
- Operating current: 7 mA
- Requires one CR 2450 lithium battery
- 10-year battery life
- Non-volatile memory (settings are stored during power loss)

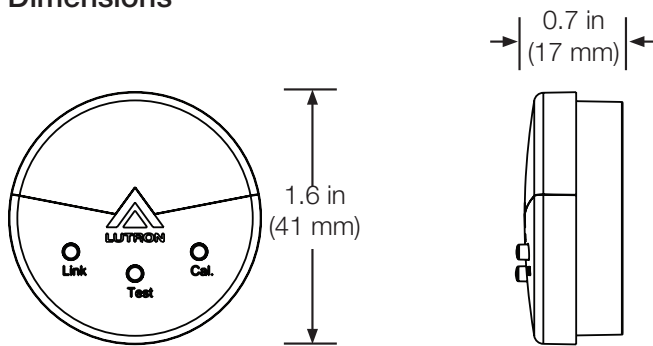
Environment

- Temperature: 32 °F to 104 °F (0 °C to 40 °C)
- 0-95% humidity, non-condensing.
- For indoor use only

Range

- Local load controls must be located within 60 ft (18 m) line of sight, or 30 ft (9 m) through walls, of a daylight sensor

Dimensions

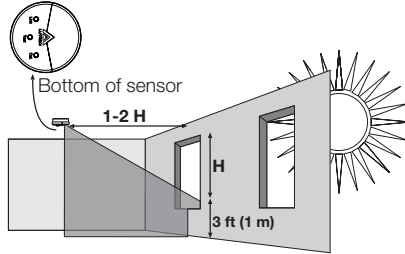


Job Name:	Model Numbers:
Job Number:	

Mounting

Location for average size areas

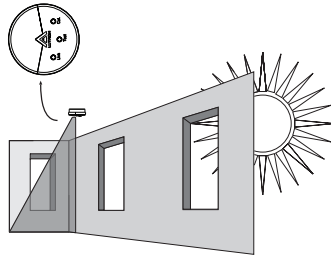
Arrow points towards the area viewed by the sensor (towards windows)



H = Effective Window Height

Location for narrow areas (corridors, private offices)

Arrow points towards the area viewed by the sensor (away from window)



Installation

Determine the Daylight Sensor Mounting Location using the diagrams at left:

- The arrow on the daylight sensor points toward the area viewed by the sensor.
- Place the daylight sensor so its viewing area is centered on the nearest window at a distance from the window of one to two times the effective window height (H).
- The effective window height (H) starts at the window sill or 3 ft (1 m) up from the floor, whichever is higher, and ends at the top of the window.
- Ensure that the view of the daylight sensor is not obstructed.
- Do not position the daylight sensor in the well of a skylight or above indirect lighting fixtures.
- For narrow areas where the daylight sensor cannot be placed 1-2 (H) from windows, place sensor near windows facing into the space.

Daylight Sensor Communication

- A sensor can communicate with up to 10 local load devices
- A single local load device or zone can have only one daylight sensor communicate to it

Job Name:	Model Numbers:
Job Number:	

Wireless Ceiling Mount Sensor

Lutron's ceiling-mounted occupancy/vacancy sensors are wireless, battery-powered passive infrared (PIR) sensors that automatically control lights via RF communication to compatible dimming and switching devices. These sensors detect the heat from people moving within an area to determine when the space is occupied. The sensors then wirelessly transmit the appropriate commands to the associated dimming and switching devices to turn the lights on or off automatically. They combine both convenience and exceptional energy savings along with ease of installation.

Features

- Wireless occupancy sensor has 3 settings available: Auto-On/Auto-Off, Auto-On Low-Light/Auto-Off, and Manual-On/Auto-Off
- Auto-On Low-Light feature will only turn lights on automatically if there is less than approximately 1 fc (10 lux) of ambient light
- Vacancy model available to meet CA Title 24 requirements
- 10-year battery life design
- Passive infrared motion detection with exclusive Lutron XCT™ Technology for fine motion detection
- 360° coverage ranges from 324 sq. ft to 676 sq. ft. (depending on mounting height)
- Multiple ceiling-mount methods available for different ceiling materials
- RoHS compliant
- Simple and intuitive adjustments available for Timeout, Auto-On, and Activity settings
- Front accessible test buttons make setup easy
- Lens illuminates during test mode to verify ideal locations
- Multiple sensors can be added for extended coverage—refer to product specification submittals of receiving device to determine system limits



Models Available:

- LRF2-OCRB-P-WH-xx
434 MHz Occupancy/Vacancy Sensor
 - LRF2-VCRB-P-WH-xx
434 MHz Vacancy Sensor
- xx = Color Options:
 WH (white)
 BL (black)
 LA (light almond)

Compatible RF Devices:

- For use with Lutron® products only.
- Communicates to the following wireless *Lutron* systems:
 - Maestro® Wireless® (MRF2)
 - GRAFIK Eye® QS Wireless
 - Energi Savr Node™ QS (with QS Sensor Module on QS Link)
 - Quantum® (with QS Sensor Module on QS Link)
 - RadioRA® 2

LUTRON® SPECIFICATION SUBMITTAL

Page

Job Name:	Model Numbers:
Job Number:	

Specifications

Standards

- FCC certified
- IC certified
- COFETEL certified
- RoHS compliant

Environment

- Temperature: 32 °F to 104 °F (0 °C to 40 °C)
- For indoor use only

Power

- Operating voltage: 3 V_{DC}
- Operating current: 14 µA nominal
- Requires one CR 123 lithium battery
- 10-year battery life design
- Non-volatile memory (saved changes are stored during power loss)

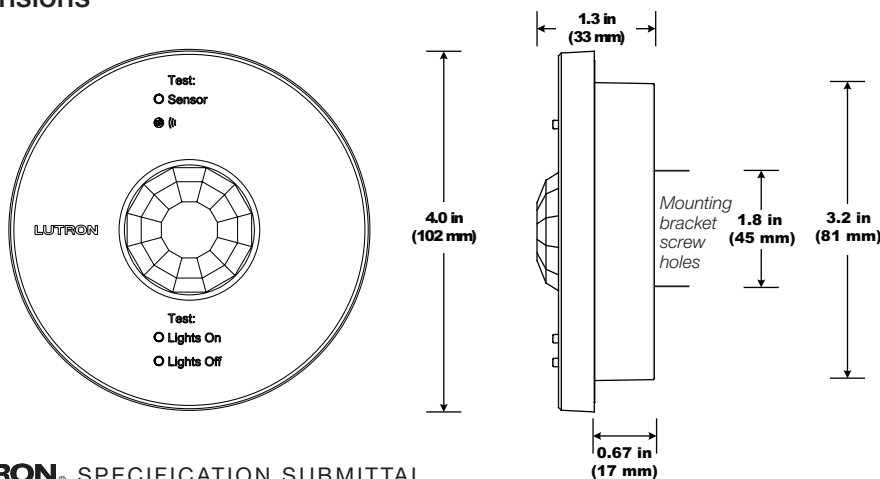
Sensor Coverage Test

- Front accessible test button
- Lens illuminates orange in response to motion during test mode and is visible from 60 ft (18 m)

Wireless Communication Test

- Front accessible test buttons
- Turn loads on and off

Dimensions



Timeout Options

- 1 minute **
- 5 minutes
- 15 minutes *
- 30 minutes

Auto-On Options (Occupancy Version Only)

- “Always” * - Sensor turns lights ON and OFF automatically.
- “Low light” - Sensor turns lights ON automatically only in low ambient light conditions. Sensor turns lights OFF automatically.
- “Disable” - Lights must be turned ON manually from dimming or switching device. Sensor turns lights OFF automatically.

Activity Options

- Low Activity * (Ⓕ)
- Medium Activity (Ⓕ)
- High Activity (Ⓕ)

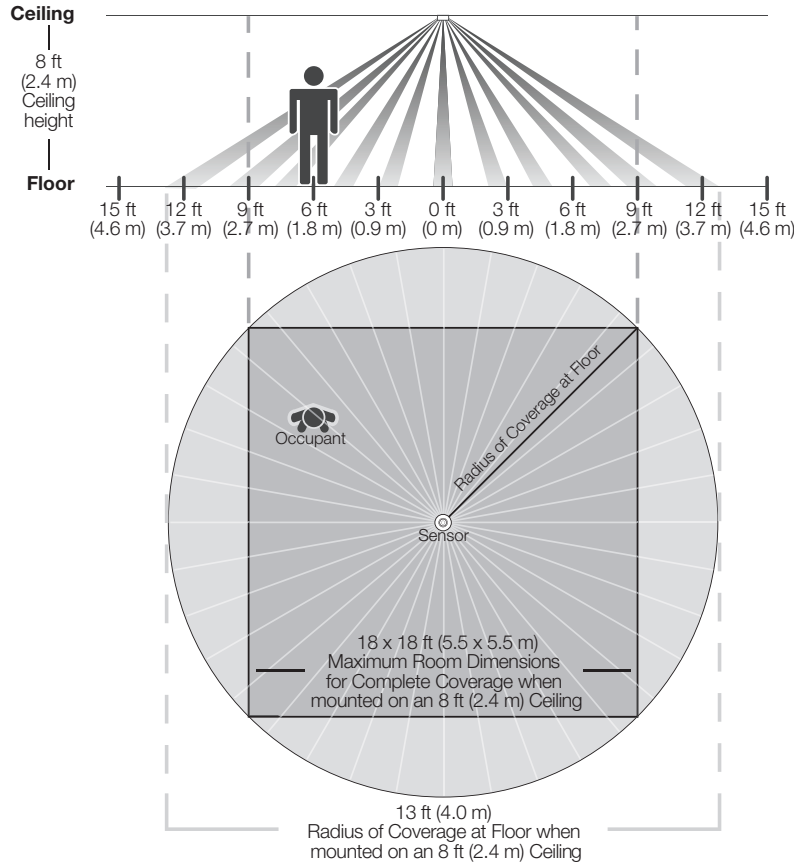
* - default settings

** - intended for use in high-activity, briefly occupied areas only

Job Name:	Model Numbers:
Job Number:	

Range Diagrams

Sensor Coverage with an 8 ft (2.4 m) Ceiling



Sensor Coverage Chart (for sensor mounted in center of room)

Ceiling Height	Max. Room Dimensions for Complete Coverage	Radius of Coverage at Floor
8 ft (2.4 m)	18 x 18 ft (5.5 x 5.5 m)	13 ft (4.0 m)
9 ft (2.7 m)	20 x 20 ft (6.1 x 6.1 m)	14.5 ft (4.4 m)
10 ft (3.0 m)	22 x 22 ft (6.7 x 6.7 m)	16 ft (4.9 m)
12 ft (3.7 m)	26 x 26 ft (7.9 x 7.9 m)	19 ft (5.8 m)

* Multiple sensors can be added for extended coverage—refer to product specification submittals of receiving device to determine system limits.

Job Name:	Model Numbers:
Job Number:	



Installation Overview

Sensor Placement

- The sensor’s ability to detect motion requires line of sight of room occupants. The sensor must have an unobstructed view of the room. **DO NOT** mount behind or near tall cabinets, shelves, hanging fixtures, ceiling fans, etc. The sensor cannot see through glass objects such as patio or shower doors.
- Hot objects and moving air currents can affect the sensor’s performance. To ensure proper operation, the sensor should be mounted at least 4 ft (1.2 m) away from light bulbs below the ceiling line and HVAC vents.
- The sensor’s performance depends on a temperature differential between the ambient room temperature and that of room occupants. Warmer rooms may reduce the sensor’s ability to detect occupants.
- The sensor should be mounted within 60 ft (18 m) line of sight or 30 ft (9.1 m) through walls, of the associated dimming and switching receiving devices.

Mounting

- Mounting of any RF devices on or in close proximity to a metal surface (e.g. directly on fixture with metal housing, metal-backed ceiling tile) will drastically reduce the effective range of radio signal transmission or reception.
- All RF devices must be mounted on non-conductive materials to ensure proper performance.

Temporary mounting is recommended to test sensor coverage and wireless communication before permanently installing the sensor.

Drop Ceiling (Compressed Fiber Ceiling Tile)

- The ceiling tile mounting wire is provided for both temporary and permanent mounting of the sensor to ceiling tiles. It is designed to allow temporary mounting, testing, and repositioning (if necessary) of the sensor without damaging a ceiling tile. Once the sensor’s final position has been chosen, the mounting wire should be twisted to lock the sensor in place permanently.

Solid Ceiling (Drywall, Plaster, Concrete, or Wood)

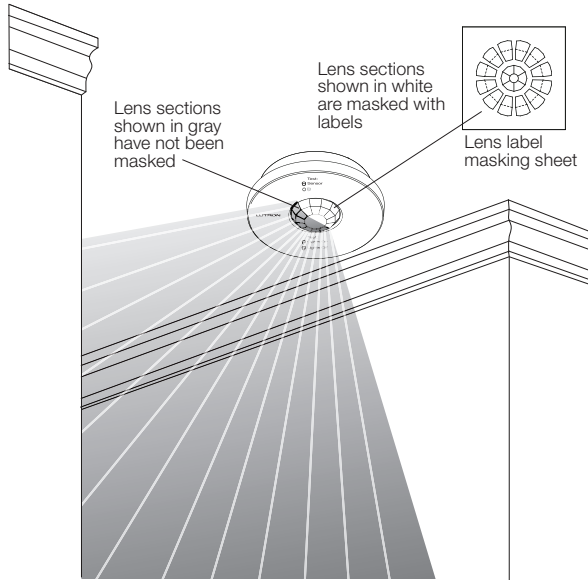
- Temporary mounting: One 3M™ Command™ adhesive strip is provided for temporarily mounting and testing the sensor. This strip is designed for easy, damage-free removal and is not reusable.
- Permanent mounting: Screws and anchors (for drywall or plaster) provided to mount sensor.

3M and Command are trademarks of 3M Company.

Job Name:	Model Numbers:
Job Number:	

Lens Masking

Whenever possible, the sensor should be installed in a location where it cannot easily see into areas outside the intended space, such as hallways or adjacent rooms. If this situation cannot be avoided, portions of the lens are masked with the provided labels to block the sensor's view of the undesired areas.



Job Name:	Model Numbers:
Job Number:	

END OF SECTION 265000

DIVISION 32 – EXTERIOR IMPROVEMENTS**SECTION 32 84 00
PLANTING IRRIGATION****PART 1–GENERAL****1.01 SECTION REQUIREMENTS**

- A. Design 100 percent water-coverage, low flow irrigation system for lawns and 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**2.01 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: 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. Emitters: Plastic body with single outlet six outlets, to deliver flow at approximately 20 psig (138 kPa) of 0.5 gph

(0.525 mL/s)

- M. Drip Tubes: Flexible PVC, NPS 1/2 (DN 15), NPS 3/4 (DN 20), NPS 1 (DN 25) as req'd.
- N. 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

3.01 INSTALLATION

- O. Install components having pressure rating equal to or greater than system operating pressure.
- P. Lay piping on solid ground or within architectural planters, uniformly sloped without humps or depressions. Slope circuit piping down toward drain valve a minimum of 0.4 percent.
- Q. Install water meters in meter boxes with shutoff valve on meter inlet. Include valve on meter outlet and valved bypass around meter.
- R. Install pressure regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet and valved bypass.
- S. Sprinklers: Flush circuit piping with full head of water and install sprinklers after hydrostatic test is completed.

END OF SECTION 328400

SECTION 32 93 00 PLANTS

PART 1—GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Submit certificates of inspection, as required by governmental authorities, and manufacturers or vendors certified analysis for soil amendments, herbicides, insecticides and fertilizer materials, submit other data substantiating that materials comply with specified requirements. Submit the following material samples: Mulch, topsoil, One typical sample of each shrub and groundcover material as specified, prior to planting for approval.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

PART 2—PRODUCTS

2.01 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.

2.02 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. Compost: Well-composted, stable, and weed-free organic matter; pH range of 5.5 to 8.
- C. 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.
- D. 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.
- E. Organic Mulch: Pine straw mulch.
- F. Mineral Mulch: Fine grade washed shell.
 1. Size Range: as available locally
 2. Color: white.
- G. Weed-Control Barrier: Polypropylene or polyester nonwoven fabric.

PART 3—EXECUTION

3.01 PREPARATION

- A. Planting Bed Establishment: Spread planting soil mixture to a depth of **4 inches (100 mm)** but not less than required to meet finish grades.
- B. Trees and Shrubs:
 1. Set trees and shrubs plumb and in center of pit with top of ball **flush with** adjacent finish grades.



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2. Prune, thin, and shape trees and shrubs after planting.
- C. Set ground cover and plants **as indicated**. Water after planting. Do not cover plant crowns with wet soil.
- D. Mulching: **Apply organic mulch, 3 inches** (50 mm) **thick** and finish level with adjacent finish grades. Do not place mulch against trunks or stems.
- E. 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.
- F. 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 32 93 00

APPENDICES



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APPENDIX A: STRUCTURAL CALCULATIONS



Structural Engineering

Structural Calculations

SOLAR DECATHLON
For USF Architectural Department
Tampa, Florida

H&A #10HA042
C.O.A. #27043

March 10, 2011



KARL F. HEES
FL PE 59795

MAR 10 2011

Solar Rack Framing



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JOB SOLAR DECAATHLON 10HA042

SHEET # _____ OF _____ ①

CALCULATED BY: T. WILDS DATE: 10/24/10

CHECKED BY: _____ DATE: _____

SUBJECT: SOLAR PANEL RACKS

SOLAR PANEL SUPPORT FRAMING:

SOLAR PANEL WT. = 33.1 lbs

DIMENSIONS = 31.42in x 61.39in / 1144in² = 13.4 ft²

WEIGHT = $\frac{33.1 \text{ lbs}}{13.4 \text{ ft}^2} = 2.5 \text{ PSF}$

ROOF STR. FRAMING @ 8'-0" O.C. MAX.

WIND LOADS ON FRONT LOUVERS: (ASSUMING 1.5in THICK @ 4in ON CENTER)

$q = 26.6 \text{ PSF}$ $E = 0.375$ $Cf = 1.6$

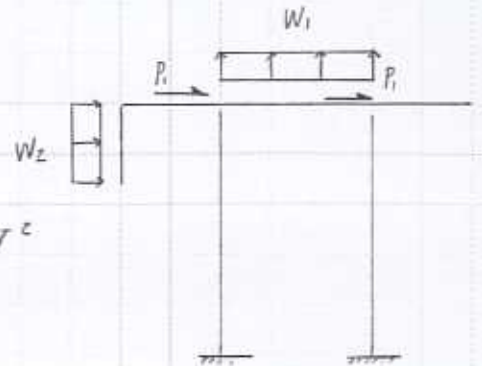
$P = 26.6 \text{ PSF} (1.6)(0.85) = 36.1 \text{ PSF}$

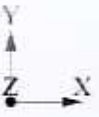
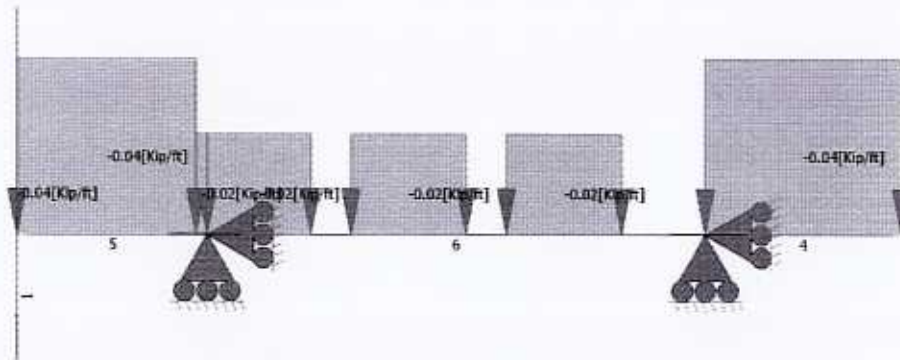
AVE WIND LOAD = $36.1 \text{ PSF} (0.375) = 13.5 \text{ PSF}$

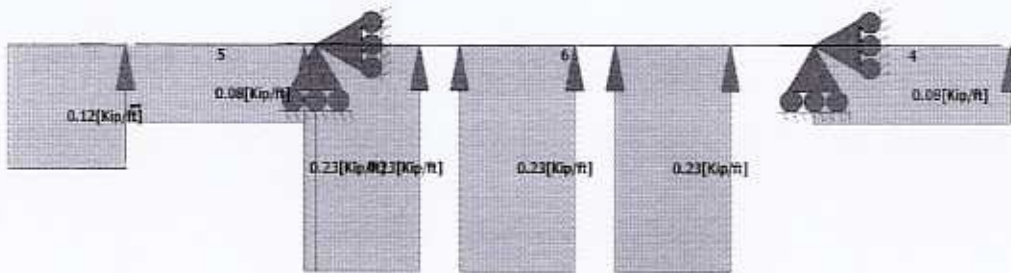
WIND LOADS ON SOLAR RACKS:

$q = 26.6 \text{ PSF}$ $G_{Cpf} = -1.07$ $G_{Cpi} = \pm 0.00$

$P = -28.5 \text{ PSF}$

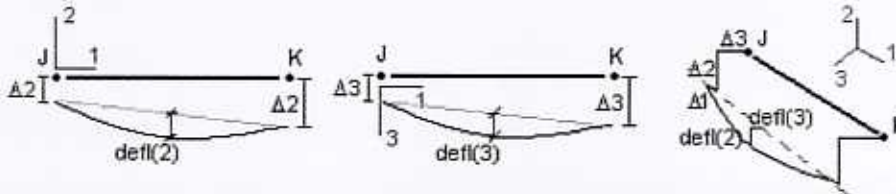






Analysis Results

Local deflections in members



Use definitions

Condition : D1=DL

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	-0.401	-0.301	0.000	0.00000	-	-
50%	-0.401	-0.151	0.000	0.00000	-	-
100%	-0.401	0.000	0.000	0.00000	-	-
MEMBER 4						
0%	0.000	-0.267	0.000	0.00000	-	-
50%	0.000	-0.124	0.000	0.00000	0.00898 (L/7578)	-
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 5						
0%	0.000	-0.401	0.000	0.00000	-	-
50%	0.000	-0.176	0.000	0.00000	0.02378 (L/2776)	-
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 6						
0%	0.000	0.000	0.000	0.00000	-	-
50%	0.000	0.122	0.000	0.00000	0.12213 (L/1417)	-
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D4=DL+WL

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	-1.304	-0.973	0.000	0.00000	-	-
50%	-1.304	-0.483	0.000	0.00000	-	-
100%	-1.304	0.000	0.000	0.00000	-	-
MEMBER 4						
0%	0.000	-0.917	0.000	0.00000	-	-
50%	0.000	-0.465	0.000	0.00000	-	-
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 5						
0%	0.000	-1.304	0.000	0.00000	-	-
50%	0.000	-0.612	0.000	0.00000	0.04010 (L/1646)	-

100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 6						
0%	0.000	0.000	0.000	0.00000	-	-
50%	0.000	0.848	0.000	0.00000	0.84835 (L/204)	-
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D6=0.6DL+WL

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	-1.144	-0.853	0.000	0.00000	-	-
50%	-1.144	-0.423	0.000	0.00000	-	-
100%	-1.144	0.000	0.000	0.00000	-	-
MEMBER 4						
0%	0.000	-0.811	0.000	0.00000	-	-
50%	0.000	-0.415	0.000	0.00000	-0.00993 (L/6854)	-
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 5						
0%	0.000	-1.144	0.000	0.00000	-	-
50%	0.000	-0.541	0.000	0.00000	0.03059 (L/2157)	-
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 6						
0%	0.000	0.000	0.000	0.00000	-	-
50%	0.000	0.799	0.000	0.00000	0.79950 (L/216)	-
100%	0.000	0.000	0.000	0.00000	-	-

Maximum relative deflections

Remark.- Magnitude of deflections in absolute value.

CONDITION D1=DL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.00000 (< L/10000)	32.50000	0.00000 (< L/10000)	0.00000
4	0.00971 (L/7007)	62.50000	0.00000 (< L/10000)	0.00000
5	0.02448 (L/2696)	57.50000	0.00000 (< L/10000)	0.00000
6	0.12352 (L/1401)	45.00000	0.00000 (< L/10000)	0.00000

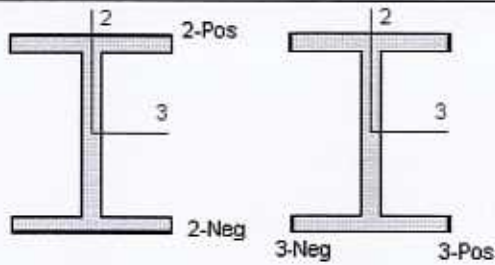
CONDITION4=DL+WL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.00389 (< L/10000)	62.50000	0.00000 (< L/10000)	0.00000
4	0.00685 (L/9931)	62.50000	0.00000 (< L/10000)	0.00000
5	0.04010 (L/1646)	50.00000	0.00000 (< L/10000)	0.00000
6	0.84950 (L/204)	47.50000	0.00000 (< L/10000)	0.00000

CONDITION6=0.6DL+WL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.00389 (< L/10000)	62.50000	0.00000 (< L/10000)	0.00000
4	0.01074 (L/6338)	62.50000	0.00000 (< L/10000)	0.00000
5	0.03065 (L/2153)	47.50000	0.00000 (< L/10000)	0.00000
6	0.80028 (L/216)	47.50000	0.00000 (< L/10000)	0.00000

Member stresses



Location of the fibers with maximum bending stresses

CONDITION D1=DL

Station	Axial [Kip/in ²]	Shear V2 [Kip/in ²]	Shear V3 [Kip/in ²]	Bending			
				2-Pos [Kip/in ²]	2-Neg [Kip/in ²]	3-Pos [Kip/in ²]	3-Neg [Kip/in ²]
MEMBER 1							
0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50%	0.03	0.00	0.00	0.00	0.00	0.00	0.00
100%	0.06	0.00	0.00	0.00	0.00	0.00	0.00
MEMBER 4							
0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50%	0.00	0.09	0.00	0.68	-0.68	0.00	0.00
100%	0.00	0.17	0.00	2.73	-2.73	0.00	0.00
MEMBER 5							
0%	0.00	0.13	0.00	0.00	0.00	0.00	0.00
50%	0.00	0.15	0.00	2.19	-2.19	0.00	0.00
100%	0.00	0.18	0.00	4.71	-4.71	0.00	0.00
MEMBER 6							
0%	0.00	0.15	0.00	4.71	-4.71	0.00	0.00
50%	0.00	0.02	0.00	1.25	-1.25	0.00	0.00
100%	0.00	0.08	0.00	2.73	-2.73	0.00	0.00

CONDITION D4=DL+WL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50%	0.03	0.14	0.00	0.70	-0.70	0.00	0.00
100%	0.06	0.28	0.00	2.78	-2.78	0.00	0.00
MEMBER 4							
0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50%	0.00	0.06	0.00	-0.48	0.48	0.00	0.00
100%	0.00	0.12	0.00	-1.93	1.93	0.00	0.00
MEMBER 5							
0%	-0.12	0.13	0.00	2.78	-2.78	0.00	0.00
50%	-0.12	0.01	0.00	3.88	-3.88	0.00	0.00
100%	-0.12	0.14	0.00	3.09	-3.09	0.00	0.00
MEMBER 6							
0%	0.00	0.65	0.00	3.09	-3.09	0.00	0.00
50%	0.00	0.12	0.00	13.70	-13.70	0.00	0.00
100%	0.00	0.56	0.00	-1.93	1.93	0.00	0.00

CONDITION D6=0.6DL+WL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50%	0.02	0.14	0.00	0.70	-0.70	0.00	0.00
100%	0.03	0.28	0.00	2.78	-2.78	0.00	0.00
MEMBER 4							
0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50%	0.00	0.10	0.00	-0.75	0.75	0.00	0.00
100%	0.00	0.19	0.00	-3.02	3.02	0.00	0.00
MEMBER 5							
0%	-0.12	0.08	0.00	2.78	-2.78	0.00	0.00
50%	-0.12	0.05	0.00	3.00	-3.00	0.00	0.00
100%	-0.12	0.21	0.00	1.20	-1.20	0.00	0.00
MEMBER 6							
0%	0.00	0.71	0.00	1.20	-1.20	0.00	0.00
50%	0.00	0.11	0.00	13.20	-13.20	0.00	0.00
100%	0.00	0.60	0.00	-3.02	3.02	0.00	0.00

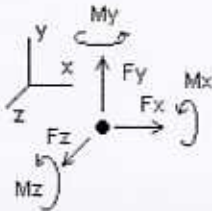
Current Date: 3/3/2011 3:26 PM

Units system: English

File name: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Advanse\Louver Frame Current.adv\

Analysis Results

Reactions



Direction of positive forces and moments

Node	Forces [Kip]			Moments [Kip*ft]		
	FX	FY	FZ	MX	MY	MZ
Condition DL=Dead Load						
6	0.00000	0.39471	0.00000	0.00000	0.00000	0.00000
7	0.00000	0.51185	0.00000	0.00000	0.00000	0.00000
SUM	0.00000	0.90656	0.00000	0.00000	0.00000	0.00000
Condition WL=Wind Load						
6	0.00000	-1.44225	0.00000	0.00000	0.00000	0.00000
7	-0.42960	-1.72265	0.00000	0.00000	0.00000	0.00000
SUM	-0.42960	-3.16490	0.00000	0.00000	0.00000	0.00000



HEES & ASSOCIATES, INC.

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karl@heesassociates.com • www.heesassociates.com
C.O.A. #27043

JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF 9

CALCULATED BY: T. WILDA DATE: 3/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: TRANSFER ST. BM.

TYPICAL TRANSFER BEAM:

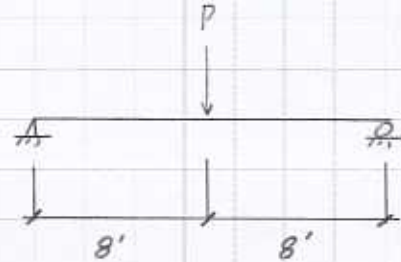
$$P_D = 0.52^k$$

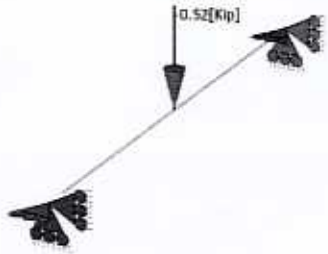
$$P_W = -1.72^k$$

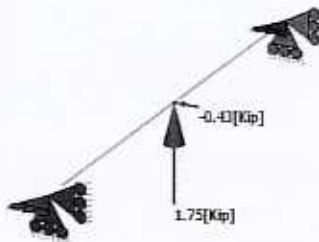
$$P_W(LAT) = 0.43^k$$

(SEE REACTIONS FROM
SOLAR RACK)

USE HSS 4x4x5/16"







Analysis Results

Maximum relative deflections

Remark - Magnitude of deflections in absolute value.

CONDITION1=DL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.36919 (L/520)	50.00000	0.00000 (< L/10000)	0.00000

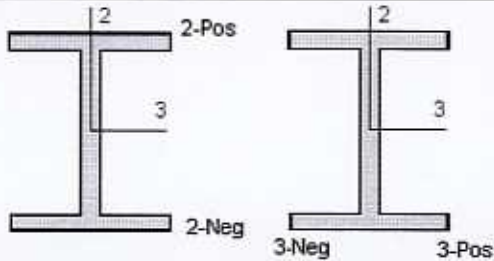
CONDITION4=DL+WL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.61187 (L/314)	50.00000	0.24106 (L/796)	50.00000

CONDITION6=0.6DL+WL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.75955 (L/253)	50.00000	0.24106 (L/796)	50.00000

Member stresses



Location of the fibers with maximum bending stresses

CONDITION D1=DL

Station	Axial [Kip/in ²]	Shear V2 [Kip/in ²]	Shear V3 [Kip/in ²]	Bending			
				2-Pos [Kip/in ²]	2-Neg [Kip/in ²]	3-Pos [Kip/in ²]	3-Neg [Kip/in ²]
MEMBER 1							
0%	0.00	0.21	0.00	0.00	0.00	0.00	0.00
50%	0.00	0.15	0.00	-6.66	6.66	0.00	0.00
100%	0.00	0.21	0.00	0.00	0.00	0.00	0.00

CONDITION D4=DL+WL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.29	0.12	0.00	0.00	0.00	0.00
50%	0.00	0.35	0.12	11.81	-11.81	-4.54	4.54
100%	0.00	0.29	0.12	0.00	0.00	0.00	0.00

CONDITION D6=0.6DL+WL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.37	0.12	0.00	0.00	0.00	0.00
50%	0.00	0.41	0.12	14.47	-14.47	-4.54	4.54
100%	0.00	0.37	0.12	0.00	0.00	0.00	0.00

Porch Roof Framing



JOB SOLAR DECK/STALON 10HA042
 SHEET # _____ OF (14)
 CALCULATED BY: T. WILDA DATE: 10/23/10
 CHECKED BY: _____ DATE: _____
 SUBJECT: FRONT PORCH ROOF STR. B.M.

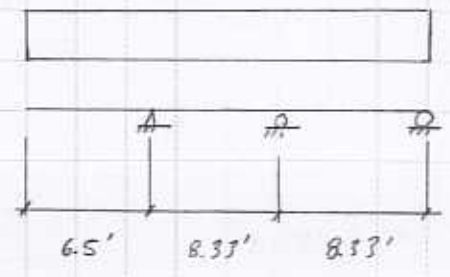
HEES & ASSOCIATES, INC.
 4192 Prairie View Drive South, Sarasota, Florida 34232
 Telephone: (941) 387-5266
 Fax: (941) 342-6088
 khees@verizon.net
 C.O.A. #27043

STEEL BEAM SUPPORTING PORCH FRAMING:

GRAVITY LOADS: DEAD = 20 PSF
 LIVE = 20 PSF

LOADS (e WORST-CASE CONTIG)

$D = 20 \text{ PSF} \times 5.42 = 110 \text{ PLF}$
 $L = 20 \text{ PSF} \times 5.42 = 110 \text{ PLF}$



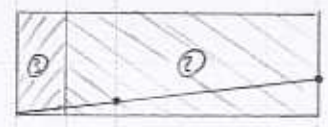
WIND LOADS: (PARTIALLY ENCLOSED) $q = 27.6 \text{ PSF}$

ROOF LOADS: (100 PSF)

ZONE ① = ZONE ② = 100 FT²

$P = 27.6 \text{ PSF} (-1.1 - 0.55) = -45.6 \text{ PSF}$

e T.W.1. $U = -45.6 \text{ PSF} \times 5.42' = -250 \text{ PLF}$



USE 4 1/2" x 4 1/2" x 5/16"

Title Block Line 1
 You can change this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Title :
 Dsgnr:
 Project Desc.:
 Project Notes :

Job #

15

Printed: 7 MAR 2011, 8:49AM

Steel Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec6
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

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Licensee :

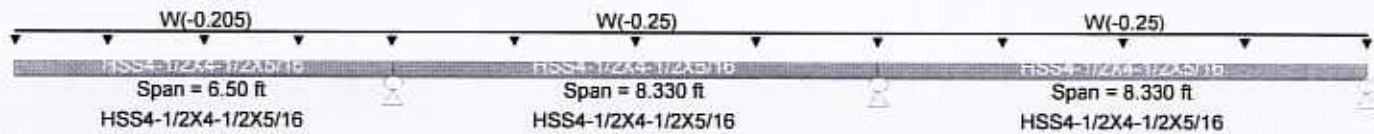
Description : Tube Steel Beam At Front Porch Wind

Material Properties

Calculations per AISC 360-05, IBC 2006, CBC 2007, ASCE 7-05

Analysis Method : Allowable Stress Design
 Beam Bracing : Completely Unbraced
 Bending Axis : Major Axis Bending
 Load Combination 2006 IBC & ASCE 7-05

Fy : Steel Yield : 46.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1
 Uniform Load : W = -0.2050 k/ft, Tributary Width = 1.0 ft
 Load for Span Number 2
 Uniform Load : W = -0.250 k/ft, Tributary Width = 1.0 ft
 Load for Span Number 3
 Uniform Load : W = -0.250 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.260 : 1	Maximum Shear Stress Ratio =	0.041 : 1
Section used for this span	HSS4-1/2X4-1/2X5/16	Section used for this span	HSS4-1/2X4-1/2X5/16
Mu : Applied	4.331 k-ft	Vu : Applied	1.431 k
Mn / Omega : Allowable	16.688 k-ft	Vn/Omega : Allowable	34.887 k
Load Combination	+D+W+H	Load Combination	+D+W+H
Location of maximum on span	6.500ft	Location of maximum on span	6.500 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward L+Lr+S Deflection	0.000 in	Ratio =	0 < 360
Max Upward L+Lr+S Deflection	0.000 in	Ratio =	0 < 360
Max Downward Total Deflection	0.040 in	Ratio =	2502
Max Upward Total Deflection	-0.419 in	Ratio =	372

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values				
			M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega	
Overall MAXimum Envelope															
Dsgn. L = 6.50 ft	6.50 ft	1	0.260	0.041	4.33		4.33	27.87	16.69	1.00	1.00	1.43	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	2	0.260	0.041	4.33	0.24	4.33	27.87	16.69	2.80	1.00	1.43	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	3	0.099	0.034	1.09	-1.66	1.66	27.87	16.69	1.22	1.00	1.17	58.26	34.89	
+D+W+H															
Dsgn. L = 6.50 ft	6.50 ft	1	0.260	0.041	4.33		4.33	27.87	16.69	1.00	1.00	1.43	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	2	0.260	0.041	4.33	0.24	4.33	27.87	16.69	2.80	1.00	1.43	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	3	0.099	0.034	1.09	-1.66	1.66	27.87	16.69	1.22	1.00	1.17	58.26	34.89	
+D+0.750Lr+0.750L+0.750W+H															
Dsgn. L = 6.50 ft	6.50 ft	1	0.195	0.031	3.25		3.25	27.87	16.69	1.00	1.00	1.07	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	2	0.195	0.031	3.25	0.18	3.25	27.87	16.69	2.80	1.00	1.07	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	3	0.075	0.025	0.81	-1.24	1.24	27.87	16.69	1.22	1.00	0.88	58.26	34.89	
+D+0.750Lr+0.750S+0.750W+H															
Dsgn. L = 6.50 ft	6.50 ft	1	0.195	0.031	3.25		3.25	27.87	16.69	1.00	1.00	1.07	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	2	0.195	0.031	3.25	0.18	3.25	27.87	16.69	2.80	1.00	1.07	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	3	0.075	0.025	0.81	-1.24	1.24	27.87	16.69	1.22	1.00	0.88	58.26	34.89	
+0.60D+W+H															
Dsgn. L = 6.50 ft	6.50 ft	1	0.260	0.041	4.33		4.33	27.87	16.69	1.00	1.00	1.43	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	2	0.260	0.041	4.33	0.24	4.33	27.87	16.69	2.80	1.00	1.43	58.26	34.89	
Dsgn. L = 8.33 ft	8.33 ft	3	0.099	0.034	1.09	-1.66	1.66	27.87	16.69	1.22	1.00	1.17	58.26	34.89	

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "+" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	W Only	-0.4191	0.000

Title Block Line 1
 You can changes this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Title :
 Dsgnr:
 Project Desc.:
 Project Notes :

Job #

16

Printed: 7 MAR 2011, 8:49AM

Steel Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec6
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Tube Steel Beam At Front Porch Wind

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "+" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	2	0.0399	2.952		0.0000	0.000
	3	0.0000	2.952	W Only	-0.0493	4.429

Vertical Reactions - Unfactored

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Overall MAXimum		-2.763	-1.823	-0.911
W Only		-2.763	-1.823	-0.911

Title Block Line 1
 You can change this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.

Title :
 Dsgn:
 Project Desc.:

Job #

17

Title Block Line 6

Printed: 7 MAR 2011, 6:49AM

Steel Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calc\Enercalc\misc.ec6
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

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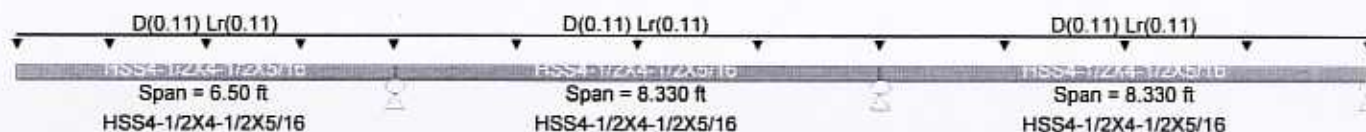
Description: Tube Steel Beam At Front Porch Gravity

Material Properties

Calculations per AISC 360-05, IBC 2006, CBC 2007, ASCE 7-05

Analysis Method: Allowable Stress Design
 Beam Bracing: Beam is Fully Braced against lateral-torsion buckling
 Bending Axis: Major Axis Bending
 Load Combination: 2006 IBC & ASCE 7-05

Fy: Steel Yield: 46.0 ksi
 E: Modulus: 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1
 Uniform Load: D = 0.110, Lr = 0.110 k/ft, Tributary Width = 1.0 ft
 Load for Span Number 2
 Uniform Load: D = 0.110, Lr = 0.110 k/ft, Tributary Width = 1.0 ft
 Load for Span Number 3
 Uniform Load: D = 0.110, Lr = 0.110 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.278 : 1	Maximum Shear Stress Ratio =	0.041 : 1
Section used for this span	HSS4-1/2X4-1/2X5/16	Section used for this span	HSS4-1/2X4-1/2X5/16
Mu : Applied	4.648 k-ft	Vu : Applied	1.430 k
Mn / Omega : Allowable	16.688 k-ft	Vn/Omega : Allowable	34.887 k
Load Combination	+D+Lr+H	Load Combination	+D+Lr+H
Location of maximum on span	6.500ft	Location of maximum on span	6.500 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward L+Lr+S Deflection	0.233 in Ratio = 668		
Max Upward L+Lr+S Deflection	-0.024 in Ratio = 4132		
Max Downward Total Deflection	0.466 in Ratio = 334		
Max Upward Total Deflection	-0.048 in Ratio = 2066		

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values			
			M	V	Mmax +	Mmax -	Ma - Max	Mrx	Mrx/Omega	Cb	Rm	Va Max	Vrx	Vrx/Omega
Overall MAXimum Envelope														
Dsgn. L = 6.50 ft	6.50 ft	1	0.278	0.041										
Dsgn. L = 8.33 ft	8.33 ft	2	0.278	0.040	-0.00	-4.65	4.65	27.87	16.69	1.00	1.00	1.43	58.26	34.89
Dsgn. L = 8.33 ft	8.33 ft	3	0.093	0.029	1.55	-0.75	1.55	27.87	16.69	1.00	1.00	1.01	58.26	34.89
+D														
Dsgn. L = 6.50 ft	6.50 ft	1	0.139	0.020										
Dsgn. L = 8.33 ft	8.33 ft	2	0.139	0.020	-0.00	-2.32	2.32	27.87	16.69	1.00	1.00	0.72	58.26	34.89
Dsgn. L = 8.33 ft	8.33 ft	3	0.047	0.014	0.78	-0.37	0.78	27.87	16.69	1.00	1.00	0.50	58.26	34.89
+D+Lr+H														
Dsgn. L = 6.50 ft	6.50 ft	1	0.278	0.041										
Dsgn. L = 8.33 ft	8.33 ft	2	0.278	0.040	-0.00	-4.65	4.65	27.87	16.69	1.00	1.00	1.38	58.26	34.89
Dsgn. L = 8.33 ft	8.33 ft	3	0.093	0.029	1.55	-0.75	1.55	27.87	16.69	1.00	1.00	1.01	58.26	34.89
+D+0.750Lr+0.750L+H														
Dsgn. L = 6.50 ft	6.50 ft	1	0.244	0.036										
Dsgn. L = 8.33 ft	8.33 ft	2	0.244	0.035	-0.00	-4.07	4.07	27.87	16.69	1.00	1.00	1.25	58.26	34.89
Dsgn. L = 8.33 ft	8.33 ft	3	0.081	0.025	1.36	-0.65	1.36	27.87	16.69	1.00	1.00	0.88	58.26	34.89
+D+0.750Lr+0.750L+0.750W+H														
Dsgn. L = 6.50 ft	6.50 ft	1	0.244	0.036										
Dsgn. L = 8.33 ft	8.33 ft	2	0.244	0.035	-0.00	-4.07	4.07	27.87	16.69	1.00	1.00	1.25	58.26	34.89
Dsgn. L = 8.33 ft	8.33 ft	3	0.081	0.025	1.36	-0.65	1.36	27.87	16.69	1.00	1.00	0.88	58.26	34.89
+D+0.750Lr+0.750L+0.5250E+H														
Dsgn. L = 6.50 ft	6.50 ft	1	0.244	0.036										
Dsgn. L = 8.33 ft	8.33 ft	2	0.244	0.035	-0.00	-4.07	4.07	27.87	16.69	1.00	1.00	1.25	58.26	34.89
Dsgn. L = 8.33 ft	8.33 ft	3	0.081	0.025	1.36	-0.65	1.36	27.87	16.69	1.00	1.00	0.88	58.26	34.89

Title Block Line 1
 You can changes this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.

Title Block Line 6

Title :
 Dsgnr:
 Project Desc.:
 Project Notes :

Job #

18

Printed: 7 MAR 2011, 8:48AM

Steel Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ecb
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:85736

Lic. #: KW-06008353

Licensee :

Description : Tube Steel Beam At Front Porch Gravity

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. ** Defl	Location in Span	Load Combination	Max. ** Defl	Location in Span
D+Lr	1	0.4664	0.000		0.0000	0.000
	2	0.0000	0.000	D+Lr	-0.0484	3.058
D+Lr	3	0.0474	4.429		0.0000	3.058

Vertical Reactions - Unfactored

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Overall MAXimum		2.815	1.454	0.827
D Only		1.407	0.727	0.413
Lr Only		1.407	0.727	0.413
D+Lr		2.815	1.454	0.827



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (19)

CALCULATED BY: T. WILDA DATE: 3/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: STR. CHANNEL & FRONT PORCH

STR. CHANNEL & PORCH ROOF:

$T.W. = \frac{1}{2}(7.67') = 3.83'$

$W_w = 3.83' \times (-62.3 \text{ psf} + 5.0 \text{ psf})$

$W_w = -220 \text{ psf}$

$W_d = 3.83' \times 20 \text{ psf} = 80 \text{ psf}$

$W_c = 3.83' \times 20 \text{ psf} = 80 \text{ psf}$



USE C7x9.8 (GALV.)

REACTIONS: WIND = -1500 lbs
GRAVITY = 1100 lbs

ATTACHMENT TO STUDS & CONTIG END

$e \frac{1}{2}'' \phi, 2' (11) = 620 \text{ lbs}$

$e \frac{3}{4}'' \phi, 2' (11) = 940 \text{ lbs}$

$C_D = 1.6 \text{ (WIND)}$

$C_D = 1.25 \text{ (GRAVITY)}$

$C_{M1} = 0.70$

$C_T = 1.00$

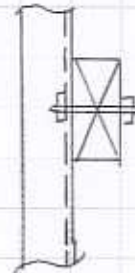
$A_M = 1.5 \times 5.5 \text{ IN} = 8.25 \text{ IN}$

$A_M/A_S = 8.25 / 150 \text{ IN} = 5.5$

$A_S = 0.21 \text{ IN} \times 7.0 \text{ IN} = 1.50 \text{ IN}$

$\therefore C_g = 0.98$

..



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JOB SOLAR DECATHLON 10HA042
SHEET # _____ OF (20)
CALCULATED BY: T. WILDA DATE: 3/8/11
CHECKED BY: _____ DATE: _____
SUBJECT: STE. CHANNEL @ FRONT PORCH

@ $\frac{3}{4}$ " ϕ BOLTS

EDGE DISTANCE - N/A

BOLTS IN A ROW = 3IN OL 4D $\therefore C_A = 1.0$

$$Z'(11) = 940 \text{ lbs} \times 0.70 \times 0.98 = 645 \text{ lbs}$$

$$\text{WIND} = 645 \text{ lbs} \times 1.6 = 1032 \text{ lbs} \times 2 \text{ BOLTS} = 2065 \text{ lbs} \geq 1500 \text{ lbs}$$

$$\text{GRAVITY} = 645 \text{ lbs} \times 1.25 = 805 \text{ lbs} \times 2 \text{ BOLTS} = 1610 \text{ lbs} \geq 1100 \text{ lbs}$$

USE (2) $\frac{3}{4}$ " ϕ ASTM A325N THROUGH
BOLTS W/ 3" SPACINGS

Scope :

Rev: 580007
User: KW-0608353, Ver 5.6.0, 1-Nov-2005
(c)1983-2006 ENERCALC Engineering Software

Steel Beam Design

Page 1
misc.ecw.Calculations

Description Porch Channel Gravity

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : C7X9.8

Center Span 6.50 ft
Left Cant 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 0.00 ft

Fixed-Free
Bm Wt. Added to Loads
LL & ST Act Together

Fy 36.00 ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0 ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL	0.080							k/ft
LL	0.080							k/ft
ST								k/ft
Start Location								ft
End Location								ft

Summary

Beam OK
Static Load Case Governs Stress

Using: C7X9.8 section, Span = 6.50ft, Fy = 36.0ksi
End Fixity = Fixed-Free, Lu = 0.00ft, LDF = 1.000

	Actual	Allowable		
Moment	3.586 k-ft	12.019 k-ft	Max. Deflection	-0.106 in
fb : Bending Stress	7.089 ksi	23.760 ksi	Length/DL Defl	2,771.6 : 1
fb / Fb	0.298 : 1		Length/(DL+LL Defl)	1,465.4 : 1
Shear	1.103 k	21.168 k		
fv : Shear Stress	0.751 ksi	14.400 ksi		
fv / Fv	0.052 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	3.59 k-ft						k-ft
Max. M -		-1.90	-3.59				k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	1.10 k	0.58	1.10				k
Shear @ Right	k						k
Center Defl.	-0.106 in	-0.056	-0.106	-0.106	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	1.10	0.58	1.10	1.10			k
Reaction @ Rt							k

Fa calc'd per Eq. E2-1, K*L/r < Cc
I Beam Passes Table B5.1, Fb per Eq. F1-1, Fb = 0.66 Fy

HEES AND ASSOCIATES
1381 FIFTH STREET
SARASOTA FL 34236

Title :
Dsgnr:
Description :

Job #
Date: 4:00PM, 4 MAR 11

22

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Page 2
misc.ecw.Calculations

Description Porch Channel Gravity

Section Properties C7X9.8

Depth	7.000 in	Weight	9.75 #/ft
Web Thick	0.210 in	Ixx	21.200 in4
Width	2.090 in	Iyy	0.957 in4
Flange Thick	0.366 in	Sxx	6.070 in3
Area	2.87 in2	Syy	0.617 in3
Xcg Dist.	0.000 in	R-xx	2.720 in
Values for LRFD Design....		R-yy	0.578 in
J	0.100 in4	Zx	7.190 in3
Cw	9.15 in6	Zy	1.260 in3
		K	0.875 in

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Porch Channel Wind

General Information Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : C7X9.8		Fixed-Free	Fy	36.00ksi
Center Span	6.50 ft	Bm Wt. Added to Loads	Load Duration Factor	1.00
Left Cant.	0.00 ft	LL & ST Act Together	Elastic Modulus	29,000.0 ksi
Right Cant.	0.00 ft			
Lu : Unbraced Length	0.00 ft			

Distributed Loads Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL								k/ft
LL								k/ft
ST	0.220							k/ft
Start Location								ft
End Location								ft

Summary

Using: C7X9.8 section, Span = 6.50ft, Fy = 36.0ksi
End Fixity = Fixed-Free, Lu = 0.00ft, LDF = 1.000

Beam OK
Short Term Load Case Governs Stress

	Actual	Allowable		
Moment	4.853 k-ft	12.019 k-ft	Max. Deflection	-0.144 in
fb : Bending Stress	9.595 ksi	23.760 ksi	Length/DL Defl	25,516.0 : 1
fb / Fb	0.404 : 1		Length/(DL+LL Defl)	1,082.7 : 1
Shear	1.493 k	21.168 k		
fv : Shear Stress	1.016 ksi	14.400 ksi		
fv / Fv	0.071 : 1			

Force & Stress Summary

	Maximum	DL Only	<<-- These columns are Dead + Live Load placed as noted -->>				
			LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	4.85 k-ft						k-ft
Max. M -		-0.21		-4.85			k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	1.49 k	0.06		1.49			k
Shear @ Right	k						k
Center Defl.	-0.144 in	-0.006	0.000	-0.144	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	1.49	0.06		1.49			k
Reaction @ Rt							k

Fa calc'd per Eq. E2-1, K*L/r < Cc
I Beam Passes Table B5.1, Fb per Eq. F1-1, Fb = 0.66 Fy

Scope :

Rev: 580007
 User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Porch Channel Wind

Section Properties **C7X9.8**

Depth	7.000 in	Weight	9.75 #/ft
Web Thick	0.210 in	lxx	21.200 in4
Width	2.090 in	lyy	0.957 in4
Flange Thick	0.366 in	Sxx	6.070 in3
Area	2.87 in2	Syy	0.617 in3
Xcg Dist.	0.000 in	R-xx	2.720 in
Values for LRFD Design....		R-yy	0.578 in
J	0.100 in4	Zx	7.190 in3
Cw	9.15 in6	Zy	1.260 in3
		K	0.875 in

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (25)CALCULATED BY: T. WILDA DATE: 3/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: PORCH ROOF

PORCH ROOF:

• ATTACHMENT OF CHANNEL TO STUDS (TYA.)

ROOF LOADS: T.W. = $\frac{1}{2}(6'-6") \cdot 3'-3"$

$$W_D = 20 \text{ PSF} \times 3.25' \times 2.0' = 130 \text{ lbs} / 1.33 = 100 \text{ lbs}$$

$$W_L = 20 \text{ PSF} \times 3.25' \times 2.0' = 130 \text{ lbs} / 1.33 = 100 \text{ lbs}$$

$$W_U = (-99.3 \text{ PSF} + 5.0 \text{ PSF}) \times 3.25' \times 2.0' = -485 \text{ lbs} / 1.33$$

$$= -365 \text{ lbs}$$

• TYA (1) $\frac{1}{2}" \phi$ THROUGH BOLTS @ 16" O.C. MAX.

$$Z_L = 330 \text{ lbs}$$

$$C_D = 1.25 \quad (D+L) \quad C_D = 1.6 \quad (D+W)$$

$$C_M = 1.00 \quad C_t = 1.0$$

$$(D+L) \quad Z' = 330 \text{ lbs} \times 1.25 = 415 \text{ lbs} \geq 200 \text{ lbs}$$

$$(W) \quad Z' = 330 \text{ lbs} \times 1.6 = 525 \text{ lbs} \geq 485 \text{ lbs}$$

USE (1) $\frac{1}{2}" \phi$ THROUGH BOLT @ 16" O.C. MAX.



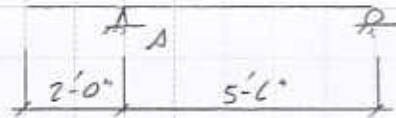
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JOB SOLAR DECATHLON 10HA042
 SHEET # _____ OF (26)
 CALCULATED BY: T. WILDA DATE: 01/23/11
 CHECKED BY: _____ DATE: _____
 SUBJECT: PORCH ROOF

PORCH ROOF FRAMING:

ROOF JUST. TIE-DOWN:

UPLIFT • -79.3 PSF + 5.0 PSF • -74.3 PSF



RA • -380 lbs

USE SIMPSON H3

U_a • -455 lbs ≥ -380 lbs



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JOB SOLAR DELATHLON LOHA042

SHEET # _____ OF (27)

CALCULATED BY: T. WILDA DATE: 1/25/11

CHECKED BY: _____ DATE: _____

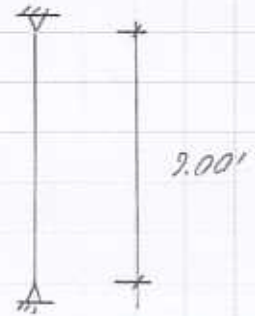
SUBJECT: STR. COLUMN & PORCH

Worst-Case STR. COLUMN & PORCH:

$P_D = 1.41^k$ $L = 1.41^k$ (FROM TUBE STEEL DESIGN)

$h_u = 9.00'$

USE HSS 4x4x 3/16" COL.
PER ATTACHED ENERCALC SHEETS.



Title Block Line 1
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 Title Block Line 6

Title :
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 Project Desc.:

Job #

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Project Notes :

Printed: 7 MAR 2011, 8:55AM

Steel Column

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec6
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Porch Steel Column

General Information

Calculations per AISC 360-05, IBC 2006, CBC 2007, ASCE 7-05

Steel Section Name : **HSS4X4X3/16**
 Analysis Method : 2006 IBC & ASCE 7-05
 Steel Stress Grade
 Fy : Steel Yield 46.0 ksi
 E : Elastic Bending Modulus 29,000.0 ksi
 Load Combination : Allowable Stress

Overall Column Height 9.0 ft
 Top & Bottom Fixity Top & Bottom Pinned

Brace condition for deflection (buckling) along columns :
 X-X (width) axis : Unbraced Length for X-X Axis buckling = 10ft, K = 1.0
 Y-Y (depth) axis : Unbraced Length for Y-Y Axis buckling = 10 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 84.627 lbs * Dead Load Factor
 AXIAL LOADS . . .
 Axial Load at 9.0 ft, D = 1.410, LR = 1.410 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.06112 : 1**
 Load Combination +D+Lr+H
 Location of max. above base 0.0 ft
 At maximum location values are . . .
 Pu : Axial 2.905 k
 Pn / Omega : Allowable 47.521 k
 Mu-x : Applied 0.0 k-ft
 Mn-x / Omega : Allowable 8.424 k-ft
 Mu-y : Applied 0.0 k-ft
 Mn-y / Omega : Allowable 8.424 k-ft

PASS Maximum Shear Stress Ratio = **0.0 : 1**
 Load Combination
 Location of max. above base 0.0 ft
 At maximum location values are . . .
 Vu : Applied 0.0 k
 Vn / Omega : Allowable 0.0 k

Maximum SERVICE Load Reactions . .

Top along X-X 0.0 k
 Bottom along X-X 0.0 k
 Top along Y-Y 0.0 k
 Bottom along Y-Y 0.0 k

Maximum SERVICE Load Deflections . .

Along Y-Y 0.0 in at 0.0ft above base
 for load combination :
 Along X-X 0.0 in at 0.0ft above base
 for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
	Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D	0.031	PASS	0.00 ft	0.000	PASS	0.00 ft
+D+Lr+H	0.061	PASS	0.00 ft	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+H	0.054	PASS	0.00 ft	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+0.750W+H	0.054	PASS	0.00 ft	0.000	PASS	0.00 ft
+D+0.750Lr+0.750L+0.5250E+H	0.054	PASS	0.00 ft	0.000	PASS	0.00 ft

Maximum Reactions - Unfactored

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		Y-Y Axis Reaction		Axial Reaction @ Base
	@ Base	@ Top	@ Base	@ Top	
D Only		k		k	1.495 k
Lr Only		k		k	1.410 k
D+Lr		k		k	2.905 k

Maximum Deflections for Load Combinations - Unfactored Loads

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
Lr Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
D+Lr	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : HSS4X4X3/16

Title Block Line 1
 You can changes this area
 using the "Settings" menu item
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 Title Block Line 6

Title :
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 Project Notes :

Job #

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Printed: 7 MAR 2011, 8:55AM

Steel Column

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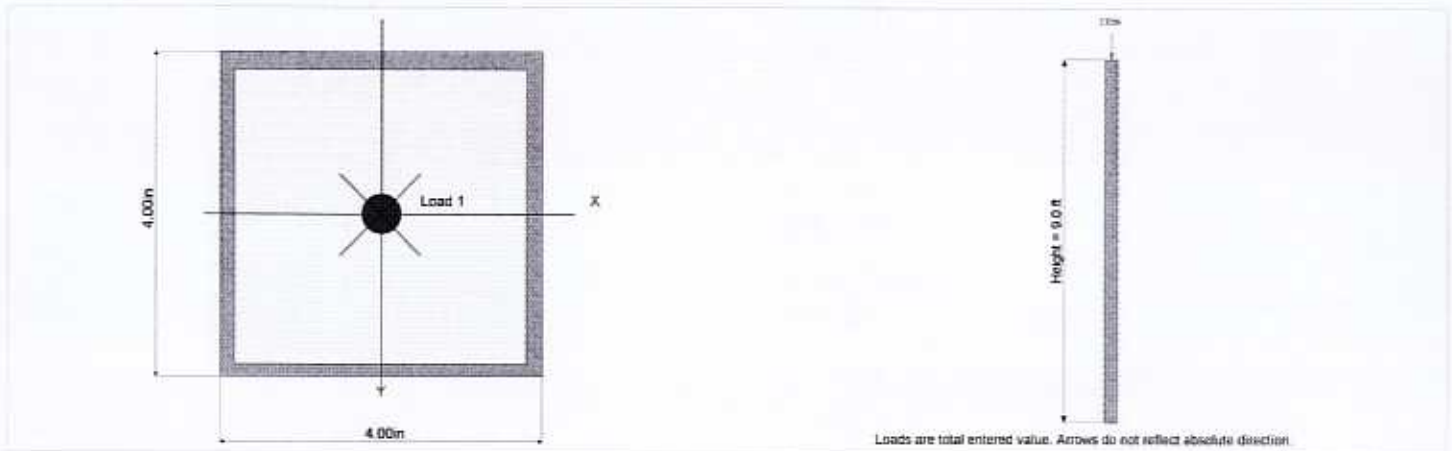
Licensee :

Description : Porch Steel Column

Steel Section Properties : HSS4X4X3/16

Depth	=	4.000 in	I xx	=	6.21 in ⁴	J	=	10.000 in ⁴
Web Thick	=	0.000 in	S xx	=	3.10 in ³			
Flange Width	=	4.000 in	R xx	=	1.550 in			
Flange Thick	=	0.187 in						
Area	=	2.580 in ²	I yy	=	6.210 in ⁴			
Weight	=	9.403 plf	S yy	=	3.100 in ³			
			R yy	=	1.550 in			

Ycg = 0.000 in



Pop-Out Framing



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (30)

CALCULATED BY: T. WILDA DATE: 2/14/11

CHECKED BY: _____ DATE: _____

SUBJECT: FRONT ENTRY POP-OUTS

FRONT ENTRY POP-OUTS:

CENTER BEAM: $T.W. = \frac{1}{2}(7.17') \cdot 3.58'$

$W_D = 30 \text{ PSF} \times 3.58' = 110 \text{ PLF}$

$W_L = 20 \text{ PSF} \times 3.58' = 75 \text{ PLF}$

$W_W = (-70.0 \text{ PSF} + 5.0 \text{ PSF}) \times 3.58' = -235 \text{ PLF}$

$L = 6.00' \quad I_u = 1.00 \text{ FT}$

USE HSS 4x4x 3/16"



EDGE BEAM: (WORST-CASE): $T.W. = \frac{1}{2}(3.67') \cdot 1.83'$

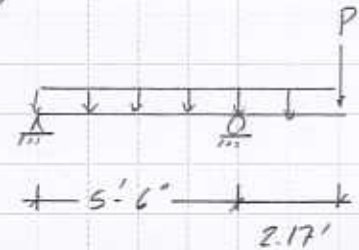
$W_D = 30 \text{ PSF} \times 1.83' = 55 \text{ PLF}$

$W_L = 20 \text{ PSF} \times 1.83' = 40 \text{ PLF}$

$W_W = (-84.3 \text{ PSF} + 5.0 \text{ PSF}) \times 1.83' = -145 \text{ PLF}$

$P_D = 120 \text{ lbs} \quad P_L = 80 \text{ lbs} \quad P_W = -320 \text{ lbs}$

USE HSS 4x4x 3/16"



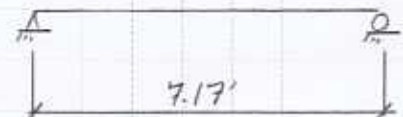
TRANS EDGE: $T.W. = \frac{1}{2}(2.17') \cdot 1.1 \text{ FT}$

$W_D = 30 \text{ PSF} \times 1.1 \text{ FT} = 35 \text{ PLF}$

$W_L = 20 \text{ PSF} \times 1.1 \text{ FT} = 25 \text{ PLF}$

..

$W_W = (-84.3 \text{ PSF} + 5.0 \text{ PSF}) \times 1.1 \text{ FT} = -90 \text{ PLF}$



Scope :

Rev: 560007
User: KW-0808353, Ver 5.8.0, 1-Nov-2006
(c)1983-2006 ENERCALC Engineering Software

Steel Beam Design

Description Front Entry Pop-Out Center Brm. Gravity

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X3/16

Center Span 6.00 ft
Left Cant. 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 1.00 ft

Pinned-Pinned
Bm Wt. Added to Loads
LL & ST Act Together

Fy 46.00ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL	0.110							k/ft
LL	0.075							k/ft
ST								k/ft
Start Location								ft
End Location								ft

Summary

Beam OK
Static Load Case Governs Stress

Using: HSS4X4X3/16 section, Span = 6.00ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 1.00ft, LDF = 1.000

	Actual	Allowable		
Moment	0.872 k-ft	7.843 k-ft	Max. Deflection	-0.031 in
fb : Bending Stress	3.375 ksi	30.360 ksi	Length/DL Defl	3,744.2 : 1
fb / Fb	0.111 : 1		Length/(DL+LL Defl)	2,295.0 : 1
Shear	0.581 k	25.613 k		
fv : Shear Stress	0.418 ksi	18.400 ksi		
fv / Fv	0.023 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	0.87 k-ft	0.53	0.87				k-ft
Max. M -							k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	0.58 k	0.36	0.58				k
Shear @ Right	0.58 k	0.36	0.58				k
Center Defl.	-0.031 in	-0.019	-0.031	-0.031	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	0.58	0.36	0.58	0.58			k
Reaction @ Rt	0.58	0.36	0.58	0.58			k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Section Properties HSS4X4X3/16

Depth	4.000 in	Weight	8.76 #/ft
Web Thick	0.174 in	Ixx	6.210 in4
Width	4.000 in	Iyy	6.210 in4
Flange Thick	0.174 in	Sxx	3.100 in3
Area	2.58 in2	Syy	3.100 in3
Rt	0.000 in	R-xx	1.550 in
Values for LRF Design....		R-yy	1.550 in
J	9.960 in4	Zx	3.670 in3
Cw	5.07 in6	Zy	3.670 in3

Scope :

Rev: 580007
User: KW-0508353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Front Entry Pop-Out Center Bm. Wind

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X3/16

Center Span 6.00 ft
Left Cant 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 1.00 ft

Pinned-Pinned
LL & ST Act Together

Fy 46.00ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL								k/ft
LL								k/ft
ST	-0.235							k/ft
Start Location								ft
End Location								ft

Summary

Beam OK
Short Term Load Case Governs Stress

Using: HSS4X4X3/16 section, Span = 6.00ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 1.00ft, LDF = 1.000

	Actual	Allowable		
Moment	1.057 k-ft	7.843 k-ft	Max. Deflection	0.038 in
fb : Bending Stress	4.094 ksi	30.360 ksi	Length/DL Defl	0.0 : 1
fb / Fb	0.135 : 1		Length/(DL+LL Defl)	1,892.2 : 1
Shear	0.705 k	25.613 k		
fv : Shear Stress	0.506 ksi	18.400 ksi		
fv / Fv	0.028 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	1.06 k-ft						k-ft
Max. M -				-1.06			k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	0.70 k			0.70			k
Shear @ Right	0.70 k			0.70			k
Center Defl.	0.038 in	0.000	0.000	0.038	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	-0.70			-0.70			k
Reaction @ Rt	-0.70			-0.70			k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Section Properties HSS4X4X3/16

Depth	4.000 in	Weight	8.76 #/ft
Web Thick	0.174 in	Ixx	6.210 in4
Width	4.000 in	Iyy	6.210 in4
Flange Thick	0.174 in	Sxx	3.100 in3
Area	2.58 in2	Syy	3.100 in3
Rt	0.000 in	R-xx	1.550 in
Values for LRFD Design....		R-yy	1.550 in
J	9.960 in4	Zx	3.670 in3
Cw	5.07 in6	Zy	3.670 in3
--			

Scope :

Rev: 560007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Front Entry Pop-Out Edge Beam Gravity

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X3/16

Center Span 5.50 ft
Left Cant. 0.00 ft
Right Cant 2.17 ft
Lu : Unbraced Length 0.00 ft

Pinned-Pinned
Bm Wt. Added to Loads
LL & ST Act Together

Fy 46.00ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL	0.055							k/ft
LL	0.040							k/ft
ST								k/ft
Start Location								ft
End Location	5.500							ft

Point Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
Dead Load	0.120							k
Live Load	0.080							k
Short Term								k
Location	7.670							ft

Summary

Beam OK

Static Load Case Governs Stress

Using: HSS4X4X3/16 section, Span = 5.50ft, Fy = 46.0ksi, Left Cant. = 0.00ft, Right Cant. = 2.17ft
End Fixity = Pinned-Pinned, Lu = 0.00ft, LDF = 1.000

	Actual	Allowable		
Moment	0.455 k-ft	7.843 k-ft	Max. Deflection	0.015 in
fb : Bending Stress	1.760 ksi	30.360 ksi	Length/DL Defl	9,298.5 : 1
fb / Fb	0.058 : 1		Length/(DL+LL Defl)	3,495.4 : 1
Shear	0.336 k	25.613 k		
fv : Shear Stress	0.242 ksi	18.400 ksi		
fv / Fv	0.013 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	0.45 k-ft	0.12	0.26		0.07		k-ft
Max. M -		-0.28	-0.28		-0.45		k-ft
Max. M @ Left							k-ft
Max. M @ Right		-0.28	-0.28		-0.45		k-ft
Shear @ Left	0.23 k	0.12	0.23		0.09		k
Shear @ Right	0.34 k	0.23	0.34		0.26		k
Center Defl.	-0.007 in	-0.002	-0.007	-0.007	0.002	0.002 in	
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000 in	
Right Cant Defl	0.015 in	-0.006	0.000	0.000	-0.015	-0.015 in	
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000 in	
Reaction @ Left	0.23	0.12	0.23	0.23	0.09	0.09 k	
Reaction @ Rt	0.59	0.37	0.48	0.48	0.48	0.48 k	

Fa calc'd per Eq. E2-1, K*L/r < Cc

HEES AND ASSOCIATES
1381 FIFTH STREET
SARASOTA FL 34236

Title :
Dsgnr:
Description :

Job #
Date: 10:33AM, 7 MAR 11

34

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Page 2
revised pop-out framing eow Calculations

Description Front Entry Pop-Out Edge Beam Gravity

Section Properties HSS4X4X3/16

Depth	4.000 in	Weight	8.76 #/ft
Web Thick	0.174 in	Ixx	6.210 in4
Width	4.000 in	Iyy	6.210 in4
Flange Thick	0.174 in	Sxx	3.100 in3
Area	2.58 in2	Syy	3.100 in3
Rt	0.000 in	R-xx	1.550 in
Values for LRFD Design....		R-yy	1.550 in
J	9.960 in4	Zx	3.670 in3
Cw	5.07 in6	Zy	3.670 in3

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
(c)1983-2006 ENERCALC Engineering Software

Steel Beam Design

Description Front Entry Pop-Out Edge Beam Wind

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X3/16

Center Span 5.50 ft
Left Cant. 0.00 ft
Right Cant 2.17 ft
Lu : Unbraced Length 0.00 ft

Pinned-Pinned
Bm Wt. Added to Loads
LL & ST Act Together

Fy 46.00 ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0 ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL								k/ft
LL								k/ft
ST	-0.145							k/ft
Start Location								ft
End Location	5.500							ft

Point Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
Dead Load								k
Live Load								k
Short Term	-0.320							k
Location	7.670							ft

Summary

Beam OK

Short Term Load Case Governs Stress

Using: HSS4X4X3/16 section, Span = 5.50ft, Fy = 46.0ksi, Left Cant. = 0.00ft, Right Cant. = 2.17ft
End Fixity = Pinned-Pinned, Lu = 0.00ft, LDF = 1.000

	Actual	Allowable		
Moment	0.674 k-ft	7.843 k-ft	Max. Deflection	0.037 in
fb : Bending Stress	2.608 ksi	30.360 ksi	Length/DL Defl	104400.6 : 1
fb / Fb	0.086 : 1		Length/(DL+LL Defl)	1,394.9 : 1
Shear	0.378 k	25.613 k		
fv : Shear Stress	0.272 ksi	18.400 ksi		
fv / Fv	0.015 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants
Max. M +	0.67 k-ft	0.02				0.67 k-ft
Max. M -		-0.02		-0.53		k-ft
Max. M @ Left						k-ft
Max. M @ Right		-0.02		-0.02		0.67 k-ft
Shear @ Left	0.38 k	0.02		0.38		0.15 k
Shear @ Right	0.37 k	0.03		0.37		0.30 k
Center Defl.	0.016 in	-0.001	0.000	0.016	0.000	-0.014 in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000 in
Right Cant Defl	0.037 in	0.000	0.000	-0.021	0.000	0.037 in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000 in
Reaction @ Left	-0.38	0.02		-0.38		0.15 k
Reaction @ Rt	-0.80	0.05		-0.35		-0.40 k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Page 2
revised pop-out framing ecw Calculations

Description Front Entry Pop-Out Edge Beam Wind

Section Properties HSS4X4X3/16

Depth	4.000 in	Weight	8.76 #/ft
Web Thick	0.174 in	txx	6.210 in4
Width	4.000 in	lyy	6.210 in4
Flange Thick	0.174 in	Sxx	3.100 in3
Area	2.58 in2	Syy	3.100 in3
Rt	0.000 in	R-xx	1.550 in
Values for LRFD Design....		R-yy	1.550 in
J	9.960 in4	Zx	3.670 in3
Cw	5.07 in6	Zy	3.670 in3

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Front Entry Pop-Out Trans Edge Gravity

General Information

Code Ref. AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X3/16

Center Span	7.17 ft	Pinned-Pinned	Fy	46.00ksi
Left Cant	0.00 ft	Bm Wt. Added to Loads	Load Duration Factor	1.00
Right Cant	0.00 ft	LL & ST Act Together	Elastic Modulus	29,000.0 ksi
Lu : Unbraced Length	1.00 ft			

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL	0.035							k/ft
LL	0.035							k/ft
ST								k/ft
Start Location								ft
End Location								ft

Summary

Beam OK
Static Load Case Governs Stress

Using: HSS4X4X3/16 section, Span = 7.17ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 1.00ft, LDF = 1.000

	Actual	Allowable		
Moment	0.506 k-ft	7.843 k-ft	Max. Deflection	-0.026 in
fb : Bending Stress	1.959 ksi	30.360 ksi	Length/DL Defl	5,954.3 : 1
fb / Fb	0.065 : 1		Length/(DL+LL Defl)	3,308.4 : 1
Shear	0.282 k	25.613 k		
fv : Shear Stress	0.203 ksi	18.400 ksi		
fv / Fv	0.011 : 1			

Force & Stress Summary

<<- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	0.51 k-ft	0.28	0.51				k-ft
Max. M -							k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	0.28 k	0.16	0.28				k
Shear @ Right	0.28 k	0.16	0.28				k
Center Defl.	-0.026 in	-0.014	-0.026	-0.026	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	0.28	0.16	0.28	0.28			k
Reaction @ Rt	0.28	0.16	0.28	0.28			k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Section Properties HSS4X4X3/16

Depth	4.000 in	Weight	8.76 #/ft
Web Thick	0.174 in	Ixx	6.210 in4
Width	4.000 in	Iyy	6.210 in4
Flange Thick	0.174 in	Sxx	3.100 in3
Area	2.58 in2	Syy	3.100 in3
Rt	0.000 in	R-xx	1.550 in
Values for LRFD Design....		R-yy	1.550 in
J	9.960 in4	Zx	3.670 in3
Cw	5.07 in6	Zy	3.670 in3

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

revised pop-out framing ecw Calculations

Description Front Entry Pop-Out Trans Edge Wind

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X3/16

Center Span 7.17 ft
Left Cant 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 1.00 ft

Pinned-Pinned
LL & ST Act Together

Fy 46.00ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL								k/ft
LL								k/ft
ST	-0.090							k/ft
Start Location								ft
End Location								ft

Summary

Beam OK

Short Term Load Case Governs Stress

Using: HSS4X4X3/16 section, Span = 7.17ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 1.00ft, LDF = 1.000

	Actual	Allowable		
Moment	0.578 k-ft	7.843 k-ft	Max. Deflection	0.030 in
fb : Bending Stress	2.239 ksi	30.360 ksi	Length/DL Defl	0.0 : 1
fb / Fb	0.074 : 1		Length/(DL+LL Defl)	2,895.3 : 1
Shear	0.323 k	25.613 k		
fv : Shear Stress	0.232 ksi	18.400 ksi		
fv / Fv	0.013 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	0.58 k-ft						k-ft
Max. M -				-0.58			k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	0.32 k			0.32			k
Shear @ Right	0.32 k			0.32			k
Center Defl.	0.030 in	0.000	0.000	0.030	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	-0.32			-0.32			k
Reaction @ Rt	-0.32			-0.32			k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Section Properties HSS4X4X3/16

Depth	4.000 in	Weight	8.76 #/ft
Web Thick	0.174 in	Ixx	6.210 in4
Width	4.000 in	Iyy	6.210 in4
Flange Thick	0.174 in	Sxx	3.100 in3
Area	2.58 in2	Syy	3.100 in3
Rt	0.000 in	R-xx	1.550 in
Values for LRFD Design....		R-yy	1.550 in
J	9.960 in4	Zx	3.670 in3
Cw	5.07 in6	Zy	3.670 in3
--			



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (39)

CALCULATED BY: T. WILDA DATE: 2/25/11

CHECKED BY: _____ DATE: _____

SUBJECT: BEDROOM POP-OUT

BEDROOM POP-OUT END FRAME:

$P = P_D = 325 \text{ lbs}$

$P_L = 215 \text{ lbs}$

$P_W = -360 \text{ lbs (MWFERS)}$

$P_{WW} = 270 \text{ lbs} \quad P_{LW} = 190 \text{ lbs}$

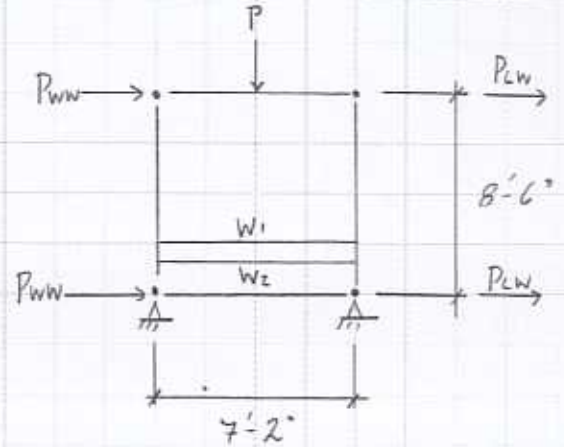
$W_1 = \frac{1}{2}(3.5') \times 20 \text{ PSF} + 35 \text{ PLF} = W_D$

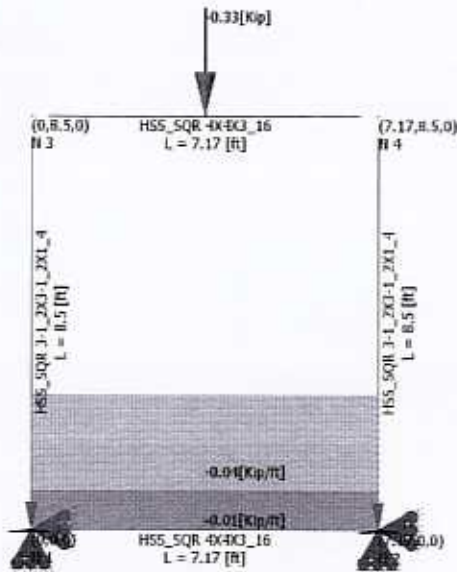
$\frac{1}{2}(3.5') \times 50 \text{ PSF} = 90 \text{ PLF} = W_L$

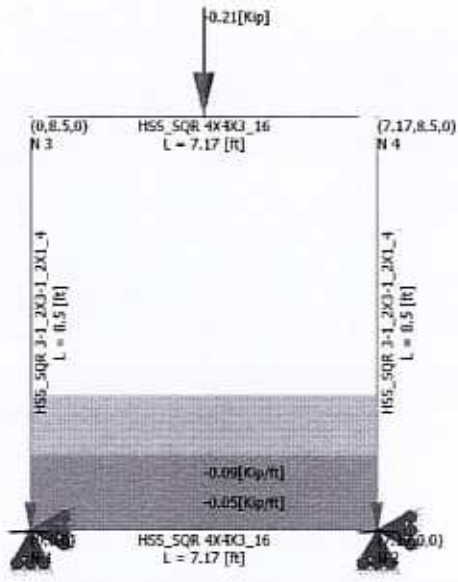
$W_2 = \frac{1}{2}(2.0') \times 10 \text{ PSF} = 10 \text{ PLF} = W_D$

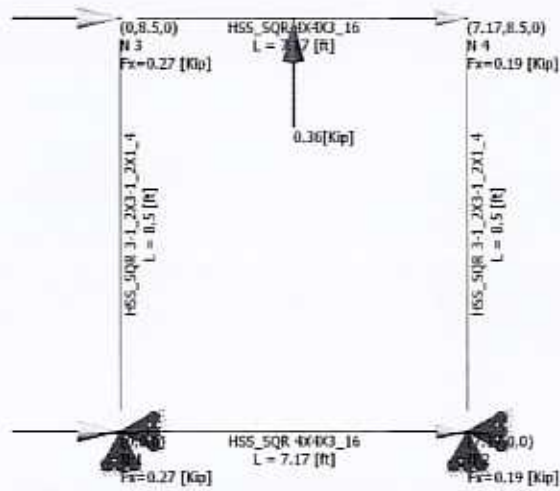
$\frac{1}{2}(2.0') \times 50 \text{ PSF} = 50 \text{ PLF} = W_L$

SEE ATTACHED RDM ADVANCE SHEETS









Current Date: 3/7/2011 10:48 AM

Units system: English

File name: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Advanse\Pop-Out Moment Frame Front Entry.adv\

Analysis Results

Reactions



Direction of positive forces and moments

Node	Forces [Kip]			Moments [Kip*ft]		
	FX	FY	FZ	MX	MY	MZ
Condition D1=DL						
1	0.04398	0.47002	0.00000	0.00000	0.00000	0.00000
2	-0.04398	0.47002	0.00000	0.00000	0.00000	0.00000
SUM	0.00000	0.94004	0.00000	0.00000	0.00000	0.00000
Condition D2=DL+LL						
1	0.10634	1.07942	0.00000	0.00000	0.00000	0.00000
2	-0.10634	1.07942	0.00000	0.00000	0.00000	0.00000
SUM	0.00000	2.15884	0.00000	0.00000	0.00000	0.00000
Condition D3=DL+0.75LL						
1	0.09075	0.92707	0.00000	0.00000	0.00000	0.00000
2	-0.09075	0.92707	0.00000	0.00000	0.00000	0.00000
SUM	0.00000	1.85414	0.00000	0.00000	0.00000	0.00000
Condition D4=DL+Wind						
1	-0.48143	-0.25531	0.00000	0.00000	0.00000	0.00000
2	-0.43857	0.83535	0.00000	0.00000	0.00000	0.00000
SUM	-0.92000	0.58004	0.00000	0.00000	0.00000	0.00000
Condition D5=DL+0.75Wind+0.75LL						
1	-0.30330	0.38307	0.00000	0.00000	0.00000	0.00000
2	-0.38670	1.20107	0.00000	0.00000	0.00000	0.00000
SUM	-0.69000	1.58414	0.00000	0.00000	0.00000	0.00000
Condition D6=0.6DL+Wind						
1	-0.49902	-0.44332	0.00000	0.00000	0.00000	0.00000
2	-0.42098	0.64734	0.00000	0.00000	0.00000	0.00000
SUM	-0.92000	0.20402	0.00000	0.00000	0.00000	0.00000

Maximum relative deflections

Remark.- Magnitude of deflections in absolute value.

CONDITION1=DL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.00412 (< L/10000)	75.00000	0.00000 (< L/10000)	0.00000
2	0.01459 (L/5897)	50.00000	0.00000 (< L/10000)	0.00000
3	0.00412 (< L/10000)	75.00000	0.00000 (< L/10000)	0.00000
4	0.00772 (< L/10000)	50.00000	0.00000 (< L/10000)	0.00000

CONDITION2=DL+LL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.01118 (L/9123)	27.50000	0.00000 (< L/10000)	0.00000
2	0.01947 (L/4418)	50.00000	0.00000 (< L/10000)	0.00000
3	0.01118 (L/9123)	27.50000	0.00000 (< L/10000)	0.00000
4	0.03326 (L/2587)	50.00000	0.00000 (< L/10000)	0.00000

CONDITION3=DL+0.75LL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.00857 (< L/10000)	25.00000	0.00000 (< L/10000)	0.00000
2	0.01825 (L/4714)	50.00000	0.00000 (< L/10000)	0.00000
3	0.00857 (< L/10000)	25.00000	0.00000 (< L/10000)	0.00000
4	0.02688 (L/3201)	50.00000	0.00000 (< L/10000)	0.00000

CONDITION4=DL+Wind

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.01572 (L/6489)	77.50000	0.00000 (< L/10000)	0.00000
2	0.00889 (L/9682)	77.50000	0.00000 (< L/10000)	0.00000
3	0.01800 (L/5666)	22.50000	0.00000 (< L/10000)	0.00000
4	0.01499 (L/5740)	30.00000	0.00000 (< L/10000)	0.00000

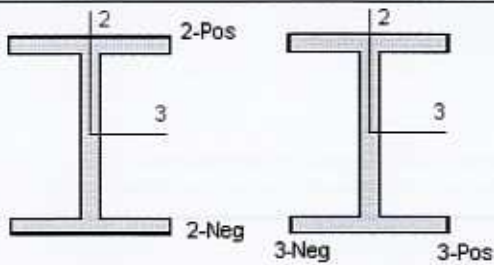
CONDITION5=DL+0.75Wind+0.75LL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.01333 (L/7653)	70.00000	0.00000 (< L/10000)	0.00000
2	0.00917 (L/9378)	30.00000	0.00000 (< L/10000)	0.00000
3	0.02134 (L/4780)	25.00000	0.00000 (< L/10000)	0.00000
4	0.03019 (L/2850)	40.00000	0.00000 (< L/10000)	0.00000

CONDITION6=0.6DL+Wind

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.01735 (L/5881)	77.50000	0.00000 (< L/10000)	0.00000
2	0.01261 (L/6824)	72.50000	0.00000 (< L/10000)	0.00000
3	0.01757 (L/5804)	25.00000	0.00000 (< L/10000)	0.00000
4	0.01268 (L/6786)	27.50000	0.00000 (< L/10000)	0.00000

Member stresses



Location of the fibers with maximum bending stresses

CONDITION D1=DL

Station	Axial [Kip/in ²]	Shear V2 [Kip/in ²]	Shear V3 [Kip/in ²]	Bending			
				2-Pos [Kip/in ²]	2-Neg [Kip/in ²]	3-Pos [Kip/in ²]	3-Neg [Kip/in ²]
MEMBER 1							
0%	-0.10	0.04	0.00	-0.70	0.70	0.00	0.00
50%	-0.08	0.04	0.00	0.08	-0.08	0.00	0.00
100%	-0.07	0.04	0.00	0.87	-0.87	0.00	0.00
MEMBER 2							
0%	-0.02	0.18	0.00	0.80	-0.80	0.00	0.00
50%	-0.02	0.15	0.00	-1.67	1.67	0.00	0.00
100%	-0.02	0.18	0.00	0.80	-0.80	0.00	0.00
MEMBER 3							
0%	-0.10	0.04	0.00	0.70	-0.70	0.00	0.00
50%	-0.08	0.04	0.00	-0.08	0.08	0.00	0.00
100%	-0.07	0.04	0.00	-0.87	0.87	0.00	0.00
MEMBER 4							
0%	0.00	0.18	0.00	0.65	-0.65	0.00	0.00
50%	0.00	0.00	0.00	-0.69	0.69	0.00	0.00
100%	0.00	0.18	0.00	0.65	-0.65	0.00	0.00

CONDITION D2=DL+LL

Station	Axial [Kip/in ²]	Shear V2 [Kip/in ²]	Shear V3 [Kip/in ²]	Bending			
				2-Pos [Kip/in ²]	2-Neg [Kip/in ²]	3-Pos [Kip/in ²]	3-Neg [Kip/in ²]
MEMBER 1							
0%	-0.13	0.09	0.00	-2.16	2.16	0.00	0.00
50%	-0.12	0.09	0.00	-0.26	0.26	0.00	0.00
100%	-0.10	0.09	0.00	1.64	-1.64	0.00	0.00
MEMBER 2							
0%	-0.04	0.28	0.00	1.51	-1.51	0.00	0.00
50%	-0.04	0.25	0.00	-2.46	2.46	0.00	0.00
100%	-0.04	0.28	0.00	1.51	-1.51	0.00	0.00
MEMBER 3							
0%	-0.13	0.09	0.00	2.16	-2.16	0.00	0.00
50%	-0.12	0.09	0.00	0.26	-0.26	0.00	0.00
100%	-0.10	0.09	0.00	-1.64	1.64	0.00	0.00
MEMBER 4							
0%	0.00	0.64	0.00	1.99	-1.99	0.00	0.00
50%	0.00	0.00	0.00	-2.83	2.83	0.00	0.00
100%	0.00	0.64	0.00	1.99	-1.99	0.00	0.00

--

CONDITION D3=DL+0.75LL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	-0.12	0.07	0.00	-1.80	1.80	0.00	0.00
50%	-0.11	0.07	0.00	-0.18	0.18	0.00	0.00
100%	-0.09	0.07	0.00	1.44	-1.44	0.00	0.00
MEMBER 2							
0%	-0.04	0.25	0.00	1.33	-1.33	0.00	0.00
50%	-0.04	0.23	0.00	-2.26	2.26	0.00	0.00
100%	-0.04	0.25	0.00	1.33	-1.33	0.00	0.00
MEMBER 3							
0%	-0.12	0.07	0.00	1.80	-1.80	0.00	0.00
50%	-0.11	0.07	0.00	0.18	-0.18	0.00	0.00
100%	-0.09	0.07	0.00	-1.44	1.44	0.00	0.00
MEMBER 4							
0%	0.00	0.53	0.00	1.66	-1.66	0.00	0.00
50%	0.00	0.00	0.00	-2.29	2.29	0.00	0.00
100%	0.00	0.53	0.00	1.66	-1.66	0.00	0.00

CONDITION D4=DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.06	0.17	0.00	3.59	-3.59	0.00	0.00
50%	0.07	0.17	0.00	-0.19	0.19	0.00	0.00
100%	0.09	0.17	0.00	-3.96	3.96	0.00	0.00
MEMBER 2							
0%	-0.02	0.24	0.00	-3.65	3.65	0.00	0.00
50%	-0.02	0.24	0.00	0.16	-0.16	0.00	0.00
100%	-0.02	0.27	0.00	3.91	-3.91	0.00	0.00
MEMBER 3							
0%	-0.13	0.20	0.00	4.63	-4.63	0.00	0.00
50%	-0.11	0.20	0.00	0.19	-0.19	0.00	0.00
100%	-0.10	0.20	0.00	-4.24	4.24	0.00	0.00
MEMBER 4							
0%	0.00	0.07	0.00	-3.31	3.31	0.00	0.00
50%	0.00	0.25	0.00	-0.86	0.86	0.00	0.00
100%	0.00	0.43	0.00	4.27	-4.27	0.00	0.00

CONDITION D5=DL+0.75Wind+0.75LL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	-0.01	0.08	0.00	1.42	-1.42	0.00	0.00
50%	0.01	0.08	0.00	-0.38	0.38	0.00	0.00
100%	0.02	0.08	0.00	-2.18	2.18	0.00	0.00
MEMBER 2							

47

0%	-0.04	0.06	0.00	-2.01	2.01	0.00	0.00
50%	-0.04	0.29	0.00	-0.89	0.89	0.00	0.00
100%	-0.04	0.32	0.00	3.66	-3.66	0.00	0.00

MEMBER 3

0%	-0.15	0.20	0.00	4.74	-4.74	0.00	0.00
50%	-0.13	0.20	0.00	0.38	-0.38	0.00	0.00
100%	-0.12	0.20	0.00	-3.98	3.98	0.00	0.00

MEMBER 4

0%	0.00	0.34	0.00	-1.31	1.31	0.00	0.00
50%	0.00	0.19	0.00	-2.42	2.42	0.00	0.00
100%	0.00	0.72	0.00	4.37	-4.37	0.00	0.00

CONDITION D6=0.6DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.10	0.18	0.00	3.87	-3.87	0.00	0.00
50%	0.11	0.18	0.00	-0.22	0.22	0.00	0.00
100%	0.12	0.18	0.00	-4.31	4.31	0.00	0.00
MEMBER 2							
0%	-0.02	0.31	0.00	-3.97	3.97	0.00	0.00
50%	-0.02	0.18	0.00	0.82	-0.82	0.00	0.00
100%	-0.02	0.19	0.00	3.59	-3.59	0.00	0.00
MEMBER 3							
0%	-0.09	0.19	0.00	4.35	-4.35	0.00	0.00
50%	-0.08	0.19	0.00	0.23	-0.23	0.00	0.00
100%	-0.07	0.19	0.00	-3.90	3.90	0.00	0.00
MEMBER 4							
0%	0.00	0.15	0.00	-3.56	3.56	0.00	0.00
50%	0.00	0.25	0.00	-0.58	0.58	0.00	0.00
100%	0.00	0.36	0.00	4.01	-4.01	0.00	0.00



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (48)

CALCULATED BY: T. WILDA DATE: 3/1/11

CHECKED BY: _____ DATE: _____

SUBJECT: POP-OUT ROOF FRAMING

Pop - Out Typical Roof Framing: (worst-case)

TYPICAL ROOF JOIST:

$$W_D = 30 \text{ PSF} \times 1.0' = 30 \text{ PLF}$$

$$W_L = 20 \text{ PSF} \times 1.0' = 20 \text{ PLF}$$

$$W_W = (-84.3 \text{ PSF} + 5.0 \text{ PSF}) \times 1.0' = -79.3 \text{ PLF}$$



USE #2 SYP 2x4 @ 12" O.C. MAX.

Scope :

Rev: 560004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
(c)1983-2006 ENERCALC Engineering Software

General Timber Beam

Description Pop-Out Typical Roof Framing Gravity

General Information Code Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2x4	Center Span	5.75 ft	.....Lu	1.00 ft
Beam Width	1.500 in	Left Cantilever	ft	.....Lu	0.00 ft
Beam Depth	3.500 in	Right Cantilever	ft	.....Lu	0.00 ft
Member Type	Manuf/So.Pine	Southern Pine, No.2 2-4	Thick, 2-4	W	
Bm Wt. Added to Loads		Fb Base Allow	1,500.0 psi		
Load Dur. Factor	1.250	Fv Allow	175.0 psi		
Beam End Fixity	Pin-Pin	Fc Allow	565.0 psi		Repetitive Member
Wood Density	35.000 pcf	E	1,600.0 ksi		

Full Length Uniform Loads

Center	DL	30.00 #/ft	LL	20.00 #/ft
Left Cantilever	DL	#/ft	LL	#/ft
Right Cantilever	DL	#/ft	LL	#/ft

Summary

Beam Design OK

Span= 5.75ft, Beam Width = 1.500in x Depth = 3.5in, Ends are Pin-Pin

Max Stress Ratio	0.387 : 1		Maximum Shear * 1.5	0.2 k
Maximum Moment Allowable	0.2 k-ft	at 2.875 ft	Allowable	1.1 k
Max. Positive Moment	0.21 k-ft	at 2.875 ft	Shear:	@ Left 0.15 k
Max. Negative Moment	0.00 k-ft	at 0.000 ft		@ Right 0.15 k
Max @ Left Support	0.00 k-ft		Camber:	@ Left 0.000 in
Max @ Right Support	0.00 k-ft			@ Center 0.135 in
Max. M allow	0.55			@ Right 0.000 in
fb 830.36 psi	Fv 38.08 psi	Reactions...	Left DL 0.09 k	Max 0.15 k
Fb 2,146.32 psi	Fv 218.75 psi		Right DL 0.09 k	Max 0.15 k

Deflections

Center Span...	Dead Load	Total Load	Left Cantilever...	Dead Load	Total Load
Deflection	-0.090 in	-0.147 in	Deflection	0.000 in	0.000 in
...Location	2.875 ft	2.875 ft	...Length/Defl	0.0	0.0
...Length/Defl	769.2	469.17	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.000 in	0.000 in
@ Center	0.135 in		...Length/Defl	0.0	0.0
@ Left	0.000 in				
@ Right	0.000 in				

Stress Calcs

Bending Analysis					
Ck	23.691	Le	2.059 ft	Sxx	3.063 in3
Cf	1.000	Rb	6.201	CI	0.995
				Area	5.250 in2
		Max Moment		Sxx Req'd	Allowable fb
@ Center		0.21 k-ft		1.18 in3	2,146.32 psi
@ Left Support		0.00 k-ft		0.00 in3	2,156.25 psi
@ Right Support		0.00 k-ft		0.00 in3	2,156.25 psi
Shear Analysis		@ Left Support		@ Right Support	
Design Shear		0.20 k		0.20 k	
Area Required		0.914 in2		0.914 in2	
Fv: Allowable		218.75 psi		218.75 psi	
Bearing @ Supports					
Max. Left Reaction		0.15 k	Bearing Length Req'd	0.174 in	
Max. Right Reaction		0.15 k	Bearing Length Req'd	0.174 in	

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
(c)1983-2006 ENERCALC Engineering Software

General Timber Beam

Page 1
misc ecw Calculations

Description Pop-Out Typical Roof Framing Wind

General Information Code Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2x4	Center Span	5.75 ft	.....Lu	5.75 ft
Beam Width	1.500 in	Left Cantilever	ft	.....Lu	0.00 ft
Beam Depth	3.500 in	Right Cantilever	ft	.....Lu	0.00 ft
Member Type	Manuf/So.Pine	Southern Pine, No.2 2-4	Thick, 2-4	W	
Bm Wt. Added to Loads		Fb Base Allow	1,500.0 psi		
Load Dur. Factor	1.250	Fv Allow	175.0 psi		
Beam End Fixity	Pin-Pin	Fc Allow	565.0 psi		Repetitive Member
Wood Density	35.000 pcf	E	1,600.0 ksi		

Full Length Uniform Loads

Center	DL	#/ft	LL	-80.00	#/ft
Left Cantilever	DL	#/ft	LL		#/ft
Right Cantilever	DL	#/ft	LL		#/ft

Summary

Beam Design OK

Span= 5.75ft, Beam Width = 1.500in x Depth = 3.5in, Ends are Pin-Pin

Max Stress Ratio	0.613 : 1		Maximum Shear * 1.5	0.3 k
Maximum Moment Allowable	-0.3 k-ft 0.5 k-ft		Allowable	1.1 k
Max. Positive Moment	0.00 k-ft	at 5.750 ft	Shear:	@ Left 0.23 k
Max. Negative Moment	-0.33 k-ft	at 2.875 ft		@ Right 0.23 k
Max @ Left Support	0.00 k-ft		Camber:	@ Left 0.000 in
Max @ Right Support	0.00 k-ft			@ Center 0.005 in
Max. M allow	0.53			@ Right 0.000 in
fb 1,274.85 psi	fv 58.46 psi	Reactions...	Left DL 0.00 k	Max -0.23 k
Fb 2,080.41 psi	Fv 218.75 psi		Right DL 0.00 k	Max -0.23 k

Deflections

Center Span...	Dead Load	Total Load	Left Cantilever...	Dead Load	Total Load
Deflection	-0.004 in	0.226 in	Deflection	0.000 in	0.000 in
...Location	2.875 ft	2.875 ft	...Length/Defl	0.0	0.0
...Length/Defl	18,852.8	305.59	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.000 in	0.000 in
@ Center	0.005 in		...Length/Defl	0.0	0.0
@ Left	0.000 in				
@ Right	0.000 in				

Stress Calcs

Bending Analysis					
Ck	23.691	Le	10.576 ft	Sxx	3.063 in3
Cf	1.000	Rb	14.053	Cl	0.965
			Max Moment	Sxx Req'd	Allowable fb
@ Center			0.33 k-ft	1.88 in3	2,080.41 psi
@ Left Support			0.00 k-ft	0.00 in3	2,156.25 psi
@ Right Support			0.00 k-ft	0.00 in3	2,156.25 psi
Shear Analysis					
		@ Left Support		@ Right Support	
Design Shear		0.31 k		0.31 k	
Area Required		1.403 in2		1.403 in2	
Fv: Allowable		218.75 psi		218.75 psi	
Bearing @ Supports					
Max. Left Reaction		-0.23 k		Bearing Length Req'd	0.267 in
Max. Right Reaction		-0.23 k		Bearing Length Req'd	0.267 in

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BEDROOM POP-OUT FRAMING:

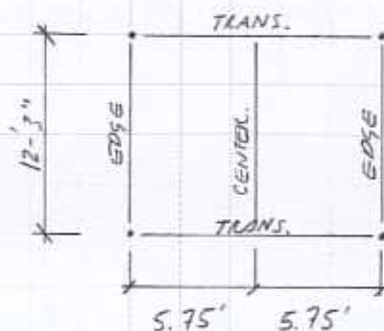
ROOF LOADS CENTER BEAM:

$$D = \frac{1}{2}(11.5') \times 30 \text{ PSF} = 175 \text{ PLF}$$

$$L = \frac{1}{2}(11.5') \times 20 \text{ PSF} = 115 \text{ PLF}$$

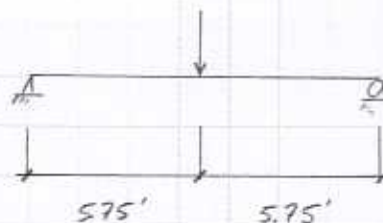
$$UPLIFT = 0 \Rightarrow \text{END} = (-47.5 \text{ PSF} + 5.0 \text{ PSF}) \times \frac{1}{2}(11.5') = -245 \text{ PLF}$$

USE HSS 4x4x5/16"



ROOF LOADS TRANS BEAM:

(SEE MOMENT FRAME
 @ ENDS OF POP-OUTS)

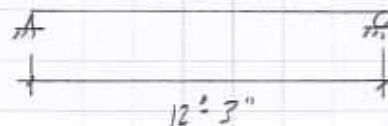


ROOF BEAM EDGE:

$$D = \frac{1}{2}(5.75') \times 30 \text{ PSF} = 90 \text{ PLF}$$

$$L = \frac{1}{2}(5.75') \times 20 \text{ PSF} = 60 \text{ PLF}$$

$$UPLIFT = -42.5 \text{ PSF} \times \frac{1}{2}(5.75') = -125 \text{ PLF}$$



Scope :

Rev: 560007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
(c)1993-2006 ENERCALC Engineering Software

Steel Beam Design

Page 1
revised pop-out framing eow Calculations

Description Pop-Out Center Span Stl Bm. Gravity

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X5/16

Center Span 12.25 ft
Left Cant. 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 1.00 ft

Pinned-Pinned
Bm Wt. Added to Loads
LL & ST Act Together

Fy 46.00ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL	0.175							k/ft
LL	0.115							k/ft
ST								k/ft
Start Location								ft
End Location								ft

Summary

Beam OK
Static Load Case Governs Stress

Using: HSS4X4X5/16 section, Span = 12.25ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 1.00ft, LDF = 1.000

	Actual	Allowable		
Moment	5.701 k-ft	11.562 k-ft	Max. Deflection	-0.581 in
fb : Bending Stress	14.970 ksi	30.360 ksi	Length/DL Defl	407.1 : 1
fb / Fb	0.493 : 1		Length/(DL+LL Defl)	253.0 : 1
Shear	1.862 k	42.835 k		
fv : Shear Stress	0.800 ksi	18.400 ksi		
fv / Fv	0.043 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	5.70 k-ft	3.54	5.70				k-ft
Max. M -							k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	1.86 k	1.16	1.86				k
Shear @ Right	1.86 k	1.16	1.86				k
Center Defl.	-0.581 in	-0.361	-0.581	-0.581	0.000	0.000 in	
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000 in	
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000 in	
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000 in	
Reaction @ Left	1.86	1.16	1.86	1.86			k
Reaction @ Rt	1.86	1.16	1.86	1.86			k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Section Properties HSS4X4X5/16

Depth	4.000 in	Weight	13.93 #/ft
Web Thick	0.291 in	Ixx	9.140 in4
Width	4.000 in	Iyy	9.140 in4
Flange Thick	0.291 in	Sxx	4.570 in3
Area	4.10 in2	Syy	4.570 in3
Rt	0.000 in	R-xx	1.490 in
Values for LRFD Design....		R-yy	1.490 in
J	15.300 in4	Zx	5.590 in3
Cw	7.91 in6	Zy	5.590 in3

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Page 1

revised pop-out framing eow Calculations

Description Pop-Out Center Span Stl Bm. Wind

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X5/16

Center Span 12.25 ft
Left Cant 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 1.00 ft

Pinned-Pinned
LL & ST Act Together

Fy 46.00 ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0 ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL								k/ft
LL								k/ft
ST	0.245							k/ft
Start Location								ft
End Location								ft

Summary

Beam OK

Short Term Load Case Governs Stress

Using: HSS4X4X5/16 section, Span = 12.25ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 1.00ft, LDF = 1.000

	Actual	Allowable		
Moment	4.596 k-ft	11.562 k-ft	Max. Deflection	-0.468 in
fb : Bending Stress	12.067 ksi	30.360 ksi	Length/DL Defl	0.0 : 1
fb / Fb	0.397 : 1		Length/(DL+LL Defl)	313.9 : 1
Shear	1.501 k	42.835 k		
fv : Shear Stress	0.645 ksi	18.400 ksi		
fv / Fv	0.035 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	4.60 k-ft			4.60			k-ft
Max. M -							k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	1.50 k			1.50			k
Shear @ Right	1.50 k			1.50			k
Center Defl.	-0.468 in	0.000	0.000	-0.468	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	1.50			1.50			k
Reaction @ Rt	1.50			1.50			k

Fa calc'd per Eq. E2-1, K*Lu/r < Cc

Section Properties HSS4X4X5/16

Depth	4.000 in	Weight	13.93 #/ft
Web Thick	0.291 in	Ixx	9.140 in4
Width	4.000 in	Iyy	9.140 in4
Flange Thick	0.291 in	Sxx	4.570 in3
Area	4.10 in2	Syy	4.570 in3
Rt	0.000 in	R-xx	1.490 in
Values for LRFD Design....		R-yy	1.490 in
J	15.300 in4	Zx	5.590 in3
Cw	7.91 in6	Zy	5.590 in3

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Pop-Out Trans Stl Bm. Gravity

General Information Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X1/4

Center Span 11.50 ft
Left Cant. 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 5.75 ft

Pinned-Pinned
Bm Wt. Added to Loads
LL & ST Act Together

Fy 46.00ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0 ksi

Point Loads Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
Dead Load	1.160							k
Live Load	0.700							k
Short Term								k
Location	5.750							ft

Summary

Beam OK
Static Load Case Governs Stress

Using: HSS4X4X1/4 section, Span = 11.50ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 5.75ft, LDF = 1.000

	Actual	Allowable		
Moment	5.537 k-ft	8.970 k-ft	Max. Deflection	-0.470 in
fb : Bending Stress	17.036 ksi	27.600 ksi	Length/DL Defl	458.9 : 1
fb / Fb	0.617 : 1		Length/(DL+LL Defl)	293.5 : 1
Shear	0.996 k	34.298 k		
fv : Shear Stress	0.534 ksi	18.400 ksi		
fv / Fv	0.029 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	5.54 k-ft	3.52	5.54				k-ft
Max. M -							k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	1.00 k	0.65	1.00				k
Shear @ Right	1.00 k	0.65	1.00				k
Center Defl.	-0.470 in	-0.301	-0.470	-0.470	0.000	0.000 in	
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000 in	
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000 in	
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000 in	
Reaction @ Left	1.00	0.65	1.00	1.00			k
Reaction @ Rt	1.00	0.65	1.00	1.00			k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Section Properties HSS4X4X1/4

Depth	4.000 in	Weight	11.45 #/ft
Web Thick	0.233 in	Ixx	7.800 in4
Width	4.000 in	Iyy	7.800 in4
Flange Thick	0.233 in	Sxx	3.900 in3
Area	3.37 in2	Syy	3.900 in3
Rt	0.000 in	R-xx	1.520 in
Values for LRFD Design....		R-yy	1.520 in
J	12.800 in4	Zx	4.690 in3
Cw	6.56 in6	Zy	4.690 in3

Scope :

Rev: 560007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Pop-Out Trans Stl Bm. Wind

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X1/4

Center Span 11.50 ft
Left Cant 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 5.75 ft

Pinned-Pinned
LL & ST Act Together

Fy 46.00ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0 ksi

Point Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
Dead Load								k
Live Load								k
Short Term	-1.500							k
Location	5.750							ft

Summary

Beam OK

Short Term Load Case Governs Stress

Using: HSS4X4X1/4 section, Span = 11.50ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 5.75ft, LDF = 1.000

	Actual	Allowable		
Moment	4.312 k-ft	8.970 k-ft	Max. Deflection	0.363 in
fb : Bending Stress	13.269 ksi	27.600 ksi	Length/DL Defl	0.0 : 1
fb / Fb	0.481 : 1		Length/(DL+LL Defl)	380.1 : 1
Shear	0.750 k	34.298 k		
fv : Shear Stress	0.402 ksi	18.400 ksi		
fv / Fv	0.022 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	4.31 k-ft						k-ft
Max. M -				-4.31			k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	0.75 k			0.75			k
Shear @ Right	0.75 k			0.75			k
Center Defl.	0.363 in	0.000	0.000	0.363	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	-0.75			-0.75			k
Reaction @ Rt	-0.75			-0.75			k

Fa calc'd per Eq. E2-1, K*Lu/r < Cc

Section Properties HSS4X4X1/4

Depth	4.000 in	Weight	11.45 #/ft
Web Thick	0.233 in	Ixx	7.800 in4
Width	4.000 in	Iyy	7.800 in4
Flange Thick	0.233 in	Sxx	3.900 in3
Area	3.37 in2	Syy	3.900 in3
Rt	0.000 in	R-xx	1.520 in
Values for LRFD Design....		R-yy	1.520 in
J	12.800 in4	Zx	4.690 in3
Cw	6.56 in6	Zy	4.690 in3

Scope :

Rev: 580007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Pop-Out Edge Span Stl Bm. Gravity

General Information Code Ref. AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X3/16		Pinned-Pinned	Fy	46.00ksi
Center Span	12.25 ft	LL & ST Act Together	Load Duration Factor	1.00
Left Cant	0.00 ft		Elastic Modulus	29,000.0 ksi
Right Cant	0.00 ft			
Lu : Unbraced Length	1.00 ft			

Distributed Loads Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL	0.090							k/ft
LL	0.060							k/ft
ST								k/ft
Start Location								ft
End Location								ft

Summary

Beam OK
Static Load Case Governs Stress

Using: HSS4X4X3/16 section, Span = 12.25ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 1.00ft, LDF = 1.000

	Actual	Allowable		
Moment	2.814 k-ft	7.843 k-ft	Max. Deflection	-0.422 in
fb : Bending Stress	10.892 ksi	30.360 ksi	Length/DL Defl	580.6 : 1
fb / Fb	0.359 : 1		Length/(DL+LL Defl)	348.3 : 1
Shear	0.919 k	25.613 k		
fv : Shear Stress	0.660 ksi	18.400 ksi		
fv / Fv	0.036 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	2.81 k-ft	1.69	2.81				k-ft
Max. M -							k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	0.92 k	0.55	0.92				k
Shear @ Right	0.92 k	0.55	0.92				k
Center Defl.	-0.422 in	-0.253	-0.422	-0.422	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	0.92	0.55	0.92	0.92			k
Reaction @ Rt	0.92	0.55	0.92	0.92			k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Section Properties HSS4X4X3/16

Depth	4.000 in	Weight	8.76 #/ft
Web Thick	0.174 in	Ixx	6.210 in4
Width	4.000 in	Iyy	6.210 in4
Flange Thick	0.174 in	Sxx	3.100 in3
Area	2.58 in2	Syy	3.100 in3
Rt	0.000 in	R-xx	1.550 in
Values for LRFD Design....		R-yy	1.550 in
J	9.960 in4	Zx	3.670 in3
Cw	5.07 in6	Zy	3.670 in3

Scope :

Rev: 580007
User: KW-0508353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Pop-Out Edge Span Stl Bm. Wind

General Information

Code Ref. AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS4X4X3/16

Center Span 12.25 ft
Left Cant 0.00 ft
Right Cant 0.00 ft
Lu : Unbraced Length 1.00 ft

Pinned-Pinned
LL & ST Act Together

Fy 46.00 ksi
Load Duration Factor 1.00
Elastic Modulus 29,000.0 ksi

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL								k/ft
LL								k/ft
ST	0.125							k/ft
Start Location								ft
End Location								ft

Summary

Beam OK
Short Term Load Case Governs Stress

Using: HSS4X4X3/16 section, Span = 12.25ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 1.00ft, LDF = 1.000

	Actual	Allowable		
Moment	2.345 k-ft	7.843 k-ft	Max. Deflection	-0.352 in
fb : Bending Stress	9.076 ksi	30.360 ksi	Length/DL Defl	0.0 : 1
fb / Fb	0.299 : 1		Length/(DL+LL Defl)	418.0 : 1
Shear	0.766 k	25.613 k		
fv : Shear Stress	0.550 ksi	18.400 ksi		
fv / Fv	0.030 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	2.34 k-ft			2.34			k-ft
Max. M -							k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	0.77 k			0.77			k
Shear @ Right	0.77 k			0.77			k
Center Defl.	-0.352 in	0.000	0.000	-0.352	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	0.77			0.77			k
Reaction @ Rt	0.77			0.77			k

Fa calc'd per Eq. E2-1, K*L/r < Cc

Section Properties HSS4X4X3/16

Depth	4.000 in	Weight	8.76 #/ft
Web Thick	0.174 in	Ixx	6.210 in4
Width	4.000 in	Iyy	6.210 in4
Flange Thick	0.174 in	Sxx	3.100 in3
Area	2.58 in2	Syy	3.100 in3
Rt	0.000 in	R-xx	1.550 in
Values for LRFD Design....		R-yy	1.550 in
J	9.960 in4	Zx	3.670 in3
Cw	5.07 in6	Zy	3.670 in3
--			



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (58)

CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: MOMENT FRAME @ POP-OUTS

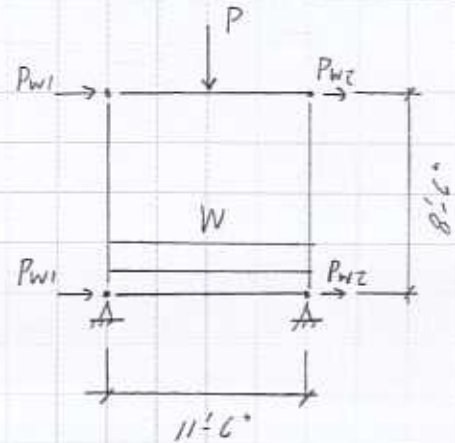
MOMENT FRAMES @ ENDS OF POP-OUTS:

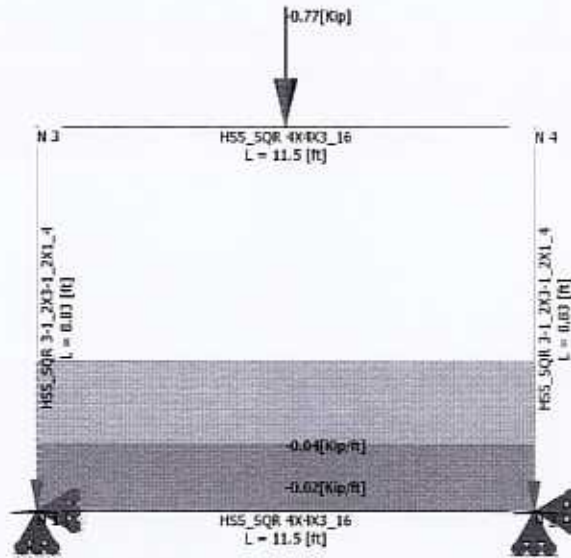
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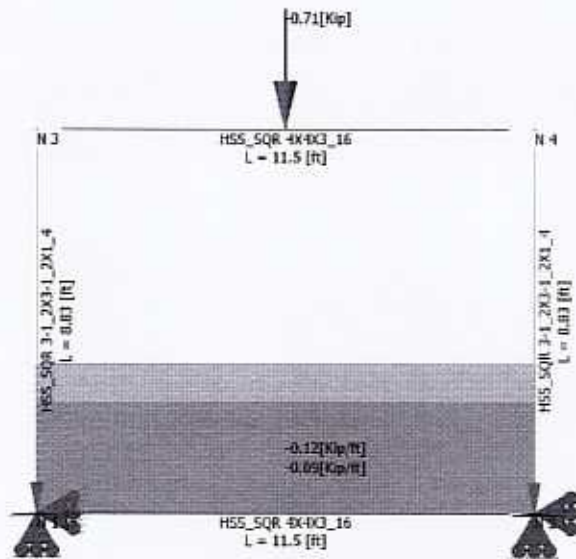
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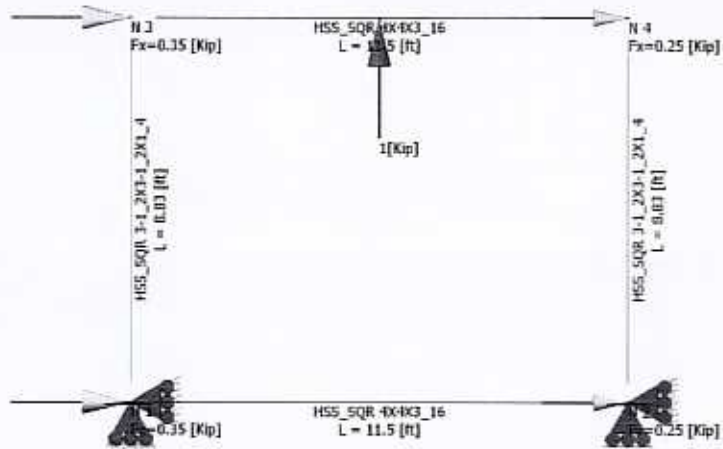
$$P_U = -1.0^k \text{ (MWFERS)}$$

$$P_{W1} = 0.35^k \quad P_{W2} = 0.25^k$$









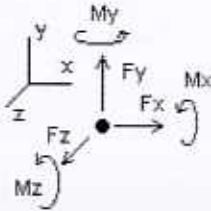
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Units system: English

File name: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Advanse\Pop-Out Moment Frame.adv\

Analysis Results

Reactions



Direction of positive forces and moments

Node	Forces (Kip)			Moments (Kip*ft)		
	FX	FY	FZ	MX	MY	MZ
Condition D2=DL+LL						
1	0.44943	2.45097	0.00000	0.00000	0.00000	0.00000
2	-0.44943	2.45097	0.00000	0.00000	0.00000	0.00000
SUM	0.00000	4.90194	0.00000	0.00000	0.00000	0.00000
Condition D3=DL+0.75LL						
1	0.38029	2.07472	0.00000	0.00000	0.00000	0.00000
2	-0.38029	2.07472	0.00000	0.00000	0.00000	0.00000
SUM	0.00000	4.14944	0.00000	0.00000	0.00000	0.00000
Condition D4=DL+Wind						
1	-0.60044	-0.01473	0.00000	0.00000	0.00000	0.00000
2	-0.59956	0.90667	0.00000	0.00000	0.00000	0.00000
SUM	-1.20000	0.89194	0.00000	0.00000	0.00000	0.00000
Condition D5=DL+0.75Wind+0.75LL						
1	-0.19969	1.35420	0.00000	0.00000	0.00000	0.00000
2	-0.70031	2.04524	0.00000	0.00000	0.00000	0.00000
SUM	-0.90000	3.39944	0.00000	0.00000	0.00000	0.00000
Condition D6=0.6DL+Wind						
1	-0.66959	-0.39311	0.00000	0.00000	0.00000	0.00000
2	-0.53041	0.52828	0.00000	0.00000	0.00000	0.00000
SUM	-1.20000	0.13516	0.00000	0.00000	0.00000	0.00000

Maximum relative deflections

Remark.- Magnitude of deflections in absolute value.

CONDITION2=DL+LL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.04650 (L/2279)	25.00000	0.00000 (< L/10000)	0.00000
2	0.19019 (L/726)	50.00000	0.00000 (< L/10000)	0.00000
3	0.04650 (L/2279)	25.00000	0.00000 (< L/10000)	0.00000
4	0.25507 (L/541)	50.00000	0.00000 (< L/10000)	0.00000

CONDITION3=DL+0.75LL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.03547 (L/2987)	25.00000	0.00000 (< L/10000)	0.00000
2	0.17221 (L/801)	50.00000	0.00000 (< L/10000)	0.00000
3	0.03547 (L/2987)	25.00000	0.00000 (< L/10000)	0.00000
4	0.20554 (L/671)	50.00000	0.00000 (< L/10000)	0.00000

CONDITION4=DL+Wind

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.04051 (L/2616)	70.00000	0.00000 (< L/10000)	0.00000
2	0.05721 (L/2412)	67.50000	0.00000 (< L/10000)	0.00000
3	0.04631 (L/2288)	27.50000	0.00000 (< L/10000)	0.00000
4	0.09418 (L/1465)	37.50000	0.00000 (< L/10000)	0.00000

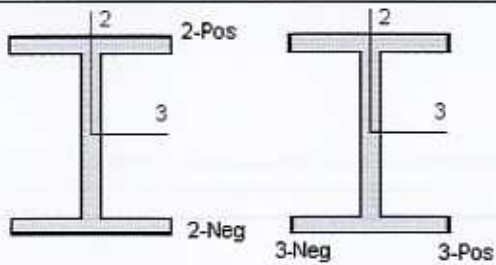
CONDITION5=DL+0.75Wind+0.75LL

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.04743 (L/2234)	45.00000	0.00000 (< L/10000)	0.00000
2	0.05592 (L/2468)	40.00000	0.00000 (< L/10000)	0.00000
3	0.06885 (L/1539)	27.50000	0.00000 (< L/10000)	0.00000
4	0.22851 (L/604)	45.00000	0.00000 (< L/10000)	0.00000

CONDITION6=0.6DL+Wind

Member	Defl. (2) [in]	@(%)	Defl. (3) [in]	@(%)
1	0.04839 (L/2190)	70.00000	0.00000 (< L/10000)	0.00000
2	0.09791 (L/1410)	60.00000	0.00000 (< L/10000)	0.00000
3	0.04621 (L/2293)	30.00000	0.00000 (< L/10000)	0.00000
4	0.07413 (L/1862)	35.00000	0.00000 (< L/10000)	0.00000

Member stresses



Location of the fibers with maximum bending stresses

CONDITION D2=DL+LL

Station	Axial [Kip/in ²]	Shear V2 [Kip/in ²]	Shear V3 [Kip/in ²]	Bending			
				2-Pos [Kip/in ²]	2-Neg [Kip/in ²]	3-Pos [Kip/in ²]	3-Neg [Kip/in ²]
MEMBER 1							
0%	-0.30	0.36	0.00	-9.19	9.19	0.00	0.00
50%	-0.29	0.36	0.00	-0.85	0.85	0.00	0.00
100%	-0.27	0.36	0.00	7.48	-7.48	0.00	0.00
MEMBER 2							
0%	-0.17	0.73	0.00	6.89	-6.89	0.00	0.00
50%	-0.17	0.69	0.00	-10.13	10.13	0.00	0.00
100%	-0.17	0.73	0.00	6.89	-6.89	0.00	0.00
MEMBER 3							
0%	-0.30	0.36	0.00	9.19	-9.19	0.00	0.00
50%	-0.29	0.36	0.00	0.85	-0.85	0.00	0.00
100%	-0.27	0.36	0.00	-7.48	7.48	0.00	0.00
MEMBER 4							
0%	0.00	1.46	0.00	8.47	-8.47	0.00	0.00
50%	0.00	0.00	0.00	-9.05	9.05	0.00	0.00
100%	0.00	1.46	0.00	8.47	-8.47	0.00	0.00

CONDITION D3=DL+0.75LL

Station	Axial [Kip/in ²]	Shear V2 [Kip/in ²]	Shear V3 [Kip/in ²]	Bending			
				2-Pos [Kip/in ²]	2-Neg [Kip/in ²]	3-Pos [Kip/in ²]	3-Neg [Kip/in ²]
MEMBER 1							
0%	-0.27	0.31	0.00	-7.59	7.59	0.00	0.00
50%	-0.26	0.31	0.00	-0.53	0.53	0.00	0.00
100%	-0.24	0.31	0.00	6.52	-6.52	0.00	0.00
MEMBER 2							
0%	-0.15	0.65	0.00	6.01	-6.01	0.00	0.00
50%	-0.15	0.60	0.00	-9.05	9.05	0.00	0.00
100%	-0.15	0.65	0.00	6.01	-6.01	0.00	0.00
MEMBER 3							
0%	-0.27	0.31	0.00	7.59	-7.59	0.00	0.00
50%	-0.26	0.31	0.00	0.53	-0.53	0.00	0.00
100%	-0.24	0.31	0.00	-6.52	6.52	0.00	0.00
MEMBER 4							
0%	0.00	1.19	0.00	6.99	-6.99	0.00	0.00
50%	0.00	0.00	0.00	-7.32	7.32	0.00	0.00
100%	0.00	1.19	0.00	6.99	-6.99	0.00	0.00

CONDITION D4=DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.07	0.20	0.00	3.52	-3.52	0.00	0.00
50%	0.09	0.20	0.00	-1.12	1.12	0.00	0.00
100%	0.10	0.20	0.00	-5.77	5.77	0.00	0.00
MEMBER 2							
0%	-0.04	0.27	0.00	-5.32	5.32	0.00	0.00
50%	-0.04	0.11	0.00	1.81	-1.81	0.00	0.00
100%	-0.04	0.15	0.00	4.93	-4.93	0.00	0.00
MEMBER 3							
0%	-0.09	0.28	0.00	7.61	-7.61	0.00	0.00
50%	-0.07	0.28	0.00	1.13	-1.13	0.00	0.00
100%	-0.06	0.28	0.00	-5.35	5.35	0.00	0.00
MEMBER 4							
0%	0.00	0.18	0.00	-3.24	3.24	0.00	0.00
50%	0.00	0.21	0.00	-2.83	2.83	0.00	0.00
100%	0.00	0.61	0.00	7.01	-7.01	0.00	0.00

CONDITION D5=DL+0.75Wind+0.75LL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	-0.08	0.05	0.00	-2.86	2.86	0.00	0.00
50%	-0.07	0.05	0.00	-1.69	1.69	0.00	0.00
100%	-0.05	0.05	0.00	-0.53	0.53	0.00	0.00
MEMBER 2							
0%	-0.13	0.14	0.00	-0.49	0.49	0.00	0.00
50%	-0.13	0.42	0.00	-3.35	3.35	0.00	0.00
100%	-0.13	0.46	0.00	7.20	-7.20	0.00	0.00
MEMBER 3							
0%	-0.20	0.41	0.00	11.20	-11.20	0.00	0.00
50%	-0.19	0.41	0.00	1.70	-1.70	0.00	0.00
100%	-0.17	0.41	0.00	-7.81	7.81	0.00	0.00
MEMBER 4							
0%	0.00	1.03	0.00	2.63	-2.63	0.00	0.00
50%	0.00	0.16	0.00	-7.84	7.84	0.00	0.00
100%	0.00	1.35	0.00	10.33	-10.33	0.00	0.00

CONDITION D6=0.6DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.14	0.26	0.00	4.63	-4.63	0.00	0.00
50%	0.15	0.26	0.00	-1.29	1.29	0.00	0.00
100%	0.16	0.26	0.00	-7.22	7.22	0.00	0.00
MEMBER 2							

Header Framing

0%	-0.01	0.43	0.00	-6.65	6.65	0.00	0.00
50%	-0.01	0.04	0.00	4.12	-4.12	0.00	0.00
100%	-0.01	0.01	0.00	3.60	-3.60	0.00	0.00
<hr/>							
MEMBER 3							
0%	-0.01	0.23	0.00	6.50	-6.50	0.00	0.00
50%	-0.01	0.23	0.00	1.30	-1.30	0.00	0.00
100%	0.00	0.23	0.00	-3.90	3.90	0.00	0.00
<hr/>							
MEMBER 4							
0%	0.00	0.02	0.00	-4.27	4.27	0.00	0.00
50%	0.00	0.21	0.00	-1.97	1.97	0.00	0.00
100%	0.00	0.45	0.00	5.99	-5.99	0.00	0.00

JOB SOLAR DECATHALON 10HA042SHEET # _____ OF (67)CALCULATED BY: T. WILDA DATE: 10/23/10

CHECKED BY: _____ DATE: _____

SUBJECT: STL. HEADER**HEES & ASSOCIATES, INC.**

1381 Fifth Street • Sarasota, Florida 34236

Telephone: (941) 955-4555 • Fax: (941) 955-9333

karl@heesassociates.com • www.heesassociates.com

C.O.A. #27043

STL. BM. DESIGN HEADER DESIGN:
(ABOVE SLIDERS)

LOADS: ROOF - DEAD = 25 PSF
LIVE = 20 PSF

TRIB. WIDTH = $\frac{1}{2}(15'-8") = 7.835'$

$W_D = 25 \text{ PSF} \times 7.835' = 200 \text{ PLF}$

$W_L = 20 \text{ PSF} \times 7.835' = 160 \text{ PLF}$

LOAD COMB: $D + W$ $0.6D + W$ $D + 0.75L_r + 0.75W$

WIND LOADS (C.F.C.) = -36.1 PSF (WALL LOADS)

$W_W = -36.1 \text{ PSF} \times \frac{1}{2}(10.67 \text{ RT}) = -195 \text{ PLF}$

WIND LOADS: ZONE ① = -35.0 PSF (UPLIFT)

ZONE ② = -41.5 PSF

UPLIFT LOAD TO WALL = $-41.5 \text{ PSF} (3.0 \text{ RT})(1.5 \text{ RT}) - 41.5 \text{ PSF} (3.0 \text{ RT})(14.17 \text{ RT})$
 $- 35.0 \text{ PSF} (9.67 \text{ RT})(7.83 \text{ RT}) / 15.67 \text{ RT}$
= -295 PLF

STUD WALL WT. = $20 \text{ PSF} \times 2.17 \text{ RT} = 45 \text{ PLF}$

$E_{WD} = 245 \text{ PLF}$

$E_{WL} = 160 \text{ PLF}$

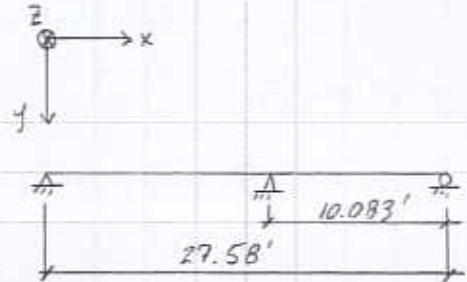
$E_{W_y} = -390 \text{ PLF}$

$E_{W_z} = -195 \text{ PLF}$

$\Delta_{UM} (y\text{-dir}) = L/240$

$\Delta_{UM} (z\text{-dir}) = L/360$

USE HSS $10 \times 3\frac{1}{2} \times \frac{5}{16}$ (SEE ATTACHED ADVANCE SHEETS)



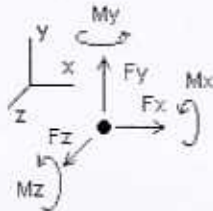
Current Date: 10/25/2010 9:41 AM

Units system: English

File name: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Advance\Sliding Header Beam.adv\

Analysis Results

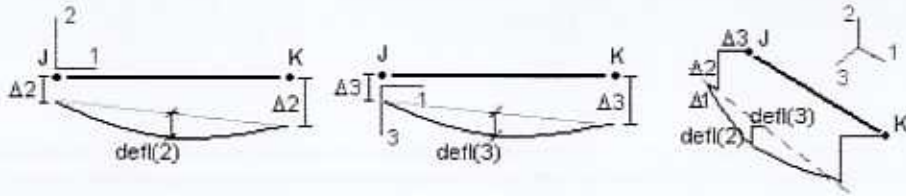
Reactions



Direction of positive forces and moments

Node	Forces [Kip]			Moments [Kip*ft]		
	FX	FY	FZ	MX	MY	MZ
Condition D2=DL+LL						
1	0.00000	3.05246	0.00000	0.00000	0.00000	0.00000
2	0.00000	7.86058	0.00000	0.00000	0.00000	0.00000
3	0.00000	0.93768	0.00000	0.00000	0.00000	0.00000
SUM	0.00000	11.85072	0.00000	0.00000	0.00000	0.00000
Condition D4=DL+Wind						
1	0.00000	-0.17983	1.38462	0.00000	0.00000	0.00000
2	0.00000	-0.46310	3.56907	0.00000	0.00000	0.00000
3	0.00000	-0.05524	0.42441	0.00000	0.00000	0.00000
SUM	0.00000	-0.69818	5.37810	0.00000	0.00000	0.00000
Condition D5=DL+0.75LL+0.75Wind						
1	0.00000	1.19655	1.03846	0.00000	0.00000	0.00000
2	0.00000	3.08132	2.67680	0.00000	0.00000	0.00000
3	0.00000	0.36757	0.31831	0.00000	0.00000	0.00000
SUM	0.00000	4.64544	4.03358	0.00000	0.00000	0.00000
Condition D6=0.6DL+Wind						
1	0.00000	-0.94617	1.38462	0.00000	0.00000	0.00000
2	0.00000	-2.43653	3.56907	0.00000	0.00000	0.00000
3	0.00000	-0.29065	0.42441	0.00000	0.00000	0.00000
SUM	0.00000	-3.67335	5.37810	0.00000	0.00000	0.00000

Local deflections in members



Use definitions

Condition : D2=DL+LL

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	-0.164	0.000	0.00000	-0.16399 (L/1281)	-
50%	0.000	-0.209	0.000	0.00000	-0.20916 (L/1004)	-
75%	0.000	-0.122	0.000	0.00000	-0.12157 (L/1727)	-
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 2						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	0.019	0.000	0.00000	0.01903 (L/6357)	-
50%	0.000	0.014	0.000	0.00000	0.01392 (L/8689)	-
75%	0.000	0.005	0.000	0.00000	-	-
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D4=DL+Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	0.010	-0.394	0.00000	-	-0.39385 (L/533)
50%	0.000	0.012	-0.502	0.00000	-	-0.50203 (L/418)
75%	0.000	0.007	-0.291	0.00000	-	-0.29097 (L/722)
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 2						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	-0.001	0.047	0.00000	-	0.04714 (L/2566)
50%	0.000	-0.001	0.035	0.00000	-	0.03510 (L/3447)
75%	0.000	0.000	0.013	0.00000	-	0.01301 (L/9297)
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D5=DL+0.75LL+0.75Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	-0.064	-0.295	0.00000	-0.06428 (L/3267)	-0.29539 (L/711)
50%	0.000	-0.082	-0.377	0.00000	-0.08199 (L/2561)	-0.37652 (L/558)
75%	0.000	-0.048	-0.218	0.00000	-0.04766 (L/4407)	-0.21823 (L/962)
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 2						
0%	0.000	0.000	0.000	0.00000	-	-
25%	--	0.007	0.035	0.00000	-	0.03536 (L/3421)

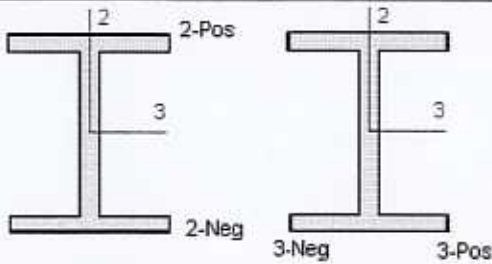
70

50%	0.000	0.005	0.026	0.00000	-	0.02632 (L/4595)
75%	0.000	0.002	0.010	0.00000	-	-
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D6=0.6DL+Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	0.051	-0.394	0.00000	0.05083 (L/4131)	-0.39385 (L/533)
50%	0.000	0.065	-0.502	0.00000	0.06483 (L/3239)	-0.50203 (L/418)
75%	0.000	0.038	-0.291	0.00000	0.03768 (L/5573)	-0.29097 (L/722)
100%	0.000	0.000	0.000	0.00000	-	-
MEMBER 2						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	-0.006	0.047	0.00000	-	0.04714 (L/2566)
50%	0.000	-0.004	0.035	0.00000	-	0.03510 (L/3447)
75%	0.000	-0.002	0.013	0.00000	-	0.01301 (L/9297)
100%	0.000	0.000	0.000	0.00000	-	-

Member stresses



Location of the fibers with maximum bending stresses

CONDITION D2=DL+LL

Station	Axial [Kip/in ²]	Shear V2 [Kip/in ²]	Shear V3 [Kip/in ²]	Bending			
				2-Pos [Kip/in ²]	2-Neg [Kip/in ²]	3-Pos [Kip/in ²]	3-Neg [Kip/in ²]
MEMBER 1							
0%	0.00	0.81	0.00	0.00	0.00	0.00	0.00
25%	0.00	0.31	0.00	-6.67	6.67	0.00	0.00
50%	0.00	0.19	0.00	-7.40	7.40	0.00	0.00
75%	0.00	0.68	0.00	-2.20	2.20	0.00	0.00
100%	0.00	1.18	0.00	8.93	-8.93	0.00	0.00
MEMBER 2							
0%	0.00	0.90	0.00	8.93	-8.93	0.00	0.00
25%	0.00	0.61	0.00	3.74	-3.74	0.00	0.00
50%	0.00	0.32	0.00	0.53	-0.53	0.00	0.00

71

75%	0.00	0.04	0.00	-0.72	0.72	0.00	0.00
100%	0.00	0.25	0.00	0.00	0.00	0.00	0.00

CONDITION D4=DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.05	0.80	0.00	0.00	0.00	0.00
25%	0.00	0.02	0.31	0.39	-0.39	5.64	-5.64
50%	0.00	0.01	0.19	0.44	-0.44	6.26	-6.26
75%	0.00	0.04	0.68	0.13	-0.13	1.85	-1.85
100%	0.00	0.07	1.17	-0.53	0.53	-7.58	7.58
MEMBER 2							
0%	0.00	0.05	0.89	-0.53	0.53	-7.58	7.58
25%	0.00	0.04	0.61	-0.22	0.22	-3.18	3.18
50%	0.00	0.02	0.32	-0.03	0.03	-0.45	0.45
75%	0.00	0.00	0.04	0.04	-0.04	0.61	-0.61
100%	0.00	0.01	0.25	0.00	0.00	0.00	0.00

CONDITION D5=DL+0.75LL+0.75Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.32	0.60	0.00	0.00	0.00	0.00
25%	0.00	0.12	0.23	-2.61	2.61	4.23	-4.23
50%	0.00	0.07	0.14	-2.90	2.90	4.70	-4.70
75%	0.00	0.27	0.51	-0.86	0.86	1.39	-1.39
100%	0.00	0.46	0.88	3.50	-3.50	-5.68	5.68
MEMBER 2							
0%	0.00	0.35	0.67	3.50	-3.50	-5.68	5.68
25%	0.00	0.24	0.46	1.47	-1.47	-2.39	2.39
50%	0.00	0.13	0.24	0.21	-0.21	-0.34	0.34
75%	0.00	0.02	0.03	-0.28	0.28	0.45	-0.45
100%	0.00	0.10	0.18	0.00	0.00	0.00	0.00

CONDITION D6=0.6DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.25	0.80	0.00	0.00	0.00	0.00
25%	0.00	0.10	0.31	2.07	-2.07	5.64	-5.64
50%	0.00	0.06	0.19	2.29	-2.29	6.26	-6.26
75%	0.00	0.21	0.68	0.68	-0.68	1.85	-1.85
100%	0.00	0.37	1.17	-2.77	2.77	-7.58	7.58
MEMBER 2							

0%	0.00	0.28	0.89	-2.77	2.77	-7.58	7.58
25%	0.00	0.19	0.61	-1.16	1.16	-3.18	3.18
50%	0.00	0.10	0.32	-0.16	0.16	-0.45	0.45
75%	0.00	0.01	0.04	0.22	-0.22	0.61	-0.61
100%	0.00	0.08	0.25	0.00	0.00	0.00	0.00

JOB SOLID DECATAGON 10HA042

SHEET # _____ OF (73)

CALCULATED BY: T. WILDA DATE: 10/23/10

CHECKED BY: _____ DATE: _____

SUBJECT: STL BM HEADERS

HEES & ASSOCIATES, INC.

1381 Fifth Street • Sarasota, Florida 34236
 Telephone: (941) 955-4555 • Fax: (941) 955-9333
 karl@heesassociates.com • www.heesassociates.com
 C.O.A. #27043

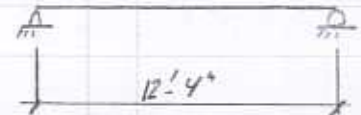
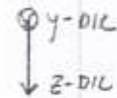
STL BM HEADER OVER BED-ROOM POP-OUT

LOADINGS: $ED = 245 \text{ PLF}$ $EL = 160 \text{ PLF}$

$\Sigma W_2 = -295 \text{ PLF}$ (SEE PREVIOUS CALCS)

WIND Y-DIR. = $\frac{1}{2}(2'-4") \times 36.1 \text{ PSF} = 45 \text{ PLF} = \Sigma W_1$

USE HSS 6x3x $\frac{3}{16}$ "



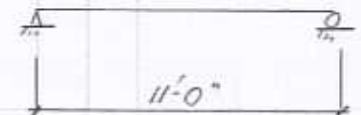
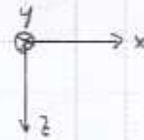
WOOD HEADER BEAM @ 11'-0" WIDG STUD WALL OPENING:

LOADINGS $ED = 245 \text{ PSF}$ $EL = 160 \text{ PLF}$

$\Sigma W_2 = -295 \text{ PLF}$ (SEE PREVIOUS CALCS)

WIND Y-DIR = $\frac{1}{2}(11.00) \times 36.1 \text{ PSF} = 200 \text{ PLF}$

USE HSS 6x3x $\frac{3}{16}$ "



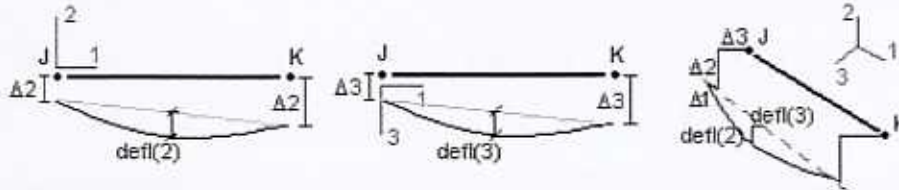
Current Date: 10/27/2010 4:06 PM

Units system: English

File name: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Advanse\Header Beam 12.33ft span.adv

Analysis Results

Local deflections in members



Use definitions

Condition : D2=DL+LL

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	-0.399	0.000	0.00000	-0.39865 (L/371)	-
50%	0.000	-0.559	0.000	0.00000	-0.55930 (L/265)	-
75%	0.000	-0.399	0.000	0.00000	-0.39865 (L/371)	-
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D4=DL+Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	0.039	-0.127	0.00000	0.03852 (L/3841)	-0.12703 (L/1165)
50%	0.000	0.054	-0.178	0.00000	0.05404 (L/2738)	-0.17823 (L/830)
75%	0.000	0.039	-0.127	0.00000	0.03852 (L/3841)	-0.12703 (L/1165)
100%	0.000	0.000	0.000	0.00000	-	-

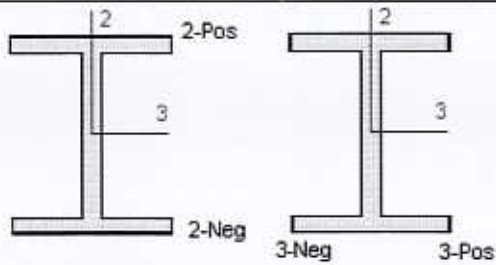
Condition : D5=DL+0.75LL+0.75Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	-0.148	-0.095	0.00000	-0.14764 (L/1002)	-0.09527 (L/1553)
50%	0.000	-0.207	-0.134	0.00000	-0.20713 (L/714)	-0.13368 (L/1107)
75%	0.000	-0.148	-0.095	0.00000	-0.14764 (L/1002)	-0.09527 (L/1553)
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D6=0.6DL+Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	0.136	-0.127	0.00000	0.13649 (L/1084)	-0.12703 (L/1165)
50%	0.000	0.191	-0.178	0.00000	0.19149 (L/773)	-0.17823 (L/830)
75%	0.000	0.136	-0.127	0.00000	0.13649 (L/1084)	-0.12703 (L/1165)
100%	0.000	0.000	0.000	0.00000	-	-

Member stresses



Location of the fibers with maximum bending stresses

CONDITION D2=DL+LL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	1.76	0.00	0.00	0.00	0.00	0.00
25%	0.00	0.88	0.00	-15.89	15.89	0.00	0.00
50%	0.00	0.00	0.00	-21.18	21.18	0.00	0.00
75%	0.00	0.88	0.00	-15.89	15.89	0.00	0.00
100%	0.00	1.76	0.00	0.00	0.00	0.00	0.00

CONDITION D4=DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.17	0.32	0.00	0.00	0.00	0.00
25%	0.00	0.09	0.16	1.54	-1.54	2.54	-2.54
50%	0.00	0.00	0.00	2.05	-2.05	3.38	-3.38
75%	0.00	0.09	0.16	1.54	-1.54	2.54	-2.54
100%	0.00	0.17	0.32	0.00	0.00	0.00	0.00

CONDITION D5=DL+0.75LL+0.75Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.65	0.24	0.00	0.00	0.00	0.00
25%	0.00	0.33	0.12	-5.88	5.88	1.90	-1.90

50%	0.00	0.00	0.00	-7.84	7.84	2.54	-2.54
75%	0.00	0.33	0.12	-5.88	5.88	1.90	-1.90
100%	0.00	0.65	0.24	0.00	0.00	0.00	0.00

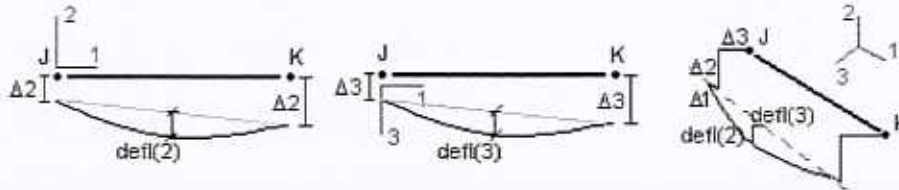
CONDITION D6=0.6DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.60	0.32	0.00	0.00	0.00	0.00
25%	0.00	0.30	0.16	5.44	-5.44	2.54	-2.54
50%	0.00	0.00	0.00	7.25	-7.25	3.38	-3.38
75%	0.00	0.30	0.16	5.44	-5.44	2.54	-2.54
100%	0.00	0.60	0.32	0.00	0.00	0.00	0.00

Current Date: 10/27/2010 4:05 PM
 Units system: English
 File name: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Advanse\Header Beam 11ft span.adv

Analysis Results

Local deflections in members



Use definitions

Condition : D2=DL+LL

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	-0.253	0.000	0.00000	-0.25302 (L/522)	-
50%	0.000	-0.355	0.000	0.00000	-0.35495 (L/372)	-
75%	0.000	-0.253	0.000	0.00000	-0.25302 (L/522)	-
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D4=DL+Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	0.024	-0.358	0.00000	0.02445 (L/5399)	-0.35810 (L/369)
50%	0.000	0.034	-0.502	0.00000	0.03430 (L/3849)	-0.50243 (L/263)
75%	0.000	0.024	-0.358	0.00000	0.02445 (L/5399)	-0.35810 (L/369)
100%	0.000	0.000	0.000	0.00000	-	-

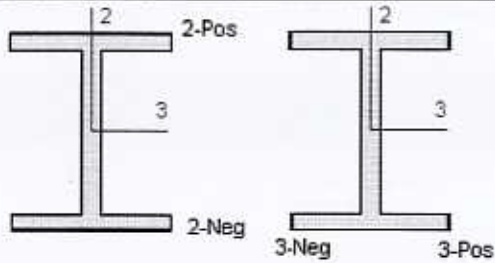
Condition : D5=DL+0.75LL+0.75Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	-0.094	-0.269	0.00000	-0.09370 (L/1409)	-0.26858 (L/491)
50%	0.000	-0.131	-0.377	0.00000	-0.13145 (L/1004)	-0.37683 (L/350)
75%	0.000	-0.094	-0.269	0.00000	-0.09370 (L/1409)	-0.26858 (L/491)
100%	0.000	0.000	0.000	0.00000	-	-

Condition : D6=0.6DL+Wind

Station	Axis 1 [in]	Axis 2 [in]	Axis 3 [in]	Rotation11 [Rad]	Defl. (2) [in]	Defl. (3) [in]
MEMBER 1						
0%	0.000	0.000	0.000	0.00000	-	-
25%	0.000	0.087	-0.358	0.00000	0.08663 (L/1524)	-0.35810 (L/369)
50%	0.000	0.122	-0.502	0.00000	0.12153 (L/1086)	-0.50243 (L/263)
75%	0.000	0.087	-0.358	0.00000	0.08663 (L/1524)	-0.35810 (L/369)
100%	0.000	0.000	0.000	0.00000	-	-

Member stresses



Location of the fibers with maximum bending stresses

CONDITION D2=DL+LL

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	1.57	0.00	0.00	0.00	0.00	0.00
25%	0.00	0.79	0.00	-12.64	12.64	0.00	0.00
50%	0.00	0.00	0.00	-16.86	16.86	0.00	0.00
75%	0.00	0.79	0.00	-12.64	12.64	0.00	0.00
100%	0.00	1.57	0.00	0.00	0.00	0.00	0.00

CONDITION D4=DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.15	1.26	0.00	0.00	0.00	0.00
25%	0.00	0.08	0.63	1.22	-1.22	8.98	-8.98
50%	0.00	0.00	0.00	1.63	-1.63	11.97	-11.97
75%	0.00	0.08	0.63	1.22	-1.22	8.98	-8.98
100%	0.00	0.15	1.26	0.00	0.00	0.00	0.00

CONDITION D5=DL+0.75LL+0.75Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.58	0.94	0.00	0.00	0.00	0.00
25%	0.00	0.29	0.47	-4.68	4.68	6.73	-6.73

79

50%	0.00	0.00	0.00	-6.24	6.24	8.98	-8.98
75%	0.00	0.29	0.47	-4.68	4.68	6.73	-6.73
100%	0.00	0.58	0.94	0.00	0.00	0.00	0.00

CONDITION D6=0.6DL+Wind

Station	Axial [Kip/in2]	Shear V2 [Kip/in2]	Shear V3 [Kip/in2]	Bending			
				2-Pos [Kip/in2]	2-Neg [Kip/in2]	3-Pos [Kip/in2]	3-Neg [Kip/in2]
MEMBER 1							
0%	0.00	0.54	1.26	0.00	0.00	0.00	0.00
25%	0.00	0.27	0.63	4.33	-4.33	8.98	-8.98
50%	0.00	0.00	0.00	5.77	-5.77	11.97	-11.97
75%	0.00	0.27	0.63	4.33	-4.33	8.98	-8.98
100%	0.00	0.54	1.26	0.00	0.00	0.00	0.00



HEES & ASSOCIATES, INC.

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karl@heesassociates.com • www.heesassociates.com
C.O.A. #27043

JOB SOLAR DECATHLON 10HA047

SHEET # _____ OF (80)

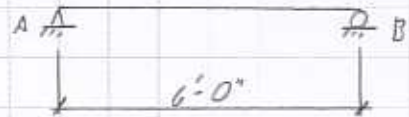
CALCULATED BY: T. WILDA DATE: 03/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: WOOD HEADER

WOOD HEADER @ EAST-END:

OPENING HT. = 7.00'



$$W_w = 5.25' \times -41.8 \text{ PSF} = -220 \text{ PLF} \quad 0 \Rightarrow 1'-8''$$
$$5.25' \times -34.7 \text{ PSF} = -185 \text{ PLF} \quad 1'-8'' \Rightarrow 6.00'$$

$$W_d = 20 \text{ PSF} \times 4.00' \text{ (WALL WT.)} = 80 \text{ PLF}$$

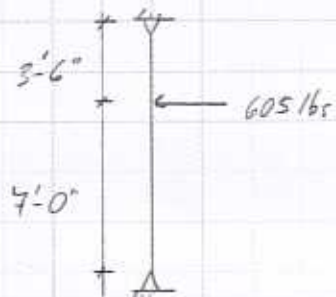
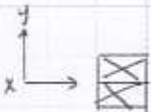
$$\frac{f_b}{F_b} \text{ (WEAK AXIS)} = 0.741$$

$$\frac{f_b}{F_b} \text{ (STRONG AXIS)} = 0.102$$

$$\Sigma = 0.843 < 1.0 \quad \text{GOOD!} \quad \text{USE (2) } 2 \times 10 \text{'s}$$

$$\text{Worst-Case } R = 605 \text{ lbs, USE HGA10KT } P_d = 1165 \text{ lbs}$$

KING STUDS ADJACENT TO HEADER:



• USE (3) 2x4 KING STUDS

Title Block Line 1
 You can change this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Title :
 Dsgnr:
 Project Desc.:

Job #

81

Project Notes :

Printed: 4 MAR 2011, 4:12PM

Wood Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ecb
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Wood Header East-End Weak-Axis

Material Properties

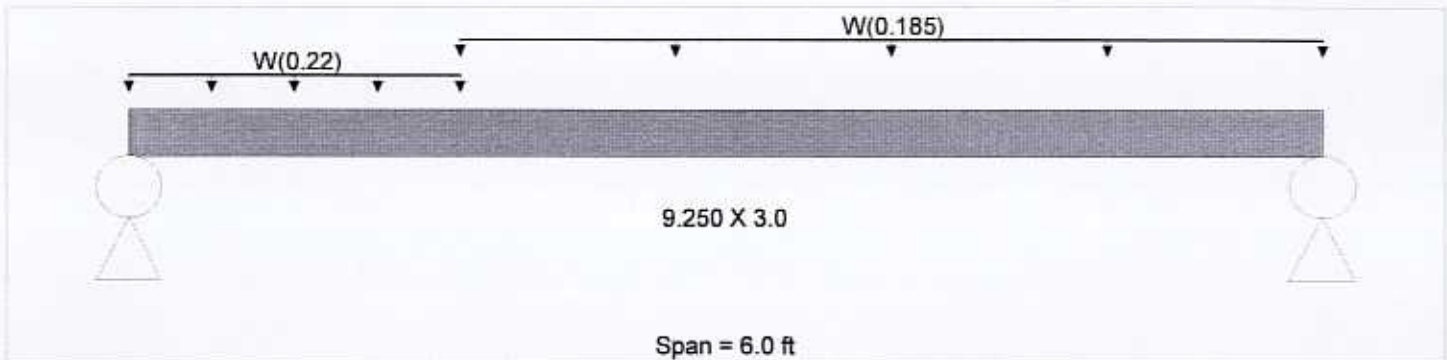
Calculations per NDS 2005, IBC 2006, CBC 2007, ASCE 7-05

Analysis Method : Allowable Stress Design
 Load Combination 2006 IBC & ASCE 7-05

Fb - Tension	1,000.0 psi	E : Modulus of Elasticity	
Fb - Compr	1,000.0 psi	Ebend-xx	1,300.0 ksi
Fc - Prtl	1,000.0 psi	Eminbend-xx	1,300.0 ksi
Fc - Perp	1,000.0 psi		
Fv	65.0 psi		
Ft	65.0 psi	Density	34.0 pcf

Wood Species :
 Wood Grade :

Beam Bracing : Beam is Fully Braced against lateral-torsion buckling



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1

Uniform Load : W = 0.220 k/ft, Extent = 0.0 --> 1.670 ft, Tributary Width = 1.0 ft
 Uniform Load : W = 0.1850 k/ft, Extent = 1.670 --> 6.0 ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.741	1	Maximum Shear Stress Ratio	=	0.459	1
Section used for this span		9.250 X 3.0		Section used for this span		9.250 X 3.0	
fb : Actual	=	741.24 psi		fv : Actual	=	29.87 psi	
FB : Allowable	=	1,000.00 psi		Fv : Allowable	=	65.00 psi	
Load Combination	=	+D+W+H		Load Combination	=	+D+W+H	
Location of maximum on span	=	2.970 ft		Location of maximum on span	=	0.000 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward L+Lr+S Deflection		0.000 in	Ratio = 0 < 360				
Max Upward L+Lr+S Deflection		0.000 in	Ratio = 0 < 360				
Max Downward Total Deflection		0.208 in	Ratio = 346				
Max Upward Total Deflection		0.000 in	Ratio = 0 < 240				

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios							Summary of Moment Values			Summary of Shear Values		
			M	V	C _d	C _{fv}	C _r	C _m	C _t	Mactual	fb-design	Fb-allow	Vactual	fv-design	Fv-allow
+D+W+H	Length = 6.0 ft	1	0.741	0.459	1.000	1.000	1.000	1.000	1.000	0.86	741.24	1,000.00	0.55	29.87	65.00
+D+0.750Lr+0.750L+0.750W+H	Length = 6.0 ft	1	0.556	0.345	1.000	1.000	1.000	1.000	1.000	0.64	555.93	1,000.00	0.41	22.40	65.00
+D+0.750L+0.750S+0.750W+H	Length = 6.0 ft	1	0.556	0.345	1.000	1.000	1.000	1.000	1.000	0.64	555.93	1,000.00	0.41	22.40	65.00
+0.60D+W+H	Length = 6.0 ft	1	0.741	0.459	1.000	1.000	1.000	1.000	1.000	0.86	741.24	1,000.00	0.55	29.87	65.00

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "+&" Defl	Location in Span	Load Combination	Max. "+&" Defl	Location in Span
W Only	1	0.2077	3.000		0.0000	0.000

Title Block Line 1
You can changes this area
using the "Settings" menu item
and then using the "Printing &
Title Block" selection.
Title Block Line 6

Title :
Dsgnr:
Project Desc.:

Project Notes :

Job #

82

Printed: 4/MAR/2011, 4:12PM

Wood Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec6
ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. # : KW-06008353

Licensee :

Description : Wood Header East-End Weak-Axis

Vertical Reactions - Unfactored

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.605	0.563
W Only	0.605	0.563

Title Block Line 1
 You can changes this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Title :
 Dsgnr:
 Project Desc.:
 Project Notes :

Job #

83

Printed: 4/MAR/2011, 4:12PM

Wood Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ecb
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Wood Header East-End Strong-Axis

Material Properties

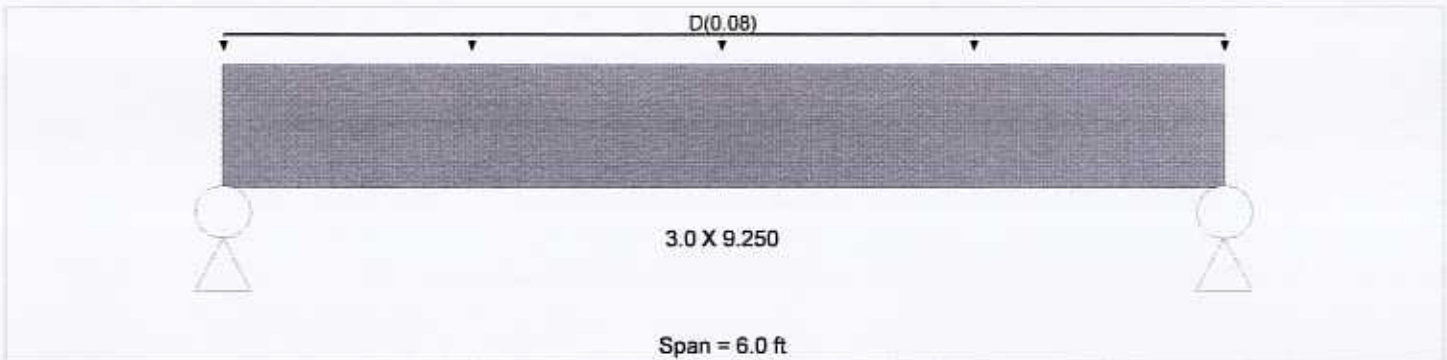
Calculations per NDS 2005, IBC 2006, CBC 2007, ASCE 7-05

Analysis Method : Allowable Stress Design
 Load Combination 2006 IBC & ASCE 7-05

Fb - Tension 1,000.0 psi E : Modulus of Elasticity
 Fb - Compr 1,000.0 psi Ebend- xx 1,300.0 ksi
 Fc - Prll 1,000.0 psi Eminbend - xx 1,300.0 ksi
 Fc - Perp 1,000.0 psi
 Fv 65.0 psi
 Ft 65.0 psi Density 34.0 pcf

Wood Species :
 Wood Grade :

Beam Bracing : Completely Unbraced



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1

Uniform Load : D = 0.080 k/ft, Extent = 0.0 --> 6.0 ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.102 1	Maximum Shear Stress Ratio =	0.150 : 1
Section used for this span	3.0 X 9.250	Section used for this span	3.0 X 9.250
fb : Actual =	100.98 psi	fv : Actual =	9.73 psi
FB : Allowable =	992.66 psi	Fv : Allowable =	65.00 psi
Load Combination =	+D	Load Combination =	+D
Location of maximum on span =	3.000ft	Location of maximum on span =	0.000ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
Maximum Deflection			
Max Downward L+Lr+S Deflection	0.000 in Ratio =	0 < 360	
Max Upward L+Lr+S Deflection	0.000 in Ratio =	0 < 360	
Max Downward Total Deflection	0.009 in Ratio =	7875	
Max Upward Total Deflection	0.000 in Ratio =	0 < 240	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios							Summary of Moment Values			Summary of Shear Values		
			M	V	C _d	C _{flv}	C _r	C _m	C _t	Mactual	fb-design	Fb-allow	Vactual	fv-design	Fv-allow
+D	Length = 6.0 ft	1	0.102	0.150	1.000	1.000	1.000	1.000	1.000	0.36	100.98	992.66	0.18	9.73	65.00

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "- Defl	Location in Span	Load Combination	Max. "+ Defl	Location in Span
D Only	1	0.0091	3.030		0.0000	0.000

Vertical Reactions - Unfactored

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.240	0.240
D Only	0.240	0.240

Timber Column Design

Description King Studs @ Openings

General Information de Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Wood Section		Total Column Height	10.50 ft
Rectangular Column		Load Duration Factor	1.60
Column Depth	(along y-y axis) 4.50 in	Fc	1,650.00 psi
Width	(along x-x axis) 3.50 in	Fb	1,500.00 psi
		E - Elastic Modulus	1,600 ksi
		Southern Pine, No.2 2 -4 Thick, 2	
Unbraced length for "y-y" axis sideways deflection	10.50 ft		
Unbraced length for "x-x" axis sideways deflection	4.00 ft		
Lu XX for Bending	0.00 ft		

Loads

	<u>Dead Load</u>	<u>Live Load</u>	<u>Short Term Load</u>
Axial Load	40.00 lbs	30.00 lbs	0.00 lbs
Eccentricity	0.000 in		
Applied Moment	0.00 in-#	0.00 in-#	16,940.00 in-#
Max. Design Moment	0.00 in-#	0.00 in-#	16,940.00 in-#

Summary

Column OK

Width= 3.50in, Depth= 4.50in, Total Column Ht= 10.50ft

	<u>DL + LL</u>	<u>DL + LL + ST</u>	<u>DL + ST</u>
fc : Compression	4.44 psi	4.44 psi	2.54 psi
Fc : Allowable	555.78 psi	579.63 psi	579.63 psi
fbx : Flexural	0.00 psi	1,434.07 psi	1,434.07 psi
F'bx : Allowable	1,499.84 psi	2,399.59 psi	2,399.59 psi
Interaction Value	0.0080	0.6021	0.6001

Stress Details

Fc : X-X	1,348.10 psi
Fc : Y-Y	555.78 psi
F'c : Allowable	555.78 psi
F'c:Allow * Load Dur Factor	579.63 psi
F'bx	1,499.84 psi
F'bx * Load Duration Factor	2,399.59 psi

For Bending Stress Calcs...

Max k*Lu / d	50.00
Le : Bending	0.00 ft
<i>(Lu-xx * NDS Table 3.3.3 factor)</i>	
Rb : (Le d / b^2) ^ .5	1.000
Min. Allow k*Lu / d	11.00
Cf:Bending	1.000

For Axial Stress Calcs...

Cf : Axial	1.000
Axial X-X k Lu / d	13.71
Axial Y-Y k Lu / d	28.00



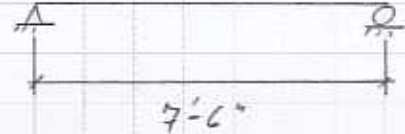
HEES & ASSOCIATES, INC.
 1381 Fifth Street • Sarasota, Florida 34236
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 karl@heesassociates.com • www.heesassociates.com
 C.O.A. #27043

JOB SOLAR DECATHLON 10HA042
 SHEET # _____ OF (85)
 CALCULATED BY: T. WILDA DATE: 02/7/11
 CHECKED BY: _____ DATE: _____
 SUBJECT: WOOD HEADER

FRONT - ENTRY POP-OUT:

HEADER OVER POP-OUT:

ROOF LOADS:



$$\text{DEAD} = 30 \text{ PSF} \times \frac{1}{2}(14.75') = 225 \text{ PLF}$$

$$\text{LIVE} = 20 \text{ PSF} \times \frac{1}{2}(14.75') = 150 \text{ PLF}$$

$$\begin{aligned} \text{UPLIFT} &= (-42.2 \text{ PSF} + 5.0 \text{ PSF}) \times 3 \text{ RT} = -115 \text{ lbs} \\ &+ (-31.5 \text{ PSF} + 5.0 \text{ PSF}) \times 4.4 \text{ RT} = -120 \text{ lbs} \end{aligned}$$

$$E = -235 \text{ PLF}$$

$$\text{LATERAL} = -44.8 \text{ PSF} \times \frac{1}{2}(2.73') = -55 \text{ PLF}$$

USE (2) 2X10'S #2 S4P.

S.A. f_b/f_b GRAVITY = 0.583

S.A. f_b/f_b WIND = 0.369

W.A. f_b/f_b WIND = 0.084

..

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
(c)1983-2006 ENERCALC Engineering Software

General Timber Beam

Description Front Entry Pop-Out Wood Header Strong Axis Gravity

General Information Code Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2-2x10	Center Span	7.50 ft	.....Lu	7.50 ft
Beam Width	3.000 in	Left Cantilever	ft	.....Lu	0.00 ft
Beam Depth	9.250 in	Right Cantilever	ft	.....Lu	0.00 ft
Member Type	Manuf/So.Pine	Southern Pine, No.2 2-4	Thick, 10	Wid	
Bm Wt. Added to Loads		Fb Base Allow	1,050.0	psi	
Load Dur. Factor	1.250	Fv Allow	175.0	psi	
Beam End Fixity	Pin-Pin	Fc Allow	565.0	psi	
Wood Density	35.000 pcf	E	1,600.0	ksi	

Full Length Uniform Loads

Center	DL	225.00 #/ft	LL	150.00 #/ft
Left Cantilever	DL	#/ft	LL	#/ft
Right Cantilever	DL	#/ft	LL	#/ft

Summary

Beam Design OK

Span= 7.50ft, Beam Width = 3.000in x Depth = 9.25in, Ends are Pin-Pin

Max Stress Ratio	0.583	:	1		
Maximum Moment Allowable	2.7 k-ft			Maximum Shear * 1.5 Allowable	1.7 k
	4.6 k-ft				6.1 k
Max. Positive Moment	2.68 k-ft	at	3.750 ft	Shear:	@ Left 1.43 k
Max. Negative Moment	0.00 k-ft	at	0.000 ft		@ Right 1.43 k
Max @ Left Support	0.00 k-ft			Camber:	@ Left 0.000 in
Max @ Right Support	0.00 k-ft				@ Center 0.078 in
					@ Right 0.000 in
Max. M allow	4.61			Reactions...	
fb 752.89 psi		f _v 61.90 psi		Left DL 0.87 k	Max 1.43 k
Fb 1,292.47 psi		F _v 218.75 psi		Right DL 0.87 k	Max 1.43 k

Deflections

Center Span...	Dead Load	Total Load	Left Cantilever...	Dead Load	Total Load
Deflection	-0.052 in	-0.086 in	Deflection	0.000 in	0.000 in
...Location	3.750 ft	3.750 ft	...Length/Defl	0.0	0.0
...Length/Defl	1,727.0	1,048.43	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.000 in	0.000 in
@ Center	0.078 in		...Length/Defl	0.0	0.0
@ Left	0.000 in				
@ Right	0.000 in				

Stress Calcs

Bending Analysis					
Ck	28.316	Le	14.457 ft	Sxx	42.781 in ³
Cf	1.000	Rb	13.356	CI	0.985
				Area	27.750 in ²
			<u>Max Moment</u>	<u>Sxx Req'd</u>	<u>Allowable fb</u>
@ Center			2.68 k-ft	24.92 in ³	1,292.47 psi
@ Left Support			0.00 k-ft	0.00 in ³	1,312.50 psi
@ Right Support			0.00 k-ft	0.00 in ³	1,312.50 psi
Shear Analysis			@ Left Support	@ Right Support	
Design Shear			1.72 k	1.72 k	
Area Required			7.853 in ²	7.853 in ²	
Fv Allowable			218.75 psi	218.75 psi	
Bearing @ Supports					
Max. Left Reaction			1.43 k	Bearing Length Req'd	0.845 in
Max. Right Reaction			1.43 k	Bearing Length Req'd	0.845 in

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
(c)1983-2006 ENERCALC Engineering Software

General Timber Beam

Description Front Entry Pop-Out Wood Header Strong Axis Wind

General Information Code Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2-2x10	Center Span	7.50 ft	Lu	7.50 ft
Beam Width	3.000 in	Left Cantilever	ft	Lu	0.00 ft
Beam Depth	9.250 in	Right Cantilever	ft	Lu	0.00 ft
Member Type	Manuf/So.Pine	Southern Pine, No.2 2-4	Thick, 10	Wid	
Bm Wt. Added to Loads		Fb Base Allow	1,050.0 psi		
Load Dur. Factor	1.250	Fv Allow	175.0 psi		
Beam End Fixity	Pin-Pin	Fc Allow	565.0 psi		
Wood Density	35.000 pcf	E	1,600.0 ksi		

Full Length Uniform Loads

Center	DL	#/ft	LL	235.00	#/ft
Left Cantilever	DL	#/ft	LL		#/ft
Right Cantilever	DL	#/ft	LL		#/ft

Summary

Beam Design OK

Span= 7.50ft, Beam Width = 3.000in x Depth = 9.25in, Ends are Pin-Pin

Max Stress Ratio	0.369 ; 1		Maximum Shear * 1.5	1.1 k
Maximum Moment Allowable	1.7 k-ft	4.6 k-ft	Allowable	6.1 k
Max. Positive Moment	1.70 k-ft	at 3.750 ft	Shear:	@ Left 0.91 k
Max. Negative Moment	0.00 k-ft	at 0.000 ft		@ Right 0.91 k
Max @ Left Support	0.00 k-ft		Camber:	@ Left 0.000 in
Max @ Right Support	0.00 k-ft			@ Center 0.002 in
Max. M allow	4.61			@ Right 0.000 in
fb 476.78 psi	Fv 39.20 psi	Reactions...	Left DL 0.03 k	Max 0.91 k
Fb 1,292.47 psi	Fv 218.75 psi		Right DL 0.03 k	Max 0.91 k

Deflections

Center Span...	<u>Dead Load</u>	<u>Total Load</u>	Left Cantilever...	<u>Dead Load</u>	<u>Total Load</u>
Deflection	-0.002 in	-0.054 in	Deflection	0.000 in	0.000 in
...Location	3.750 ft	3.750 ft	...Length/Defl	0.0	0.0
...Length/Defl	59,339.3	1,655.60	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.000 in	0.000 in
@ Center	0.002 in		...Length/Defl	0.0	0.0
@ Left	0.000 in				
@ Right	0.000 in				

Stress Calcs

Bending Analysis					
Ck	28.316	Le	14.457 ft	Sxx	42.781 in3
Cf	1.000	Rb	13.356	CI	0.985
		<u>Max Moment</u>		<u>Sxx Req'd</u>	<u>Allowable fb</u>
@ Center		1.70 k-ft		15.78 in3	1,292.47 psi
@ Left Support		0.00 k-ft		0.00 in3	1,312.50 psi
@ Right Support		0.00 k-ft		0.00 in3	1,312.50 psi
Shear Analysis		@ Left Support		@ Right Support	
Design Shear		1.09 k		1.09 k	
Area Required		4.973 in2		4.973 in2	
Fv: Allowable		218.75 psi		218.75 psi	
Bearing @ Supports					
Max. Left Reaction		0.91 k	Bearing Length Req'd	0.535 in	
Max. Right Reaction		0.91 k	Bearing Length Req'd	0.535 in	

Wall Framing



HEES & ASSOCIATES, INC.

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JOB SOLAR DECATHALON 10HA042

SHEET # _____ OF (89)

CALCULATED BY: T. WILDA DATE: 10/24/10

CHECKED BY: _____ DATE: _____

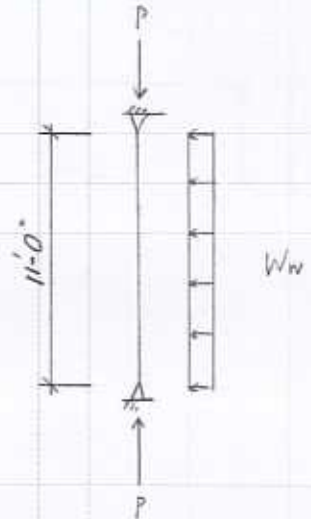
SUBJECT: WOOD STUD WALLS

WORST-CASE WOOD STUD WALL END-ZONE:

ROOF LOADS: $W_D = 160 \text{ PLF} \times 0.67 = P_D = 110 \text{ lbs}$

$W_L = 160 \text{ PLF} \times 0.67 = P_L = 110 \text{ lbs}$

↑ 8" O.C.



C.D.T. $W_w = -36.7 \text{ PSF (ZONE 5)} \times 0.67$

$W_w = -24.6 \text{ PLF}$

USE 2x4 STUDS @ 8" O.C. MAX.

TYP. ZONE:

↓ 10" O.C.

$D = 10/12 \times 160 = 135 \text{ lbs}$

$L = 10/12 \times 160 = 135 \text{ lbs}$

WIND: $W_w = -32.2 \text{ PSF (ZONE 4)} \times 10/12 = 26.8 \text{ PLF}$

USE 2x4 STUDS @ 10" O.C. MAX.

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Title :
 Dsgnr:
 Project Desc. :
 Project Notes :

Job #

90

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Wood Column

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ecb
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Wood Stud Wall End-Zone

General Information

Calculations per 2005 NDS, IBC 2006, CBC 2007, ASCE 7-05

Analysis Method : Allowable Stress Design
 End Fixities Top & Bottom Pinned
 Overall Column Height 10.170 ft
(Used for non-slender calculations)
 Wood Species Southern Pine
 Wood Grade No.2: 2" - 4" Thick : 5"-6" Wid
 Fb - Tension 1,250.0 psi Fv 175.0 psi
 Fb - Compr 1,250.0 psi Ft 725.0 psi
 Fc - Prll 1,600.0 psi Density 35.440 pcf
 Fc - Perp 565.0 psi
 E : Modulus of Elasticity ... x-x Bending y-y Bending Axial
 Basic 1,600.0 1,600.0 1,600.0 ksi
 Minimum 580.0 580.0

Wood Section Name **2x4**
 Wood Grading/Manuf. Southern Pine
 Wood Member Type Sawn
 Exact Width **1.50** in
 Exact Depth **3.50** in
 Area 5.25 in²
 Ix 5.359 in⁴
 Iy 0.9844 in⁴

Allowable Stress Modification Factors
 Cf or Cv for Bending 1.0
 Cf or Cv for Compression 1.0
 Cf or Cv for Tension 1.0
 Cm : Wet Use Factor 1.0
 Ct : Temperature Factor 1.0
 Cfu : Flat Use Factor 1.0
 Kf : Built-up columns 1.0 *NDS 15.3.2*
 Use Cr : Repetitive ? **Yes** *(non-glb only)*

Load Combination 2006 IBC & ASCE 7-05

Brace condition for deflection (buckling) along columns :
 X-X (width) axis : Fully braced against buckling along X-X Axis
 Y-Y (depth) axis : Fully braced against buckling along Y-Y Axis

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 13.140 lbs * Dead Load Factor
 AXIAL LOADS ...
 Axial Load at 10.170 ft, Yecc = 1.750in, D = 0.110, Lr = 0.110 k
 BENDING LOADS ...
 Lat. Uniform Load creating Mx-x, W = 0.0270 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.9385 : 1**
 Load Combination +0.60D+W+H
 Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3
 Location of max. above base 5.051 ft
 At maximum location values are ...
 Applied Axial 0.07388 k
 Applied Mx -0.3443 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 1,600.0 psi
PASS Maximum Shear Stress Ratio = **0.1512 : 1**
 Load Combination +D+W+H
 Location of max. above base 10.170 ft
 Applied Design Shear 26.452 psi
 Allowable Shear 175.0 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.1405 k Bottom along Y-Y 0.1373 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y -0.7661 in at 5.119 ft above base
 for load combination : W Only
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

Other Factors used to calculate allowable stresses . . .
 Cf or Cv : Size based factors Bending 1.000 Compression 1.000 Tension

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
	Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D	0.04365	PASS	10.102 ft	0.001717	PASS	10.170 ft
+D+Lr+H	0.08764	PASS	10.102 ft	0.003434	PASS	10.170 ft
+D+0.750Lr+0.750L+H	0.07661	PASS	10.102 ft	0.003004	PASS	10.170 ft
+D+W+H	0.930	PASS	5.051 ft	0.1512	PASS	10.170 ft
+D+0.750Lr+0.750L+0.750W+H	0.6765	PASS	4.983 ft	0.1151	PASS	10.170 ft
+D+0.750L+0.750S+0.750W+H	0.6921	PASS	4.983 ft	0.1138	PASS	10.170 ft
+D+0.750Lr+0.750L+0.5250E+H	0.07661	PASS	10.102 ft	0.003004	PASS	10.170 ft
+0.60D+W+H	0.9385	PASS	5.051 ft	0.1505	PASS	10.170 ft

Maximum Reactions - Unfactored

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		Y-Y Axis Reaction		Axial Reaction
	@ Base	@ Top	@ Base	@ Top	@ Base
D Only --		k	0.002	-0.002 k	0.123 k

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 Project Notes :

Job #

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Wood Column

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 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Wood Stud Wall End-Zone

Maximum Reactions - Unfactored

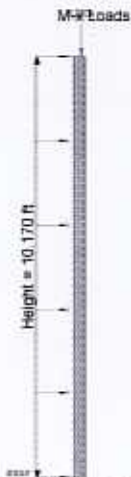
Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		Y-Y Axis Reaction		Axial Reaction
	@ Base	@ Top	@ Base	@ Top	@ Base
Lr Only		k	0.002	-0.002 k	0.110 k
W Only		k	-0.137	-0.137 k	k
D+Lr		k	0.003	-0.003 k	0.233 k
D+W		k	-0.136	-0.139 k	0.123 k
D+Lr+W		k	-0.134	-0.140 k	0.233 k

Maximum Deflections for Load Combinations - Unfactored Loads

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.022 in	5.938 ft
Lr Only	0.0000 in	0.000 ft	0.022 in	5.938 ft
W Only	0.0000 in	0.000 ft	-0.766 in	5.119 ft
D+Lr	0.0000 in	0.000 ft	0.043 in	5.938 ft
D+W	0.0000 in	0.000 ft	-0.745 in	5.119 ft
D+Lr+W	0.0000 in	0.000 ft	-0.724 in	5.051 ft

Sketches



Loads are total entered value. Arrows do not reflect absolute direction.

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92

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 ENERCALC, INC. 1983-2011, Ver. 6.0.26, N.86736

Wood Column

Lic. #: KW-06008353

Licensee :

Description : Wood Stud Wall Typical-Zone

General Information

Calculations per 2005 NDS, IBC 2006, CBC 2007, ASCE 7-05

Analysis Method : Allowable Stress Design
 End Fixities Top & Bottom Pinned
 Overall Column Height 10.170 ft
(Used for non-slender calculations)
 Wood Species Southern Pine
 Wood Grade No.2: 2" - 4" Thick : 5"-6" Wid.
 Fb - Tension 1,250.0 psi Fv 175.0 psi
 Fb - Compr 1,250.0 psi Ft 725.0 psi
 Fc - Prll 1,600.0 psi Density 35.440 pcf
 Fc - Perp 565.0 psi
 E : Modulus of Elasticity . . . x-x Bending y-y Bending Axial
 Basic 1,600.0 1,600.0 1,600.0 ksi
 Minimum 580.0 580.0

Wood Section Name **2x4**
 Wood Grading/Manuf. Southern Pine
 Wood Member Type Sawn
 Exact Width **1.50** in
 Exact Depth **3.50** in
 Area 5.250 in²
 Ix 5.359 in⁴
 Iy 0.9844 in⁴

Allowable Stress Modification Factors
 Cf or Cv for Bending 1.0
 Cf or Cv for Compression 1.0
 Cf or Cv for Tension 1.0
 Cm : Wet Use Factor 1.0
 Ct : Temperature Factor 1.0
 Cfu : Flat Use Factor 1.0
 Kf : Built-up columns 1.0 NDS 15.3.2
 Use Cr : Repetitive ? Yes (non-glb coly)

Load Combination 2006 IBC & ASCE 7-05

Brace condition for deflection (buckling) along columns :
 X-X (width) axis : Fully braced against buckling along X-X Axis
 Y-Y (depth) axis : Fully braced against buckling along Y-Y Axis

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 13.140 lbs * Dead Load Factor
 AXIAL LOADS . . .
 Axial Load at 10.170 ft, Yecc = 1.750in, D = 0.1350, Lr = 0.1350 k
 BENDING LOADS . . .
 Lat. Uniform Load creating Mx-x, W = 0.0250 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.8651 : 1**
 Load Combination +0.60D+W+H
 Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3
 Location of max. above base 5.051 ft
 At maximum location values are . . .
 Applied Axial 0.08888 k
 Applied Mx -0.3173 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 1,600.0 psi
PASS Maximum Shear Stress Ratio = **0.1405 : 1**
 Load Combination +D+W+H
 Location of max. above base 10.170 ft
 Applied Design Shear 24.583 psi
 Allowable Shear 175.0 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.1310 k Bottom along Y-Y 0.1271 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y -0.7094 in at 5.119 ft above base
 for load combination : W Only
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

Other Factors used to calculate allowable stresses . . .
 Cf or Cv : Size based factors Bending 1.000 Compression 1.000 Tension

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
	Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D	0.05362	PASS	10.102 ft	0.002107	PASS	10.170 ft
+D+Lr+H	0.1077	PASS	10.102 ft	0.004214	PASS	10.170 ft
+D+0.750Lr+0.750L+H	0.09416	PASS	10.102 ft	0.003687	PASS	10.170 ft
+D+W+H	0.8547	PASS	4.983 ft	0.1405	PASS	10.170 ft
+D+0.750Lr+0.750L+0.750W+H	0.6155	PASS	4.914 ft	0.1075	PASS	10.170 ft
+D+0.750L+0.750S+0.750W+H	0.6345	PASS	4.983 ft	0.1059	PASS	10.170 ft
+D+0.750Lr+0.750L+0.5250E+H	0.09416	PASS	10.102 ft	0.003687	PASS	10.170 ft
+0.60D+W+H	0.8651	PASS	5.051 ft	0.1396	PASS	10.170 ft

Maximum Reactions - Unfactored

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		Y-Y Axis Reaction		Axial Reaction
	@ Base	@ Top	@ Base	@ Top	@ Base
D Only --		k	0.002	-0.002 k	0.148 k

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Title :
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 Project Notes :

Job #

93

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 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Wood Column

Lic. #: KW-06008353

Licensee:

Description: Wood Stud Wall Typical-Zone

Note: Only non-zero reactions are listed.

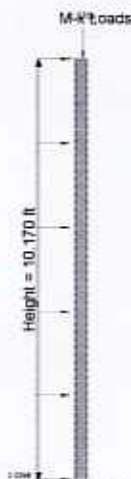
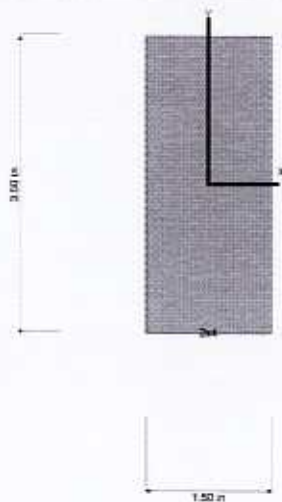
Maximum Reactions - Unfactored

Load Combination	X-X Axis Reaction		Y-Y Axis Reaction		Axial Reaction
	@ Base	@ Top	@ Base	@ Top	@ Base
Lr Only		k	0.002	-0.002 k	0.135 k
W Only		k	-0.127	-0.127 k	k
D+Lr		k	0.004	-0.004 k	0.283 k
D+W		k	-0.125	-0.129 k	0.148 k
D+Lr+W		k	-0.123	-0.131 k	0.283 k

Maximum Deflections for Load Combinations - Unfactored Loads

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.027 in	5.938 ft
Lr Only	0.0000 in	0.000 ft	0.027 in	5.938 ft
W Only	0.0000 in	0.000 ft	-0.709 in	5.119 ft
D+Lr	0.0000 in	0.000 ft	0.053 in	5.938 ft
D+W	0.0000 in	0.000 ft	-0.683 in	5.119 ft
D+Lr+W	0.0000 in	0.000 ft	-0.658 in	5.051 ft

Sketches



Loads are total entered value. Arrows do not reflect absolute direction.

Floor Framing

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 C.O.A. #27043

JOB SOLAR DELATHLON 10HA042SHEET # _____ OF (95)CALCULATED BY: T. WILDA DATE: 3/6/11

CHECKED BY: _____ DATE: _____

SUBJECT: PERIMETER RM

TYPICAL PERIMETER BEAM:

$$\text{ROOF LOADS: } T.W. = \frac{1}{2}(15.00') = 7.5 \text{ FT}$$

$$W_D = 7.5' \times 30 \text{ PSF} = 225 \text{ PLF}$$

$$W_L = 7.5' \times 20 \text{ PSF} = 150 \text{ PLF}$$

$$\text{WALL LOADS: } 11.67 \text{ FT} \times 20 \text{ PSF} = 235 \text{ PLF}$$

$$\text{2ND FLOOR LOADS: } T.W. = \frac{1}{2}(15.67') = 7.83'$$

$$W_D = 7.83' \times 20 \text{ PSF} = 160 \text{ PLF}$$

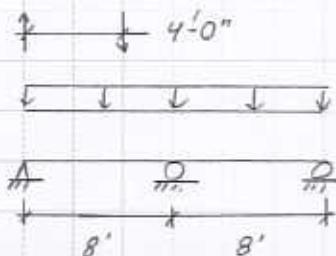
$$W_L = 7.83' \times 50 \text{ PSF} = 395 \text{ PLF}$$

$$E W_D = 620 \text{ PLF} \quad E W_L = 150 \text{ PLF} \quad E W_L = 395 \text{ PLF}$$

$$\text{OVERTURNING FROM S.W. 2} = 1215 \text{ lbs} \times 11.67' = 14,180 \text{ ft-lbs}$$

$$T/C = 14,180 \text{ ft-lbs} / 4.00' = 3545 \text{ lbs}$$

$$\underline{\underline{\text{USE } 3\frac{1}{2}'' \times 11\frac{7}{8}'' \text{ P.T. PSL}}}$$



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Title :
 Dsgnr:
 Project Desc.:
 Project Notes :

Job #

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Printed: 7 MAR 2011, 8:13AM

Wood Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec5
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N.86736

Lic. #: KW-06008353

Licensee :

Description : Typical PSL Wood Beam

Material Properties

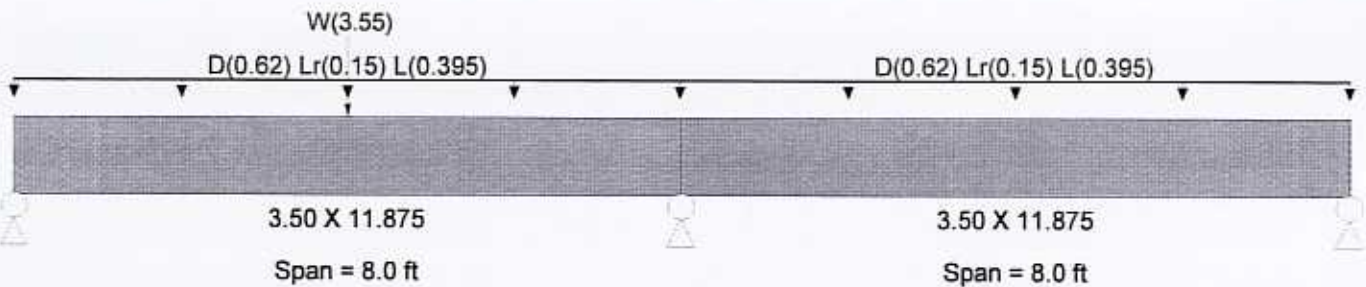
Calculations per NDS 2005, IBC 2006, CBC 2007, ASCE 7-05

Analysis Method : Allowable Stress Design
 Load Combination 2006 IBC & ASCE 7-05

Fb - Tension	2,900.0 psi	E : Modulus of Elasticity	
Fb - Compr	2,900.0 psi	Ebend- xx	2,000.0 ksi
Fc - Prll	2,900.0 psi	Eminbend - xx	1,016.54 ksi
Fc - Perp	750.0 psi		
Fv	290.0 psi		
Ft	2,025.0 psi	Density	32.210 pcf

Wood Species : iLevel Truss Joist
 Wood Grade : Parallam PSL 2.0E

Beam Bracing : Beam is Fully Braced against lateral-torsion buckling



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1

Uniform Load : D = 0.620, Lr = 0.150, L = 0.3950, Tributary Width = 1.0 ft
 Point Load : W = 3.550 k @ 4.0 ft

Load for Span Number 2

Uniform Load : D = 0.620, Lr = 0.150, L = 0.3950, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.605	1	Maximum Shear Stress Ratio	=	0.836	: 1
Section used for this span		3.50 X 11.875		Section used for this span		3.50 X 11.875	
fb : Actual	=	1,491.90 psi		fv : Actual	=	206.14 psi	
FB : Allowable	=	2,465.00 psi		Fv : Allowable	=	246.50 psi	
Load Combination		+D+0.750Lr+0.750L+0.750W+H		Load Combination		+D+0.750Lr+0.750L+0.750W+H	
Location of maximum on span	=	8.000ft		Location of maximum on span	=	7.015 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward L+Lr+S Deflection		0.022 in	Ratio = 4422				
Max Upward L+Lr+S Deflection		0.000 in	Ratio = 0 < 360				
Max Downward Total Deflection		0.089 in	Ratio = 1081				
Max Upward Total Deflection		-0.020 in	Ratio = 4867				

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios							Summary of Moment Values			Summary of Shear Values			
			M	V	C _d	C _{t/v}	C _r	C _m	C _t	Mactual	fb-design	Fb-allow	Vactual	fv-design	Fv-allow	
+D																
Length = 8.0 ft	1		0.294	0.364	1.000	1.000	1.000	0.850	1.000	-4.96	723.57	2,465.00	2.49	89.85	246.50	
Length = 8.0 ft	2		0.294	0.364	1.000	1.000	1.000	0.850	1.000	-4.96	723.57	2,465.00	2.49	89.85	246.50	
+D+L+H																
Length = 8.0 ft	1		0.481	0.597	1.000	1.000	1.000	0.850	1.000	-8.12	1,184.55	2,465.00	4.08	147.09	246.50	
Length = 8.0 ft	2		0.481	0.597	1.000	1.000	1.000	0.850	1.000	-8.12	1,184.55	2,465.00	4.08	147.09	246.50	
+D+Lr+H																
Length = 8.0 ft	1		0.365	0.453	1.000	1.000	1.000	0.850	1.000	-6.16	898.62	2,465.00	3.09	111.59	246.50	
Length = 8.0 ft	2		0.365	0.453	1.000	1.000	1.000	0.850	1.000	-6.16	898.62	2,465.00	3.09	111.59	246.50	
+D+0.750Lr+0.750L+H																
Length = 8.0 ft	1		0.487	0.605	1.000	1.000	1.000	0.850	1.000	-8.23	1,200.60	2,465.00	4.13	149.08	246.50	

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Title :
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 Project Desc.:
 Project Notes :

Job #

97

Printed: 7 MAR 2011, 6:13AM

Wood Beam

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec6
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Typical PSL Wood Beam

Load Combination	Segment Length	Span #	Max Stress Ratios						Summary of Moment Values			Summary of Shear Values		
			M	V	C _d	C _{fiv}	C _r	C _m	C _t	Mactual	fb-design	Fb-allow	Vactual	fv-design	Fv-allow
Length = 8.0 ft	2	0.487	0.605	1.000	1.000	1.000	0.850	1.000	-8.23	1,200.60	2,465.00	4.13	149.08	246.50
+D+0.750L+0.750S+H														
Length = 8.0 ft	1	0.434	0.539	1.000	1.000	1.000	0.850	1.000	-7.33	1,069.30	2,465.00	3.68	132.78	246.50
Length = 8.0 ft	2	0.434	0.539	1.000	1.000	1.000	0.850	1.000	-7.33	1,069.30	2,465.00	3.68	132.78	246.50
+D+W+H														
Length = 8.0 ft	1	0.488	0.673	1.000	1.000	1.000	0.850	1.000	8.25	1,203.33	2,465.00	4.60	165.92	246.50
Length = 8.0 ft	2	0.451	0.673	1.000	1.000	1.000	0.850	1.000	-7.62	1,111.97	2,465.00	2.82	165.92	246.50
+D+0.750Lr+0.750L+0.750W+H														
Length = 8.0 ft	1	0.605	0.836	1.000	1.000	1.000	0.850	1.000	-10.23	1,491.90	2,465.00	5.71	206.14	246.50
Length = 8.0 ft	2	0.605	0.836	1.000	1.000	1.000	0.850	1.000	-10.23	1,491.90	2,465.00	4.38	206.14	246.50
+D+0.750L+0.750S+0.750W+H														
Length = 8.0 ft	1	0.552	0.770	1.000	1.000	1.000	0.850	1.000	-9.33	1,360.61	2,465.00	5.26	189.83	246.50
Length = 8.0 ft	2	0.552	0.770	1.000	1.000	1.000	0.850	1.000	-9.33	1,360.61	2,465.00	3.93	189.83	246.50
+D+0.750Lr+0.750L+0.5250E+H														
Length = 8.0 ft	1	0.487	0.605	1.000	1.000	1.000	0.850	1.000	-8.23	1,200.60	2,465.00	4.13	149.08	246.50
Length = 8.0 ft	2	0.487	0.605	1.000	1.000	1.000	0.850	1.000	-8.23	1,200.60	2,465.00	4.13	149.08	246.50
+D+0.750L+0.750S+0.5250E+H														
Length = 8.0 ft	1	0.434	0.539	1.000	1.000	1.000	0.850	1.000	-7.33	1,069.30	2,465.00	3.68	132.78	246.50
Length = 8.0 ft	2	0.434	0.539	1.000	1.000	1.000	0.850	1.000	-7.33	1,069.30	2,465.00	3.68	132.78	246.50
+0.60D+W+H														
Length = 8.0 ft	1	0.429	0.527	1.000	1.000	1.000	0.850	1.000	7.26	1,058.62	2,465.00	3.60	129.98	246.50
Length = 8.0 ft	2	0.334	0.527	1.000	1.000	1.000	0.850	1.000	-5.64	822.55	2,465.00	1.83	129.98	246.50

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "v" Defl	Location in Span	Load Combination	Max. "v" Defl	Location in Span
D+L+W	1	0.0888	3.631		0.0000	0.000
D+L+Lr	2	0.0457	4.677	W Only	-0.0147	1.600

Vertical Reactions - Unfactored

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	4.487	12.591	3.495
D Only	1.860	6.200	1.860
L Only	1.185	3.950	1.185
Lr Only	0.450	1.500	0.450
L+Lr	1.635	5.450	1.635
W Only	1.442	2.441	-0.333
D+Lr	2.310	7.700	2.310
D+L	3.045	10.150	3.045
D+L+Lr	3.495	11.650	3.495
D+W	3.302	8.641	1.527
D+L+W	4.487	12.591	2.712
D+Lr+W	3.752	10.141	1.977



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C.O.A. #27043

JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (98)

CALCULATED BY: T. WILDA DATE: 3/6/11

CHECKED BY: _____ DATE: _____

SUBJECT: FLOOR FRAMING

FLOOR FRAMING:

JOISTS SUPPORTING POP-OUTS

TYPICAL FLOOR LOADS:

$W_D = 30 \text{ PCF}$

$W_L = \text{N/A (DURING TRANS. ONLY)}$

ROOF LOADS: $\frac{1}{2} (12.17') = 6.08'$

$W_D = 30 \text{ PSF (6.08')} = 185 \text{ PCF} \quad 0 \rightarrow 9.17'$

$W_L = \text{N/A (DURING TRANS. ONLY)}$

WALL LOADS: $20 \text{ PSF} \times 9.17' = 185 \text{ PCF} \quad 0 \rightarrow 9.17'$

$M_{MAX} = 30 (15.25)^2 / 8 = 875 \text{ ft-lbs} + 7600 \text{ ft-lbs} = 8475 \text{ ft-lbs}$

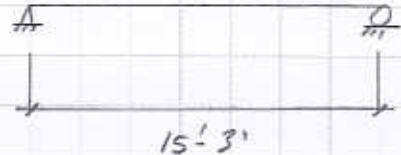
$M_D = 4215 \text{ ft-lbs} \times 3 = 12,645 \text{ ft-lbs} \geq 8475 \text{ ft-lbs}$

$V_D = 1655 \text{ ft-lbs} \times 3 = 4965 \text{ lbs} \geq 2600 \text{ lbs}$

USE (3) 11³/₈" x 230 SERIES

I-JOISTS @ SUPPORT OF POP-OUTS
(DURING TRANS ONLY)

..





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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (49)

CALCULATED BY: T. WILDA DATE: 3/9/11

CHECKED BY: _____ DATE: _____

SUBJECT: FLOOR FRAMING

FLOOR FRAMING:

TYP. FLOOR JOIST:

$W_D = 20 \text{ PSF} \times 1.33' = 30 \text{ PLF}$
 $W_L = 50 \text{ PSF} \times 1.33' = 70 \text{ PLF}$
100 PLF



$M_{MAX} = 2910 \text{ ft-lbs}$

c 230 SERIES, 11^{7/8}" DEEP

$V_{MAX} = 765 \text{ lbs}$

$M_A = 4215 \text{ ft-lbs}$

$V_A = 1655 \text{ lbs}$

USE 11^{7/8}" x 230 SERIES W/ 145237/11.88

HANGERS @ EA. END.



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (109)

CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

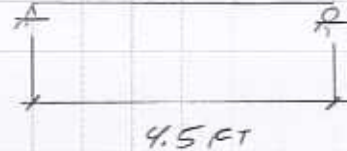
SUBJECT: FLOOR FRAMING

FLOOR FRAMING:

FRAMING @ BED-ROOM POP-OUT:

$W_D = 1.00 \times 20 \text{ PSF} = 20 \text{ PLF}$

$W_L = 1.00 \times 50 \text{ PSF} = 50 \text{ PLF}$

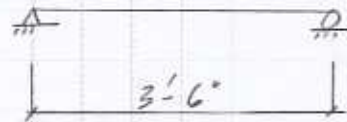


USE 2x4'S @ 12IN O.C.
PER ATTACHED ENERGCALC

FRAMING @ FRONT-ENTRY POP-OUT:

$W_D = 20 \text{ PLF}$

$W_L = 50 \text{ PLF}$



USE 2x4'S @ 10IN O.C.
PER ATTACHED ENERGCALC



Scope :

Rev: 560004
User: KW-0608353, Ver 5.6.0, 1-Nov-2006
(c)1983-2006 ENERCALC Engineering Software

General Timber Beam

Description Front Entry Pop out floor framing

General Information Code Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2x4	Center Span	3.50 ft	.....Lu	1.00 ft
Beam Width	1.500 in	Left Cantilever	ft	.....Lu	0.00 ft
Beam Depth	3.500 in	Right Cantilever	ft	.....Lu	0.00 ft
Member Type	Manuf/So.Pine	Southern Pine, No.2 2-4	Thick, 2-4	W	
Bm Wt. Added to Loads		Fb Base Allow	1,500.0 psi		
Load Dur. Factor	1.000	Fv Allow	175.0 psi		
Beam End Fixity	Pin-Pin	Fc Allow	565.0 psi		Repetitive Member
Wood Density	35.000 pcf	E	1,600.0 ksi		

Full Length Uniform Loads

Center	DL	20.00 #/ft	LL	50.00 #/ft
Left Cantilever	DL	#/ft	LL	#/ft
Right Cantilever	DL	#/ft	LL	#/ft

Summary

Beam Design OK

Span= 3.50ft, Beam Width = 1.500in x Depth = 3.5in, Ends are Pin-Pin

Max Stress Ratio	0.249 ; 1		Maximum Shear * 1.5	0.2 k
Maximum Moment Allowable	0.1 k-ft	at 1.750 ft	Allowable	0.9 k
Max. Positive Moment	0.11 k-ft	at 1.750 ft	Shear:	@ Left 0.12 k
Max. Negative Moment	0.00 k-ft	at 3.500 ft		@ Right 0.12 k
Max @ Left Support	0.00 k-ft		Camber:	@ Left 0.000 in
Max @ Right Support	0.00 k-ft			@ Center 0.013 in
Max. M allow	0.44			@ Right 0.000 in
fb 427.66 psi	f _v 29.94 psi	Left DL 0.04 k	Reactions...	Max 0.12 k
Fb 1,718.75 psi	F _v 175.00 psi	Right DL 0.04 k		Max 0.12 k

Deflections

Center Span...	<u>Dead Load</u>	<u>Total Load</u>	Left Cantilever...	<u>Dead Load</u>	<u>Total Load</u>
Deflection	-0.008 in	-0.028 in	Deflection	0.000 in	0.000 in
...Location	1.750 ft	1.750 ft	...Length/Defl	0.0	0.0
...Length/Defl	5,013.6	1,496.57	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.000 in	0.000 in
@ Center	0.013 in		...Length/Defl	0.0	0.0
@ Left	0.000 in				
@ Right	0.000 in				

Stress Calcs

Bending Analysis					
Ck	26.487	Le	2.059 ft	Sxx	3.063 in3
Cf	1.000	Rb	6.201	CI	0.996
				Area	5.250 in2
		<u>Max Moment</u>		<u>Sxx Req'd</u>	<u>Allowable fb</u>
@ Center		0.11 k-ft		0.76 in3	1,718.75 psi
@ Left Support		0.00 k-ft		0.00 in3	1,725.00 psi
@ Right Support		0.00 k-ft		0.00 in3	1,725.00 psi
Shear Analysis		@ Left Support		@ Right Support	
Design Shear		0.16 k		0.16 k	
Area Required		0.898 in2		0.898 in2	
Fv: Allowable		175.00 psi		175.00 psi	
Bearing @ Supports					
Max. Left Reaction		0.12 k	Bearing Length Req'd	0.147 in	
Max. Right Reaction		0.12 k	Bearing Length Req'd	0.147 in	

HEES AND ASSOCIATES
1381 FIFTH STREET
SARASOTA FL 34236

Title :
Dsgnr :
Description :

Job #
Date: 4:21PM, 4 MAR 11

102

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
(c)1983-2006 ENERCALC Engineering Software

General Timber Beam

Page 2
misc.ecw Calculations

Description Front Entry Pop out floor framing

Query Values

M, V, & D @ Specified Locations		Moment	Shear	Deflection
@ Center Span Location =	0.00 ft	0.00 k-ft	0.12 k	0.0000 in
@ Right Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in
@ Left Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in

103

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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General Timber Beam

Page 1
misc.ecw Calculations

Description Framing @ Bedroom Pop-Out

General Information Code Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2x4	Center Span	4.50 ft	.....Lu	1.00 ft
Beam Width	1.500 in	Left Cantilever	ft	.....Lu	0.00 ft
Beam Depth	3.500 in	Right Cantilever	ft	.....Lu	0.00 ft
Member Type	Manuf/So.Pine	Southern Pine, No.2 2-4	Thick, 2-4	W	
Bm Wt. Added to Loads		Fb Base Allow	1,500.0 psi		
Load Dur. Factor	1.000	Fv Allow	175.0 psi		
Beam End Fixity	Pin-Pin	Fc Allow	565.0 psi		Repetitive Member
Wood Density	35.000 pcf	E	1,600.0 ksi		

Full Length Uniform Loads

Center	DL	20.00 #/ft	LL	50.00 #/ft
Left Cantilever	DL	#/ft	LL	#/ft
Right Cantilever	DL	#/ft	LL	#/ft

Summary

Beam Design OK

Span= 4.50ft, Beam Width = 1.500in x Depth = 3.5in, Ends are Pin-Pin

Max Stress Ratio	0.411 : 1		Maximum Shear * 1.5	0.2 k
Maximum Moment Allowable	0.2 k-ft		Allowable	0.9 k
Max. Positive Moment	0.18 k-ft	at 2.250 ft	Shear:	@ Left 0.16 k
Max. Negative Moment	0.00 k-ft	at 0.000 ft		@ Right 0.16 k
Max @ Left Support	0.00 k-ft		Camber:	@ Left 0.000 in
Max @ Right Support	0.00 k-ft			@ Center 0.034 in
Max. M allow	0.44			@ Right 0.000 in
fb 706.94 psi	f _v 39.96 psi	Reactions...	Left DL 0.05 k	Max 0.16 k
Fb 1,718.75 psi	F _v 175.00 psi		Right DL 0.05 k	Max 0.16 k

Deflections

Center Span...	Dead Load	Total Load	Left Cantilever...	Dead Load	Total Load
Deflection	-0.023 in	-0.077 in	Deflection	0.000 in	0.000 in
...Location	2.250 ft	2.250 ft	...Length/Defl	0.0	0.0
...Length/Defl	2,358.9	704.15	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.000 in	0.000 in
@ Center	0.034 in		...Length/Defl	0.0	0.0
@ Left	0.000 in				
@ Right	0.000 in				

Stress Calcs

Bending Analysis					
Ck	26.487	Le	2.059 ft	Sxx	3.063 in ³
Cf	1.000	Rb	6.201	CI	0.996
			Max Moment	Sxx Req'd	Allowable fb
@ Center			0.18 k-ft	1.26 in ³	1,718.75 psi
@ Left Support			0.00 k-ft	0.00 in ³	1,725.00 psi
@ Right Support			0.00 k-ft	0.00 in ³	1,725.00 psi
Shear Analysis					
		@ Left Support		@ Right Support	
Design Shear		0.21 k		0.21 k	
Area Required		1.199 in ²		1.199 in ²	
Fv: Allowable		175.00 psi		175.00 psi	
Bearing @ Supports					
Max. Left Reaction		0.16 k		Bearing Length Req'd	0.189 in
Max. Right Reaction		0.16 k		Bearing Length Req'd	0.189 in

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SARASOTA FL 34236

Title :
Dsgnr:
Description :

Job #
Date: 4:21PM, 4 MAR 11

104

Scope :

Rev: 560004
User: KW-0608353, Ver 5 & 0, 1-Nov-2006
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General Timber Beam

Page 2
misc.ecw Calculations

Description Framing @ Bedroom Pop-Out

Query Values

M, V, & D @ Specified Locations		Moment	Shear	Deflection
@ Center Span Location =	0.00 ft	0.00 k-ft	0.16 k	0.0000 in
@ Right Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in
@ Left Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in

Deck Framing



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (105)

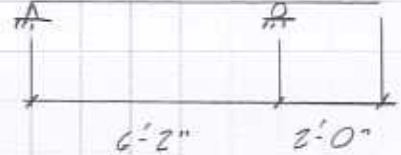
CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: DECK FRAMING

Worst - Case Typical Deck Framing:

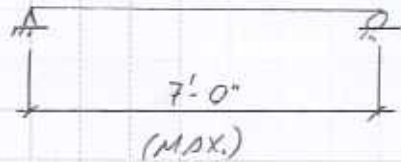
LOADS: DEAD = 10 PSF \times 1.33 = 15 PLF
LIVE = 50 PSF \times 1.33 = 70 PLF



* PER ATTACHED ENERCALC SHEETS,
USE 2x6 @ 16" O.C. MAX *

Worst - Case Deck Transfer Beam:

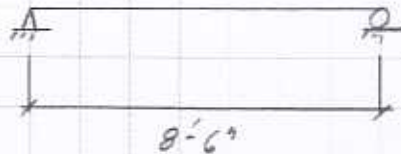
LOADS: DEAD = 80 PLF
LIVE = 380 PLF



* USE (3) 2x8 PER ATTACHED
ENERCALC SHEETS *

Typ. Deck Joist, No Cantile.

LOADS: DEAD = 15 PLF
LIVE = 70 PLF



USE 2x6 @ 16" O.C. MAX.

Scope :

Rev: 560004
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General Timber Beam

Page 1
misc.ecw Calculations

Description Typical Deck Joist

General Information Code Ref. 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2x6	Center Span	6.17 ft	.....Lu	1.00 ft
Beam Width	1.500 in	Left Cantilever	ft	.....Lu	0.00 ft
Beam Depth	5.500 in	Right Cantilever	2.00 ft	.....Lu	2.00 ft
Member Type	Sawn	Southern Pine, No.2 2 -4	Thick, 8	Wide	
Load Dur. Factor	1.000	Fb Base Allow	1,200.0 psi		
Beam End Fixity	Pin-Pin	Fv Allow	175.0 psi		
		Fc Allow	565.0 psi		Repetitive Member
		E	1,600.0 ksi		

Full Length Uniform Loads

Center	DL	15.00 #/ft	LL	70.00 #/ft
Left Cantilever	DL	#/ft	LL	#/ft
Right Cantilever	DL	15.00 #/ft	LL	70.00 #/ft

Summary

Beam Design OK

Span= 6.17ft, Right Cant= 2.00ft, Beam Width = 1.500in x Depth = 5.5in, Ends are Pin-Pin

Max Stress Ratio	0.455	: 1			
Maximum Moment Allowable	0.4 k-ft		Maximum Shear * 1.5 Allowable	0.4 k	
	0.9 k-ft			1.4 k	
Max. Positive Moment	0.39 k-ft	at 3.036 ft	Shear:	@ Left	0.26 k
Max. Negative Moment	-0.03 k-ft	at 6.170 ft		@ Right	0.29 k
Max @ Left Support	0.00 k-ft		Camber:	@ Left	0.000 in
Max @ Right Support	-0.17 k-ft			@ Center	0.017 in
Max. M allow	0.86			@ Right	0.011 in
fb	618.24 psi		Reactions...		
Fb	1,359.19 psi		Left DL	0.04 k	Max 0.26 k
			Right DL	0.08 k	Max 0.46 k

Deflections

Center Span...	Dead Load	Total Load	Left Cantilever...	Dead Load	Total Load
Deflection	-0.011 in	-0.080 in	Deflection	0.000 in	0.000 in
...Location	2.938 ft	3.069 ft	...Length/Defl	0.0	0.0
...Length/Defl	6,719.3	930.28	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.007 in	0.077 in
@ Center	0.017 in		...Length/Defl	6,632.2	623.2
@ Left	0.000 in				
@ Right	0.011 in				

Stress Calcs

Bending Analysis					
Ck	29.614	La	4.118 ft	Sxx	7.563 in3
Cf	1.000	Rb	10.993	CI	0.993
				Area	8.250 in2
			Max Moment	Sxx Req'd	Allowable fb
@ Center			0.39 k-ft	3.41 in3	1,370.81 psi
@ Left Support			0.00 k-ft	0.00 in3	1,380.00 psi
@ Right Support			0.17 k-ft	1.50 in3	1,359.19 psi
Shear Analysis					
		@ Left Support		@ Right Support	
Design Shear		0.33 k		0.38 k	
Area Required		1.873 in2		2.151 in2	
Fv: Allowable		175.00 psi		175.00 psi	
Bearing @ Supports					
Max. Left Reaction		0.26 k		Bearing Length Req'd	0.304 in
Max. Right Reaction		0.46 k		Bearing Length Req'd	0.543 in

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107

Scope :

Rev: 560004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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General Timber Beam

Page 2
misc.ecw.Calculations

Description Typical Deck Joist

Query Values

M, V, & D @ Specified Locations		Moment	Shear	Deflection
@ Center Span Location =	0.00 ft	0.00 k-ft	0.23 k	0.0000 in
@ Right Cant. Location =	0.00 ft	0.00 k-ft	0.23 k	0.0000 in
@ Left Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in

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Dsgnr:
Description :

Job #
Date: 4:18PM, 4 MAR 11

109

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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General Timber Beam

Page 2
misc.ecw Calculations

Description Worst-Case Deck Transfer Beam

Query Values

M, V, & D @ Specified Locations		Moment	Shear	Deflection
@ Center Span Location =	0.00 ft	0.00 k-ft	1.87 k	0.0000 in
@ Right Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in
@ Left Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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General Timber Beam

Page 1
misc.ecw.Calculations

Description Typical Deck Joist No Cantil.

General Information Code Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2x6	Center Span	8.50 ft	.....Lu	1.00 ft
Beam Width	1.500 in	Left Cantilever	ft	.....Lu	0.00 ft
Beam Depth	5.500 in	Right Cantilever	ft	.....Lu	2.00 ft
Member Type	Sawn	Southern Pine, No.2 2-4	Thick, 8	Wide	
Bm Wt. Added to Loads		Fb Base Allow	1,200.0 psi		
Load Dur. Factor	1.000	Fv Allow	175.0 psi		
Beam End Fixity	Pin-Pin	Fc Allow	565.0 psi		Repetitive Member
Wood Density	35.000 pcf	E	1,600.0 ksi		

Full Length Uniform Loads

Center	DL	15.00 #/ft	LL	70.00 #/ft
Left Cantilever	DL	#/ft	LL	#/ft
Right Cantilever	DL	15.00 #/ft	LL	70.00 #/ft

Summary

Beam Design OK

Span= 8.50ft, Beam Width = 1.500in x Depth = 5.5in, Ends are Pin-Pin

Max Stress Ratio	0.917 : 1		Maximum Shear * 1.5	0.5 k
Maximum Moment Allowable	0.8 k-ft		Allowable	1.4 k
Max. Positive Moment	0.79 k-ft	at 4.250 ft	Shear:	@ Left 0.37 k
Max. Negative Moment	0.00 k-ft	at 8.500 ft		@ Right 0.37 k
Max @ Left Support	0.00 k-ft		Camber:	@ Left 0.000 in
Max @ Right Support	0.00 k-ft			@ Center 0.090 in
Max. M allow	0.86			@ Right 0.000 in
fb 1,246.83 psi	Fv 60.24 psi	Reactions...	Left DL 0.07 k	Max 0.37 k
Fb 1,359.19 psi	Fv 175.00 psi		Right DL 0.07 k	Max 0.37 k

Deflections

Center Span...	Dead Load	Total Load	Left Cantilever...	Dead Load	Total Load
Deflection	-0.060 in	-0.307 in	Deflection	0.000 in	0.000 in
...Location	4.250 ft	4.250 ft	...Length/Defl	0.0	0.0
...Length/Defl	1,699.4	332.14	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.000 in	0.000 in
@ Center	0.090 in		...Length/Defl	0.0	0.0
@ Left	0.000 in				
@ Right	0.000 in				

Stress Calcs

Bending Analysis					
Ck	29.614	Le	4.118 ft	Sxx	7.563 in3
Cf	1.000	Rb	10.993	CI	0.993
				Area	8.250 in2
				Sxx Req'd	Allowable fb
@ Center	0.79 k-ft			6.88 in3	1,370.81 psi
@ Left Support	0.00 k-ft			0.00 in3	1,380.00 psi
@ Right Support	0.00 k-ft			0.00 in3	1,359.19 psi
Shear Analysis					
		@ Left Support		@ Right Support	
Design Shear	0.50 k			0.50 k	
Area Required	2.840 in2			2.840 in2	
Fv: Allowable	175.00 psi			175.00 psi	
Bearing @ Supports					
Max. Left Reaction	0.37 k			Bearing Length Req'd	0.436 in
Max. Right Reaction	0.37 k			Bearing Length Req'd	0.436 in

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Title :
Dsgnr:
Description :

Job #
Date: 1:25PM, 7 MAR 11

(111)

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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General Timber Beam

Page 2
misc.ecw Calculations

Description Typical Deck Joist No Cantil.

Query Values

M, V, & D @ Specified Locations		Moment	Shear	Deflection
@ Center Span Location =	0.00 ft	0.00 k-ft	0.37 k	0.0000 in
@ Right Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in
@ Left Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in

Lattice Support Framing

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 karl@heesassociates.com - www.heesassociates.com
 C.O.A. #27043

JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (12)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: LATTICE EXAMING

TUBE STR. BM. SUPPORTING LATTICE @ EAST-WEST ENDS:

WIND LOADS:

$$g = 26.6 \text{ PSF}$$

$$E = 0.3 \therefore Cf = 1.6$$

$$G = 0.85$$

$$P = 26.6 \text{ PSF} \times 1.6 \times 0.85 = 36.2 \text{ PSF}$$

$$Ww = 36.2 \text{ PSF} (1.5 \sin \times 12/5) \times 5.67' = 55 \text{ PCF}$$

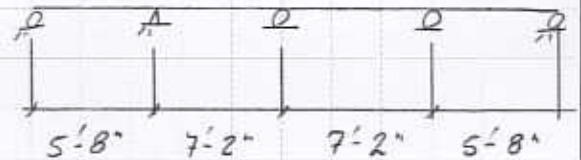
USE CONT. HSS $3\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{3}{16}''$ (LLV)

$$fb/Fb = 0.217$$

DEAD LOADS:

$$Wd = (1.5 \sin \times 4.5 \sin) / 144 \text{ IN} \times 35 \text{ PCF} \times 12 \text{ IN} / 5 \text{ IN} \times 4.5' = 20 \text{ PCF}$$

..



Scope :

Rev: 560010
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Multi-Span Steel Beam

Description HSS Supporting Lattice Framing Wind

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Fy - Yield Stress 46.00 ksi Load Duration Factor 1.00
Spans Considered Continuous Over Supports

Span Information

Description					
Span	ft	5.67	7.17	7.17	5.67
Steel Section		HSS3-1/2X2-1/2	HSS3-1/2X2-1/2	HSS3-1/2X2-1/2	HSS3-1/2X2-1/2
End Fixity		Free-Pin	Pin-Pin	Pin-Pin	Pin-Free
Unbraced Length	ft	5.67	7.17	7.17	5.67

Loads

Live Load Used This Span ?		Yes	Yes	Yes	Yes
Dead Load	k/ft				
Live Load	k/ft	0.055	0.055	0.055	0.055

Results

Mmax @ Cntr	k-ft	0.00	0.12	0.12	0.00
@ X =	ft	0.00	6.07	1.10	5.67
Max @ Left End	k-ft	0.00	-0.88	0.09	-0.88
Max @ Right End	k-ft	-0.88	0.09	-0.88	0.00
fb : Actual	psi	6,008.4	6,008.4	6,008.4	6,008.4
Fb : Allowable	psi	27,600.0	27,600.0	27,600.0	27,600.0
		Bending OK	Bending OK	Bending OK	Bending OK
fv : Actual	psi	256.0	273.3	273.3	256.0
Fv : Allowable	psi	18,400.0	18,400.0	18,400.0	18,400.0

Reactions & Deflections

Shear @ Left	k	0.00	0.33	0.06	0.31
Shear @ Right	k	0.31	0.06	0.33	0.00
Reactions...		0.00	0.00	0.00	0.00
DL @ Left	k	0.00	0.64	0.12	0.64
LL @ Left	k	0.00	0.64	0.12	0.64
Total @ Left	k	0.00	0.00	0.00	0.00
DL @ Right	k	0.64	0.12	0.64	0.00
LL @ Right	k	0.64	0.12	0.64	0.00
Total @ Right	k	-0.264	0.019	0.019	-0.264
Max. Deflection	in	0.00	1.96	5.21	5.67
@ X =	ft	515.2	4,628.1	4,628.1	515.2
Span/Deflection Ratio					

Query Values

Location	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shear	k	0.00	0.33	0.06	0.31	0.00	0.00	0.00	0.00
Moment	k-ft	0.00	-0.88	0.09	-0.88	0.00	0.00	0.00	0.00
Max. Deflection	in	-0.2641	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Scope :

Rev: 560007
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Beam Design

Description Tube Steel Supporting Lattice East-West Ends Gravity

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section : HSS3-1/2X2-1/2X3/16

Center Span	7.17 ft	Pinned-Pinned	Fy	46.00 ksi
Left Cant	0.00 ft	Bm Wt. Added to Loads	Load Duration Factor	1.00
Right Cant	0.00 ft	LL & ST Act Together	Elastic Modulus	29,000.0 ksi
Lu : Unbraced Length	7.17 ft	Minor Axis Bending !		

Distributed Loads

Note! Short Term Loads Are WIND Loads.

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	
DL	0.020							k/ft
LL								k/ft
ST								k/ft
Start Location								ft
End Location								ft

Summary

Beam OK
Static Load Case Governs Stress

Using: HSS3-1/2X2-1/2X3/16 section, Span = 7.17ft, Fy = 46.0ksi
End Fixity = Pinned-Pinned, Lu = 7.17ft, LDF = 1.000

	Actual	Allowable		
Moment	0.170 k-ft	3.358 k-ft	Max. Deflection	-0.030 in
fb : Bending Stress	1.395 ksi	27.600 ksi	Length/DL Defl	2,890.6 : 1
fb / Fb	0.051 : 1		Length/(DL+LL Defl)	2,890.6 : 1
Shear	0.095 k	8.004 k		
fv : Shear Stress	0.109 ksi	18.400 ksi		
fv / Fv	0.006 : 1			

Force & Stress Summary

<<-- These columns are Dead + Live Load placed as noted -->>

	Maximum	DL Only	LL @ Center	LL+ST @ Center	LL @ Cants	LL+ST @ Cants	
Max. M +	0.17 k-ft	0.17					k-ft
Max. M -							k-ft
Max. M @ Left							k-ft
Max. M @ Right							k-ft
Shear @ Left	0.09 k	0.09					k
Shear @ Right	0.09 k	0.09					k
Center Defl.	-0.030 in	-0.030	0.000	-0.030	0.000	0.000	in
Left Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
Right Cant Defl	0.000 in	0.000	0.000	0.000	0.000	0.000	in
...Query Defl @	0.000 ft	0.000	0.000	0.000	0.000	0.000	in
Reaction @ Left	0.09	0.09		0.09			k
Reaction @ Rt	0.09	0.09		0.09			k

Fa calc'd per Eq. E2-2, K*L/r > Cc

Section Properties HSS3-1/2X2-1/2X3/16

Depth	3.500 in	Weight	6.42 #/ft
Web Thick	0.174 in	lxx	3.090 in4
Width	2.500 in	lyy	1.820 in4
Flange Thick	0.174 in	Sxx	1.760 in3
Area	1.89 in2	Syy	1.460 in3
Rt	1.250 in	R-xx	1.280 in
Values for LRFD Design....		R-yy	0.983 in
J	3.780 in4	Zx	2.180 in3
Cw	2.67 in6	Zy	1.720 in3



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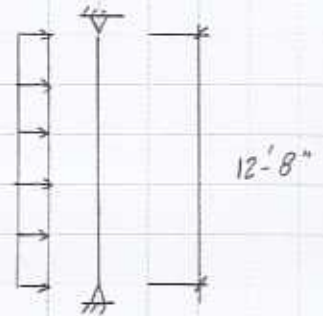
JOB SOLAR DECATHLON 10HA042
 SHEET # _____ OF (115)
 CALCULATED BY: T. WILDA DATE: 3/8/11
 CHECKED BY: _____ DATE: _____
 SUBJECT: LATTICE SUPPORT

VERTICAL TUBG STEEL SUPPORTING LATTICE:

$$W_w = \frac{1}{2}(14.33') \times 10.86 \text{ PSF} = 80 \text{ PLF}$$

GRAVITY LOADS:

$$\text{WALL LATTICE FRAMING} = 20 \text{ PLF} \times \frac{1}{2}(14.33') = 145 \text{ lbs}$$



$$e \ x = 0.00' = 145 \text{ lbs} \quad e = 4.25 \text{ IN}$$

$$e \ x = 4.75' = 145 \text{ lbs} \quad e = 4.25 \text{ IN}$$

$$e \ x = 9.5' = 145 \text{ lbs} \quad e = 4.25 \text{ IN} \quad \Sigma = 435 \text{ lbs} \quad e = 4.25 \text{ IN}$$

$$\text{HSS } 3\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{3}{16}'' = 6.87 \text{ PLF} \times \frac{1}{2}(14.33') = 50 \text{ lbs}$$

$$e \ x = 0.00' = 50 \text{ lbs} \quad e = 3.25 \text{ IN}$$

$$e \ x = 4.75' = 50 \text{ lbs} \quad e = 3.25 \text{ IN}$$

$$e \ x = 9.5' = 50 \text{ lbs} \quad e = 3.25 \text{ IN} \quad \Sigma = 150 \text{ lbs} \quad e = 3.25 \text{ IN}$$

$$\text{HSS } 3\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{5}{16}'' = 12.65 \text{ PLF} \times \frac{1}{2}(14.33') = 90 \text{ lbs}$$

$$e \ x = 12.67' = 90 \text{ lbs} \quad e = 0.0 \text{ IN}$$

$$\Sigma = 90 \text{ lbs} \quad e = 0 \text{ IN}$$

$$\text{ROOF LATTICE FRAMING} = 15 \text{ PLF} \times \frac{1}{2}(14.33') = 110 \text{ lbs}$$

$$e \ x = 12.67' = 110 \text{ lbs} \quad e = 0.0 \text{ IN}$$

$$\Sigma = 110 \text{ lbs} \quad e = 0 \text{ IN}$$

$$P_{\text{TOT}} = 785 \text{ lbs} \quad e (\text{AVE.}) = 3.0 \text{ IN}$$

..

USE HSS 3x3x3/16"

Scope :

Rev: 560010
User: KW-0608353; Ver 5.8.0, 1-Nov-2006
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Steel Column

Page 1
misc.ecw Calculations

Description Vertical Tube Steel Supporting Lattice

General Information

Code Ref: AISC 9th ASD, 1997 UBC, 2003 IBC, 2003 NFPA 5000

Steel Section	HSS3X3X3/16	Fy	46.00 ksi	X-X Sidesway :	Restrained
		Duration Factor	1.330	Y-Y Sidesway :	Restrained
Column Height	12.670 ft	Elastic Modulus	29,000.00 ksi		
End Fixity	Pin-Pin	X-X Unbraced	12.670 ft	Kxx	1.000
Live & Short Term Loads Combined		Y-Y Unbraced	12.670 ft	Kyy	1.000

Loads

Axial Load...

Dead Load	0.79 k	Ecc. for X-X Axis Moments	3.000 in
Live Load	k	Ecc. for Y-Y Axis Moments	0.000 in
Short Term Load	k		

Distributed lateral Loads...

	DL	LL	ST	Start	End
Along Y-Y			0.080 k/ft	→	ft
Along X-X			k/ft	→	ft

Summary

Column Design OK

Section : HSS3X3X3/16, Height = 12.67ft, Axial Loads: DL = 0.79, LL = 0.00, ST = 0.00k, Ecc. = 3.000in

Unbraced Lengths: X-X = 12.67ft, Y-Y = 12.67ft

Combined Stress Ratios	Dead	Live	DL + LL	DL + ST + (LL if Chosen)
AISC Formula H1 - 1				
AISC Formula H1 - 2				
AISC Formula H1 - 3	0.0967		0.0967	0.3461

XX Axis : Fa calc'd per Eq. E2-2, $K^2L/r > C_c$

YY Axis : Fa calc'd per Eq. E2-2, $K^2L/r > C_c$

Stresses

Allowable & Actual Stresses	Dead	Live	DL + LL	DL + Short
Fa : Allowable	8.41 ksi	0.00 ksi	8.41 ksi	11.18 ksi
fa : Actual	0.42 ksi	0.00 ksi	0.42 ksi	0.42 ksi
Fb:xx : Allow [F3.1]	30.36 ksi	0.00 ksi	30.36 ksi	40.38 ksi
fb : xx Actual	1.44 ksi	0.00 ksi	1.44 ksi	12.47 ksi
Fb:yy : Allow [F3.1]	30.36 ksi	0.00 ksi	30.36 ksi	40.38 ksi
fb : yy Actual	0.00 ksi	0.00 ksi	0.00 ksi	0.00 ksi

Analysis Values

F _{ex} : DL+LL	8,408 psi	C _m :x DL+LL	0.60	C _b :x DL+LL	1.00
F _{ey} : DL+LL	8,408 psi	C _m :y DL+LL	0.60	C _b :y DL+LL	1.00
F _{ex} : DL+LL+ST	11,183 psi	C _m :x DL+LL+ST	1.00	C _b :x DL+LL+ST	1.00
F _{ey} : DL+LL+ST	11,183 psi	C _m :y DL+LL+ST	0.60	C _b :y DL+LL+ST	1.00
Max X-X Axis Deflection	-0.698 in at	6.419 ft	Max Y-Y Axis Deflection	0.000 in at	0.000 ft

Scope :

Rev: 580010
 User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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Steel Column

Description Vertical Tube Steel Supporting Lattice

Section Properties HSS3X3X3/16

Property	Value	Property	Value	Values for LRFD Design....	
Depth	3.000 in	Weight	6.42 #/ft	J	4.030 in4
Web Thick	0.174 in	Ixx	2.460 in4	Cw	2.76 in6
Width	3.000 in	Iyy	2.460 in4	Zx	1.970 in3
Flange Thick	0.174 in	Sxx	1.640 in3	Zy	1.970 in3
Area	1.89 in2	Syy	1.640 in3		
Rt	0.000 in	Rxx	1.140 in		
		Ryy	1.140 in		

Section Type = HSS-Square



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (118)

CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

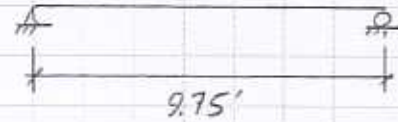
SUBJECT: LATICE

Worst-Case Lattice Design:

$$W_D = 1.5 \text{ IN} \times 4.5 \text{ IN} / 144 \text{ IN}^2 \times 35 \text{ PSF}$$

$$= 1.65 \text{ PSF}$$

$$W_W = -84.3 \text{ PSF} (1.5 \text{ IN} / 12 \text{ IN}) = -10.6 \text{ PSF}$$



USE #2 P.T. SYP 1 1/2" x 4.5 IN LATTICE FLOORS

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Title :
Dsgnr :
Description :

Job #
Date: 11:29AM, 7 MAR 11

120

Scope :

Rev: 580004
User: KW-0808353, Ver 5.8.0, 1-Nov-2006
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General Timber Beam

Page 2
misc.ecw Calculations

Description Lattice Wind

Query Values

M, V, & D @ Specified Locations		Moment	Shear	Deflection
@ Center Span Location =	0.00 ft	0.00 k-ft	0.05 k	0.0000 in
@ Right Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in
@ Left Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in

121

Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2005
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General Timber Beam

Description Lattice Self-Weight

General Information Code Ref: 1997/2001 NDS, 2000/2003 IBC, 2003 NFPA 5000. Base allowables are user defined

Section Name	2x6	Center Span	9.75 ft	Lu	9.75 ft
Beam Width	1.500 in	Left Cantilever	ft	Lu	0.00 ft
Beam Depth	4.500 in	Right Cantilever	ft	Lu	0.00 ft
Member Type	Manuf/So.Pine	Southern Pine, No.2 2-4	Thick, 5-6	W	
Load Dur. Factor	0.900	Fb Base Allow	1,250.0 psi		
Beam End Fixity	Pin-Pin	Fv Allow	175.0 psi		
		Fc Allow	565.0 psi		Repetitive Member
		E	1,600.0 ksi		

Full Length Uniform Loads

Center	DL	1.70 #/ft	LL	#/ft
Left Cantilever	DL	#/ft	LL	#/ft
Right Cantilever	DL	#/ft	LL	#/ft

Summary

Beam Design OK

Span= 9.75ft, Beam Width = 1.500in x Depth = 4.5in, Ends are Pin-Pin

Max Stress Ratio	0.039	: 1		
Maximum Moment Allowable	0.0 k-ft	0.5 k-ft	Maximum Shear * 1.5 Allowable	0.0 k 1.1 k
Max. Positive Moment	0.02 k-ft	at 4.875 ft	Shear:	@ Left 0.01 k @ Right 0.01 k
Max. Negative Moment	0.00 k-ft	at 9.750 ft	Camber:	@ Left 0.000 in @ Center 0.028 in @ Right 0.000 in
Max @ Left Support	0.00 k-ft		Reactions...	
Max @ Right Support	0.00 k-ft		Left DL	0.01 k Max 0.01 k
Max. M allow	0.52		Right DL	0.01 k Max 0.01 k
fb	47.88 psi	f _v	1.71 psi	
Fb	1,222.03 psi	Fv	157.50 psi	

Deflections

Center Span...	Dead Load	Total Load	Left Cantilever...	Dead Load	Total Load
Deflection	-0.019 in	-0.019 in	Deflection	0.000 in	0.000 in
...Location	4.875 ft	4.875 ft	...Length/Defl	0.0	0.0
...Length/Defl	6,169.0	6,169.00	Right Cantilever...		
Camber (using 1.5 * D.L. Defl) ...			Deflection	0.000 in	0.000 in
@ Center	0.028 in		...Length/Defl	0.0	0.0
@ Left	0.000 in				
@ Right	0.000 in				

Stress Calcs

Bending Analysis					
Ck	30.585	Le	17.933 ft	Sxx	5.063 in3
Cf	1.000	Rb	20.750	CI	0.945
				Area	6.750 in2
		Max Moment		Sxx Req'd	Allowable f_b
@ Center		0.02 k-ft		0.20 in3	1,222.03 psi
@ Left Support		0.00 k-ft		0.00 in3	1,293.75 psi
@ Right Support		0.00 k-ft		0.00 in3	1,293.75 psi
Shear Analysis		@ Left Support		@ Right Support	
Design Shear		0.01 k		0.01 k	
Area Required		0.073 in2		0.073 in2	
Fv Allowable		157.50 psi		157.50 psi	
Bearing @ Supports					
Max. Left Reaction		0.01 k	Bearing Length Req'd	0.010 in	
Max. Right Reaction		0.01 k	Bearing Length Req'd	0.010 in	

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Title :
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Description :

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Date: 11:29AM, 7 MAR 11

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Scope :

Rev: 580004
User: KW-0608353, Ver 5.8.0, 1-Nov-2006
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General Timber Beam

Page 2
misc.ecw.Calculations

Description Lattice Self-Weight

Query Values

M, V, & D @ Specified Locations		Moment	Shear	Deflection
@ Center Span Location =	0.00 ft	0.00 k-ft	0.01 k	0.0000 in
@ Right Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in
@ Left Cant. Location =	0.00 ft	0.00 k-ft	0.00 k	0.0000 in

Foundations

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (23)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOOTINGS

• Worst-Case FTS, DESIGN of EAST-WEST WALLS:

$$\text{LOAD TO EA. FTS} = 1635 \text{ lbs} / 2 \text{ FTS'S} = 820 \text{ lbs / FTS.}$$

GRAVITY LOADS:

$$\text{ROOF LOADS: T.A.} = \frac{1}{2}(16.00') \times \frac{1}{2}(15'-8") = 60 \text{ FT}^2$$

$$P_D = 60 \text{ FT}^2 \times 30 \text{ PSF} = 1800 \text{ lbs}$$

$$P_L = 60 \text{ FT}^2 \times 20 \text{ PSF} = 1200 \text{ lbs}$$

$$\text{WALL LOADS: } (20 \text{ PSF} \times 12.00' = 240 \text{ PSF})$$

$$\begin{aligned} \text{TOTAL SUPPORTED WALL LENGTH} &= \frac{1}{2}(16.00') + \frac{1}{2}(7.83') \\ &= 11.92' \end{aligned}$$

$$P_D = 11.92' \times 240 \text{ PSF} = 2860 \text{ lbs}$$

$$\text{FLOOR LOADS: T.A.} = 60 \text{ FT}^2$$

$$P_D = 20 \text{ PSF} \times 60 \text{ FT}^2 = 1200 \text{ lbs}$$

$$P_L = 50 \text{ PSF} \times 60 \text{ FT}^2 = 3000 \text{ lbs}$$

$$\text{DECK LOADS: T.A.} = 22.5 \text{ FT}^2$$

$$P_D = 10 \text{ PSF} \times 22.5 \text{ FT}^2 = 225 \text{ lbs}$$

$$P_L = 50 \text{ PSF} \times 22.5 \text{ FT}^2 = 1125 \text{ lbs}$$

..



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (124)

CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOOTING

• Worst-Case Ftg. Design e East-West Walls: (CONT'D)

Solar Rack Loads: $P_D = 160 \text{ lbs}$ (LATTICE + PANELS)
 $P_O = 300 \text{ lbs}$ (STL. FRAMING)

TOTAL LOADS TO FTG:

$$ED = 1800 \text{ lbs} + 2860 \text{ lbs} + 1200 \text{ lbs} + 225 \text{ lbs} + 460 \text{ lbs} = 6545 \text{ lbs}$$

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (125)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOOTINGS

MWFRS UPLIFT LOADS ON WORST-CASE FTS:

FROM ROOF: @ ZONE (E) = $-8.3 \text{ PSF} \times \frac{1}{2}(15.67') = -65 \text{ PLF}$

ZONE (E) = $-5.9 \text{ PSF} \times \frac{1}{2}(15.67') = -50 \text{ PLF}$

UPLIFT = $-65 \text{ PLF} \times 6.0 \text{ FT} = -390 \text{ LBS}$

= $-50 \text{ PLF} \times 18.67 \text{ FT} = -935 \text{ LBS}$

= -1325 LBS (FROM ROOF ONLY)

FROM SOLAR RACK:

UPLIFT @ LATTICE (AVE.) = -4.0 PSF

UPLIFT @ SOLAR PANELS = -7.1 PSF

NET UPLIFT = $-60 \text{ PLF} \times \frac{1}{2}(16.00') = -480 \text{ LBS}$

E UPLIFT = $-1325 \text{ LBS} - 480 \text{ LBS} = \underline{\underline{-1805 \text{ LBS}}}$

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (126)CALCULATED BY: T. WILDA DATE: 3/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOUNDATIONLATERAL WIND LOADS & FOUNDATIONS: (WORST CASE EAST-WEST ENDS)

$$1E + 4E = 27.8 \text{ PSF} \times 6.0 \text{ FT} \times 11.83' = 1975 \text{ lbs}$$

$$1 + 4 = 18.3 \text{ PSF} \times 19.0 \text{ FT} \times 11.83' = 4200 \text{ lbs}$$

$$\text{SOLAR RACK} = \underline{700 \text{ lbs}}$$

$$E = 6875 \text{ lbs}$$

$$\text{LOAD TO EA. FOUNDATION} = 6875 \text{ lbs} / 3 = 2295 \text{ lbs}$$

GRAVITY LOADS (C CENTER FOUNDATION)

$$P_D = 10.83' \times 20 \text{ PSF} = 220 \text{ PSF} \times \frac{1}{2} (15.58') = 1710 \text{ lbs}$$

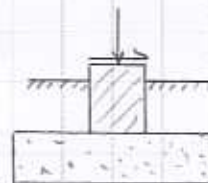
$$\text{OVERBURDEN} = 100 \text{ PSF} \times 1.33 = 130 \text{ PSF}$$

$$\text{CMU PIER} = 675 \text{ lbs}$$

$$\text{PSG WOOD BM.} = 80 \text{ lbs}$$

$$\text{LOADS FROM LATTICE FLOORING: } 1565 \text{ lbs}$$

$$E P_D = 4050 \text{ lbs} \quad e = 13 \text{ IN}$$



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 Title Block Line 6

Title :
 Dsgnr:
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 Project Notes :

Job #

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Printed: 7 MAR 2011, 3:11PM

General Footing

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec6
 ENERCALC, INC. 1983-2011, Ver: 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Worst-Case Foundation East-West End

DESIGN SUMMARY

Design N.G.

Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.3613	Soil Bearing	0.7226 ksf	2.0 ksf +D+W+H
PASS	15.236	Overturing - X-X	1.565 k-ft	23.844 k-ft D
PASS	4.665	Overturing - Z-Z	3.067 k-ft	14.307 k-ft 0.6D+W
FAIL	1.475	Sliding - X-X	2.30 k	3.393 k 0.6D+W
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k No Uplift
PASS	0.04920	Z Flexure (+X)	1.152 k-ft	23.426 k-ft +1.20D+0.50Lr+0.50L+1.60W
PASS	0.03025	Z Flexure (-X)	0.7086 k-ft	23.426 k-ft +1.40D
PASS	0.04064	X Flexure (+Z)	0.9520 k-ft	23.426 k-ft +1.40D
PASS	0.01986	X Flexure (-Z)	0.4652 k-ft	23.426 k-ft +1.40D
PASS	0.02491	1-way Shear (+X)	2.046 psi	82.158 psi +1.40D
PASS	0.02491	1-way Shear (-X)	2.046 psi	82.158 psi +1.40D
PASS	0.03449	1-way Shear (+Z)	2.833 psi	82.158 psi +1.40D
PASS	0.01532	1-way Shear (-Z)	1.259 psi	82.158 psi +1.40D
PASS	0.04777	2-way Punching	7.849 psi	164.32 psi +1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc	+Z	Actual Soil Bearing Stress +Z	-X	-X	Actual / Allowable Ratio
X-X, +D	2.0	n/a	1.772	0.4217	0.6250	n/a	n/a	0.313
X-X, +D+W+H	2.0	n/a	1.772	0.4217	0.6250	n/a	n/a	0.313
X-X, +D+0.750Lr+0.750L+0.750W+H	2.0	n/a	1.772	0.4217	0.6250	n/a	n/a	0.313
X-X, +D+0.750L+0.750S+0.750W+H	2.0	n/a	1.772	0.4217	0.6250	n/a	n/a	0.313
X-X, +0.60D+W+H	2.0	n/a	1.772	0.2530	0.3750	n/a	n/a	0.188
Z-Z, +D	2.0	0.0	n/a	n/a	n/a	0.5233	0.5233	0.262
Z-Z, +D+W+H	2.0	3.473	n/a	n/a	n/a	0.3241	0.7226	0.361
Z-Z, +D+0.750Lr+0.750L+0.750W+H	2.0	2.604	n/a	n/a	n/a	0.3739	0.6728	0.336
Z-Z, +D+0.750L+0.750S+0.750W+H	2.0	2.604	n/a	n/a	n/a	0.3739	0.6728	0.336
Z-Z, +0.60D+W+H	2.0	5.788	n/a	n/a	n/a	0.1148	0.5132	0.257

Overturing Stability

Rotation Axis & Load Combination...	Overturing Moment	Resisting Moment	Stability Ratio	Status
X-X, D	1.565 k-ft	23.844 k-ft	15.236	OK
X-X, 0.6D+W	0.9390 k-ft	14.307 k-ft	15.236	OK
Z-Z, D	None	0.0 k-ft	Infinity	OK
Z-Z, 0.6D+W	3.067 k-ft	14.307 k-ft	4.665	OK

Sliding Stability

All units k

Force Application Axis

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
X-X, D	0.0 k	4.452 k	No Sliding	OK
X-X, 0.6D+W	2.30 k	3.393 k	1.475	No Good!
Z-Z, D	0.0 k	4.452 k	No Sliding	OK
Z-Z, 0.6D+W	0.0 k	3.393 k	No Sliding	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	2.046 psi	2.046 psi	1.259 psi	2.833 psi	2.833 psi	82.158 psi	0.03449	OK
+1.20D+1.60Lr+0.80W	1.754 psi	1.754 psi	1.079 psi	2.429 psi	2.429 psi	82.158 psi	0.02956	OK
+1.20D+1.60S+0.80W	1.754 psi	1.754 psi	1.079 psi	2.429 psi	2.429 psi	82.158 psi	0.02956	OK
+1.20D+0.50Lr+0.50L+1.60W	1.754 psi	1.754 psi	1.079 psi	2.429 psi	2.429 psi	82.158 psi	0.02956	OK
+1.20D+0.50L+0.50S+1.60W	1.754 psi	1.754 psi	1.079 psi	2.429 psi	2.429 psi	82.158 psi	0.02956	OK
+0.90D+1.60W+1.60H	1.315 psi	1.315 psi	0.8094 psi	1.821 psi	1.821 psi	82.158 psi	0.02217	OK

Punching Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	7.849 psi	164.32psi	0.04777	OK
+1.20D+1.60Lr+0.80W	6.728 psi	164.32psi	0.04095	OK

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 Title Block Line 6

Title :
 Dsgnr:
 Project Desc.:
 Project Notes :

Job #

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Printed: 7 MAR 2011, 3:11PM

General Footing

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec5
 ENERCALC, INC. 1983-2011, Ver. 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Worst-Case Foundation East-West End

Punching Shear				All units k
Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.20D+1.60S+0.80W	6.728 psi	164.32psi	0.04095	OK
+1.20D+0.50Lr+0.50L+1.60W	6.728 psi	164.32psi	0.04095	OK
+1.20D+0.50L+0.50S+1.60W	6.728 psi	164.32psi	0.04095	OK
+0.90D+1.60W+1.60H	5.046 psi	164.32psi	0.03071	OK

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (130)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOUNDATIONFOUNDATIONS:WORST-CASE DECK FRAMING:

$$P_D = 560 \text{ lbs} \quad P_L = 2660 \text{ lbs}$$

$$q_e = 2000 \text{ PSF} - 195 \text{ PSF} - 135 \text{ PSF} = 1670 \text{ PSF}$$

$$\text{AREA} = \sqrt{\frac{2660 \text{ lbs} + 560 \text{ lbs}}{1670 \text{ PSF}}} = 1.4 \text{ FT SQ.}$$

USE 2'-0" x 2'-0" x 16" THK. CONC. FTS.

PORCH HSS. STL. BM:

$$P_D = 1.41^k \quad P_L = 1.41^k \quad P_W = -2.76^k$$

$$D+L = \sqrt{\frac{2.82^k}{1.67^k}} = 1.3 \text{ FT SQ.}$$

$$0.6D + W = -2.76^k + 0.60(1.41^k) = -1.91^k \times 1.5 = -2.9^k$$

• ASSUME 3'-6" x 3'-6" x 16" THK.

$$\text{FTS. WT.} = 3.5' \times 3.5' \times 1.33' \times 0.145 = 2.36^k$$

$$3.5' \times 3.5' \times 1.33' \times 0.100 = 1.62^k$$

..

$$4.00^k \geq -2.9^k$$

USE 3'-6" x 3'-6" x 16" THK.

Connections

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (131)CALCULATED BY: T. WILDA DATE: 3/4/11

CHECKED BY: _____ DATE: _____

SUBJECT: CONN.CONN. OF LATTICE FRAMING STR. POST TO PSC:

LOADS:

$$\text{LATTICE: } (1\frac{1}{2}'' \times 4\frac{1}{2}'') / 144\text{IN}^2 \times 35\text{pcf} \times 12/\text{SIN o.c} \times 13.00' = 55\text{ pcf}$$

$$\text{HSS } 3\frac{1}{2}'' \times 2'' = 6.22\text{ pcf} \times 3\text{ MEMBER} \times \frac{1}{2}(14.5') = 140\text{ lbs}$$

$$\text{HSS } 3'' \times 3'' \times \frac{1}{4}'' = 8.78\text{ pcf} \times 13.25' = 120\text{ lbs}$$

$$\text{HSS } 3\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{5}{16}'' = 12.65\text{ pcf} \times \frac{1}{2}(14.5') = 95\text{ lbs}$$

$$\text{LATTICE} = 55\text{ pcf} \times \frac{1}{2}(14.5') = 400\text{ lbs}$$

$$P_2 = 400\text{ lbs} + 140\text{ lbs} = 540\text{ lbs} \quad e = 6.5\text{IN}$$

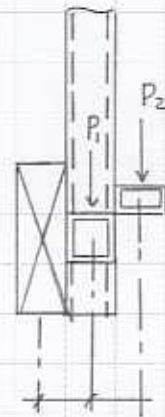
$$P_1 = 120\text{ lbs} + 95\text{ lbs} = 215\text{ lbs} \quad e = 3.25\text{IN}$$

$$EV = 540\text{ lbs} + 215\text{ lbs} = 755\text{ lbs} / 4\text{ BOLTS} = 190\text{ lbs}$$

$$EM = (540 \times 6.5\text{IN}) + (215\text{ lbs} \times 3.25\text{IN}) = 4210\text{ lb-in}$$

$$T/C = 4210\text{ lb-in} / 6\text{IN} = 705\text{ lbs T/C}$$

$$\text{BOLT DESIGN: SHEAR} = 380\text{ lbs} \quad \text{TENSION} = 705\text{ lbs}$$



..

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (132)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: CONN.

$$\text{BOLT DESIGN: } Z' = Z \times C_D \times C_M \times C_t \times C_p \times C_{\Delta} \times C_{eg} \times C_{di} \times C_{tn}$$

$$\text{EDGE DIST.} = 3.0 \text{ IN} \quad C_D = 0.90 \quad C_M = 0.70 \quad C_t = 1.0$$

$$A_M = 3\frac{1}{2}'' \times 11\frac{7}{8}'' = 41.5 \text{ IN}^2$$

$$A_M / A_s = 41.5 \text{ IN}^2 / 0.75 \text{ IN}^2 = 55$$

$$A_s = 0.25 \text{ IN} \times 3 \text{ IN} = 0.75 \text{ IN}^2$$

$$\therefore C_p = 0.99$$

$$\text{LOADED EDGE DISTANCE} = 3.0 \text{ IN} = 4D \therefore C_{\Delta} = 1.0$$

$$C_{eg} = \text{N/A} \quad C_{di} = \text{N/A} \quad C_{tn} = \text{N/A} \quad Z = 760 \text{ lbs}$$

$$Z' = 760 \text{ lbs} \times 0.90 \times 0.70 \times 0.99$$

$$Z' = 470 \text{ lbs / BOLT} \geq 380 \text{ lbs} \quad \text{BOLTS GOOD IN SHEAR.}$$



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JOB SOLAR DECATHLON 10HA042
 SHEET # _____ OF (133)
 CALCULATED BY: T. WILDA DATE: 3/4/11
 CHECKED BY: _____ DATE: _____
 SUBJECT: CONNECTIONS

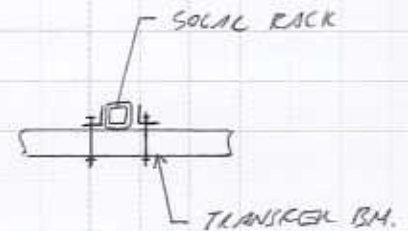
CONN. OF SOLAR RACK TO TRANSFER BM:

$$P_D = 0.51^k$$

$$P_U = -1.72^k \quad P_{LOT.} = -0.43^k$$

$$0.6D + 1.0W = 0.6(0.51) - 1.72^k = -1.41$$

• TRY (2) $(3\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{3}{16}'' \times 4''$ CG. w/ (2) $\frac{5}{8}'' \phi$ ASTM A325N BOLT



• BENDING IN ANGLE = $-1.41^k / 2$ ANGLES = 0.705^k

$$M_{MAX} = 0.705^k \times 2.5IN = 1.76 \text{ k-in}$$

$$M_n = F_y \cdot Z$$

$$Z_x = (4IN)(0.375IN)^2 / 4 = 0.141 \text{ IN}^3$$

$$F_y = 36 \text{ ksi}$$

$$\Omega = 1.67$$

$$M_n = \frac{36 \text{ ksi} (0.141 \text{ IN}^3)}{1.67} = 3.03 \text{ k-in} \geq 1.76 \text{ k-in}$$

$$1.6 M_y = F_y \cdot S_x \cdot 1.6$$

$$S_y = (4IN)(0.375)^2 / 6 = 0.094 \text{ IN}^3$$

$$1.6 M_y = \frac{36 \text{ ksi} \times 0.094 \text{ IN}^3 \times 1.6}{1.67} = 3.24 \text{ k-in} \geq 1.76 \text{ k-in}$$

USE (2) $(3\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{3}{16}''$ ANGLES



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JOB SOLAR DECATHLON 10HA0412

SHEET # _____ OF (134)

CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: CONNECTIONS

CONN. OF SOLAR RACK TO TRANSFER BEAM: CONT'D

$$F_v = -0.43^k \quad f_t = -1.41^k$$

$$F_{ut} = 90\text{ksi} \times 0.306\text{in}^2 = 27.5^k \geq 1.41^k / 2 = 0.705^k$$

$$F_{uv} = 48\text{ksi} \times 0.306\text{in}^2 = 14.7^k \geq 0.43^k / 2 = 0.215^k$$

(SINCE ACT \leq 20% ALLOW. COMB. T & V
NEED NOT BE INVESTIGATED)

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (135)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: CONNECTIONSCONN. OF SOLAR PANEL RACK TO HSS COL.

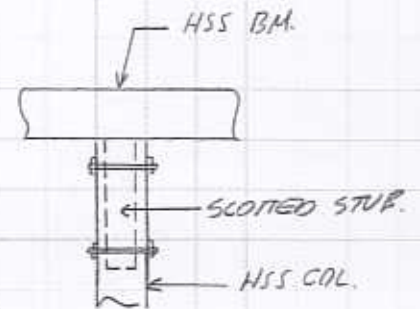
$$P_D = 0.51^k \times 2 \text{ FRAMES} = 1.02^k$$

$$P_U = -1.72^k \times 2 \text{ FRAMES} = -3.44^k$$

$$0.6D + 1.0W = 0.60(1.02^k) - 3.44^k = -2.83^k$$

$$\text{SHEAR / BOLT} = -2.83^k / 2 = -1.42^k$$

USE (2) $\frac{3}{4}$ " ϕ ASTM A325N BOLTS ($F_V = 21.2^k \geq -1.42^k$)



• WELD OF SCOTTED STUB TO BM:

$$P_D = 1.02^k$$

$$P_U = -3.44^k \quad \text{PLAT.} = 0.86^k$$

$$0.6D + 1.0W = 0.60(1.02^k) - 3.44^k = -2.1^k$$

USE $\frac{3}{16}$ " FILLET ALL AROUND - ALLOW. TEN. + SHEAR

$$= 2.76^k/\text{in} \times 3.5\text{IN} \times 4\text{IN} = 38.6^k$$

$$\text{SINCE } 38.6^k \geq (2.1^k + 0.86^k)$$

$\frac{3}{16}$ " FILLET ALL AROUND
IS GOOD.



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (136)

CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: CONNECTIONS

CONN. OF PSL TO PSL @ SHEARWALL ©:

$$GRAVITY = 10.25' \times 20 \text{ PSF} = 205 \text{ PLF} \times \frac{1}{2} (14.83') = 1520 \text{ lbs}$$

$$WIND = 2125 \text{ lbs (TIC FROM S.W. ©)}$$

$$E = 3645 \text{ lbs}$$

$$C_D = 1.6$$

$$C_t = 1.0 \quad C_D = 1.0$$

$$A_{SM} = 41.5 \text{ IN} \quad A_{SS} = 4.0 \text{ IN} \times 0.25 \text{ IN} \times 2 = 2.0 \text{ IN}$$

$$A_M/A_S = 20.75 \quad \mu = 2.0 \quad \therefore C_g = 1.0$$

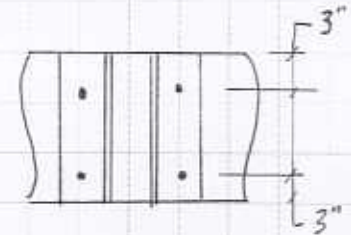
$$Z_L = 680 \text{ lbs}$$

$$Z' = 680 \text{ lbs} \times 1.6 \times 4 \text{ BOLTS} = 4352 \text{ lbs} > 3645 \text{ lbs}$$

(4) BOLTS
SINGLE SHEAR

$$Z' = 1550 \text{ lbs} \times 1.6 \times 2 \text{ BOLTS} = 4960 \text{ lbs} \geq 3645 \text{ lbs}$$

(2) BOLTS
DOUBLE SHEAR



Miscellaneous



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (138)

CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: ROOF TRUSS UPLIFT

Worst Case Roof Truss Uplift

TRUSS AREA = $16' \times 8' = 85 \text{ ft}^2$

$$\text{ZONE ②} : -42.2 + 5.0 = -37.2 \text{ psf} \times 2 \text{ RT} = -75 \text{ psf}$$

$$\text{ZONE ③} : 0 \text{ psf} \times 13' - 11' = -50.7 + 5.0 = -45.7 \text{ psf} \times 2 \text{ RT} = 91.4 \text{ psf}$$

$$R_A = R_B = -650 \text{ lbs} \quad \text{USE HTSIC}$$

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JOB SOLAR DECATHLON 10'HA042SHEET # _____ OF (39)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: STR. COL & LATTICE

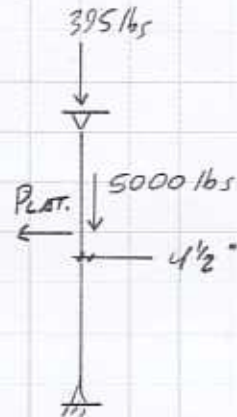
Worst Case Str. Col. Supporting Solar Rack:

$$P_D = 395 \text{ lbs (SOLAR RACK)}$$

$$P_D = 5000 \text{ lbs (HSS } 10 \times 3) \quad e = 4.5 \text{ IN} \quad v = 8.42'$$

$$P_L = 2930 \text{ lbs (HSS } 10 \times 3) \quad e = 4.5 \text{ IN} \quad v = 8.42'$$

$$P_{LAT} = 3115 \text{ lbs} \quad v = 8.42'$$

USE HSS 4x4x3/16"

• ATTACHMENT OF STR. COL. TO DOUBLE 2x6 TOP PLATE:

$$P_{LAT} = 3115 \text{ lbs} \left(\frac{8.42'}{10.83'} \right) = 2420 \text{ lbs}$$

• ASSUME (4) 1/2" Ø ASTM A325N THROUGH BOLTS
W/ 1/4" STR. PLATE

$$C_D = 1.6 \quad C_M = 1.0 \quad C_E = 1.0 \quad C_D = \frac{2.75 \text{ IN}}{3.0 \text{ IN}} = 0.91$$

$$Z_L = 510 \text{ lbs} \times 1.6 \times 1.00 = 820 \text{ lbs} \times 4 = 3280 \text{ lbs}$$

USE (4) 1/2" Ø ASTM A325N THROUGH BOLTS.

Title Block Line 1
 You can changes this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Title :
 Dsgnr:
 Project Desc.:
 Project Notes :

Job #

140

Printed: 7 MAR 2011, 3:46PM

Steel Column

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec5
 ENERCALC, INC. 1983-2011, Ver. 6.0.26, N:86736

Lic. #: KW-06008353

Licensee :

Description : Worst-Case Stl. Col. Supporting Solar Rack

General Information Calculations per AISC 360-05, IBC 2006, CBC 2007, ASCE 7-05

Steel Section Name :	HSS4X4X3/16	Overall Column Height	10.830 ft
Analysis Method :	2006 IBC & ASCE 7-05	Top & Bottom Fixity	Top & Bottom Pinned
Steel Stress Grade		Brace condition for deflection (buckling) along columns :	
Fy : Steel Yield	46.0 ksi	X-X (width) axis :	Fully braced against buckling along X-X Axis
E : Elastic Bending Modulus	29,000.0 ksi	Y-Y (depth) axis :	Fully braced against buckling along Y-Y Axis
Load Combination :	Allowable Stress		

Applied Loads Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 101.84 lbs * Dead Load Factor
 AXIAL LOADS . . .
 Axial Load at 10.830 ft, Xecc = 4.500in, D = 5.40, LR = 2.950, W = -5.40 k
 BENDING LOADS . . .
 Lat. Point Load at 8.420 ft creating Mx-x, W = 3.120 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.7803 : 1	Maximum SERVICE Load Reactions . .	
Load Combination	+0.60D+W+H	Top along X-X	0.2891 k
Location of max. above base	8.431 ft	Bottom along X-X	0.2891 k
At maximum location values are . . .		Top along Y-Y	2.426 k
Pu : Axial	-2.099 k	Bottom along Y-Y	0.6943 k
Pn / Omega : Allowable	71.066 k	Maximum SERVICE Load Deflections . . .	
Mu-x : Applied	-5.818 k-ft	Along Y-Y	-0.5075 in at 6.106 ft above base
Mn-x / Omega : Allowable	8.424 k-ft	for load combination : W Only	
Mu-y : Applied	-0.6306 k-ft	Along X-X	0.2280 in at 6.324 ft above base
Mn-y / Omega : Allowable	8.424 k-ft	for load combination : D+Lr	
PASS Maximum Shear Stress Ratio =	0.1141 : 1		
Load Combination	+D+W+H		
Location of max. above base	8.431 ft		
At maximum location values are . . .			
Vu : Applied	2.426 k		
Vn / Omega : Allowable	21.253 k		

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
	Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D	0.278	PASS	10.83 ft	0.009	PASS	0.00 ft
+D+Lr+H	0.430	PASS	10.83 ft	0.014	PASS	0.00 ft
+D+0.750Lr+0.750L+H	0.392	PASS	10.83 ft	0.012	PASS	0.00 ft
+D+W+H	0.691	PASS	8.43 ft	0.114	PASS	8.43 ft
+D+0.750Lr+0.750L+0.750W+H	0.667	PASS	8.43 ft	0.086	PASS	8.43 ft
+D+0.750L+0.750S+0.750W+H	0.575	PASS	8.43 ft	0.086	PASS	8.43 ft
+D+0.750Lr+0.750L+0.5250E+H	0.392	PASS	10.83 ft	0.012	PASS	0.00 ft
+0.60D+W+H	0.780	PASS	8.43 ft	0.114	PASS	8.43 ft

Maximum Reactions - Unfactored

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		Y-Y Axis Reaction		Axial Reaction @ Base
	@ Base	@ Top	@ Base	@ Top	
D Only	-0.187	-0.187 k			5.502 k
Lr Only	-0.102	-0.102 k			2.950 k
W Only	0.187	0.187 k	0.694	-2.426 k	5.400 k
D+Lr	-0.289	-0.289 k			8.452 k
D+W			0.694	-2.426 k	0.102 k
D+Lr+W	-0.102	-0.102 k	0.694	-2.426 k	3.052 k

Title Block Line 1
 You can change this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Title :
 Dsgnr:
 Project Desc.:
 Project Notes :

Job #

141

Printed: 7 MAR 2011, 3:49PM

Steel Column

File: Z:\2010 Jobs\10HA042 (2011 Solar Decathlon)\Calcs\Enercalc\misc.ec6
 ENERCALC, INC. 1983-2011, Ver. 6.0.26, N:86735

Lic. #: KW-06008353

Licensee :

Description : Worst-Case Stl. Col. Supporting Solar Rack

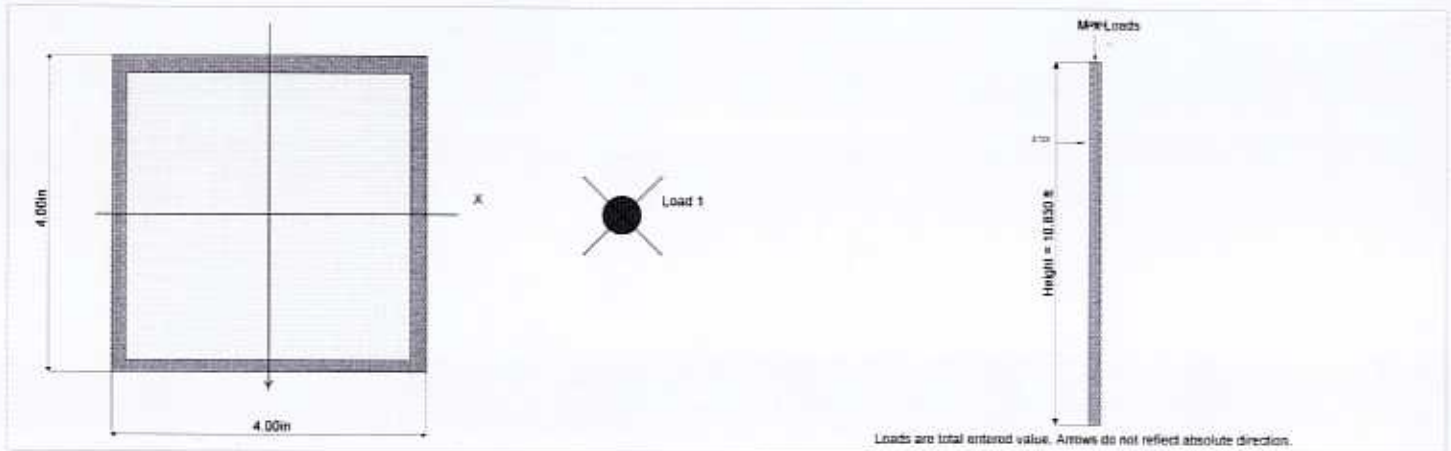
Maximum Deflections for Load Combinations - Unfactored Loads

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.1475 in	6.324 ft	0.000 in	0.000 ft
Lr Only	0.0806 in	6.324 ft	0.000 in	0.000 ft
W Only	-0.1475 in	6.324 ft	-0.508 in	6.106 ft
D+Lr	0.2280 in	6.324 ft	0.000 in	0.000 ft
D+W	0.0000 in	0.000 ft	-0.508 in	6.106 ft
D+Lr+W	0.0806 in	6.324 ft	-0.508 in	6.106 ft

Steel Section Properties : HSS4X4X3/16

Depth	=	4.000 in	I xx	=	6.21 in ⁴	J	=	10.000 in ⁴
Web Thick	=	0.000 in	S xx	=	3.10 in ³			
Flange Width	=	4.000 in	R xx	=	1.550 in			
Flange Thick	=	0.187 in						
Area	=	2.580 in ²	I yy	=	6.210 in ⁴			
Weight	=	9.403 plf	S yy	=	3.100 in ³			
			R yy	=	1.550 in			

Ycg = 0.000 in



Lateral Analysis

Florida



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JOB SOLAR DECATHLON 10HA042
 SHEET # _____ OF (142)
 CALCULATED BY: T. WILDA DATE: 3/7/11
 CHECKED BY: _____ DATE: _____
 SUBJECT: LOS. ANALYSIS (FLORIDA)

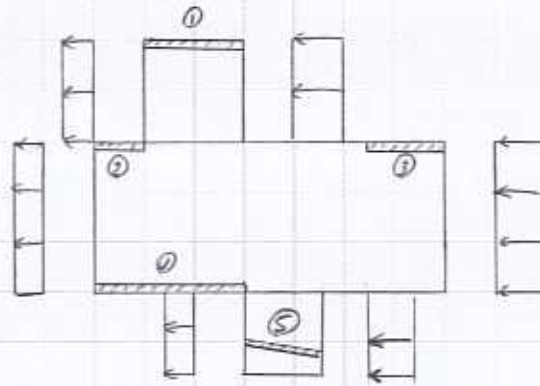
MAIN WIND FORCE RESISTING SYSTEM:

$$g = 0.00256(120)^2(0.85)(0.85)(1.00) = 26.6 \text{ PSF}$$

$$'a' = 3.0 \text{ FT}$$

WIND LOADS BY ZONES:

ZONE	GCpf	WIND PRESS.
1E	0.61	16.2 PSF
4E	-0.43	-11.5 PSF



COTEADL ANALYSIS (LEFT & RIGHT):

$$\text{WALL HT.} = 11'-8" (+1-)$$

$$\text{WALL HT. @ POP-OUTS} = 8'-10" (+1-)$$

LOAD TO ROOF DIAPHRAGM:
 MAIN BLDS.

$$1E: \frac{1}{2}(11.67') \times 16.2 \text{ PSF} = 95 \text{ PCF}$$

$$4E: \frac{1}{2}(11.67') \times -11.5 \text{ PSF} = -70 \text{ PCF}$$

$$E = 165 \text{ PCF}$$

LOAD TO ROOF DIAPHRAGM
 POP-OUTS

$$1E: \frac{1}{2}(8.83') \times 16.2 \text{ PSF} = 75 \text{ PCF}$$

$$4E: \frac{1}{2}(8.83') \times -11.5 \text{ PSF} = -55 \text{ PCF}$$

$$E = 130 \text{ PCF}$$



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (143)

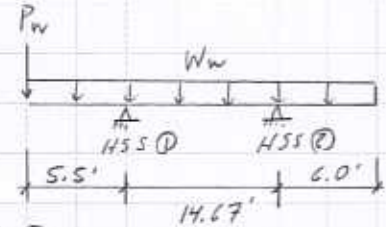
CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: LATERAL ANALYSIS (FLORIDA)

ADDITIONAL LATERAL FROM SOLAR ROCK:

- ASSUME 6" TOTAL DEPTH OF SYSTEM:



$$Ww = (20.2 \text{ PSF} - (-14.2 \text{ PSF})) \times 0.5 \text{ FT}$$

- 20 PLF

$$Pw = 20 \text{ PLF} \times 3.33 \text{ FT} = 70 \text{ lbs}$$

REACTIONS: HSS ① = 375 lbs
HSS ② = 295 lbs

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (144)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: LAT. ANALYSIS (FLORIDA)

LATERAL LOADS TO SHEARWALLS:

$$\textcircled{1} \quad T.W. = \frac{1}{2}(9.17') \times 130 \text{ PCF} = 600 \text{ lbs} \leftarrow$$

$$\textcircled{2} \text{ ; } \textcircled{3} \quad T.W. = \frac{1}{2}(9.17') \times 130 \text{ PCF} = 600 \text{ lbs}$$

$$T.W. = \frac{1}{2}(15.83') \times 165 \text{ PCF} = 1305 \text{ lbs}$$

↓ SOLAR RACK
 $E = 1905 \text{ lbs} + 295 \text{ lbs} = 2200 \text{ lbs}$

$$\textcircled{4} \quad T.W. = \frac{1}{2}(15.83') \times 165 \text{ PCF} = 1305 \text{ lbs}$$

$$T.W. = \frac{1}{2}(8.67') \times 130 \text{ PCF} = 565 \text{ lbs}$$

↓ SOLAR RACK
 $E = 1870 \text{ lbs} + 375 \text{ lbs} = 2245 \text{ lbs}$

$$\textcircled{5} \quad T.W. = \frac{1}{2}(8.67') \times 130 \text{ PCF} = 565 \text{ lbs} \leftarrow$$

FOR ANALYSIS @ S.W. 1, S.W. 5, SEE POP-OUT
FRAMING DESIGN



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JOB SOLAR DECATHLON 10HA042
 SHEET # _____ OF (45)
 CALCULATED BY: T. WILDA DATE: 3/7/11
 CHECKED BY: _____ DATE: _____
 SUBJECT: WOOD SHEARWALLS

WOOD STUD SHEARWALL DESIGN:

WOOD SHEARWALL @; HT. = 11.67', L = 4.00 FT

$$P_{WIND} = 2200 \text{ lbs} \left(\frac{4.00'}{6.67} \right) = 1320 \text{ lbs}$$

$$M_o = 1320 \text{ lbs} \times 11.67' = 15,405 \text{ ft-lbs}$$

$$\text{ROOF DEAD} = \frac{1}{2}(15.00') \times 30 \text{ PSF} = 225 \text{ PLF}$$

$$\text{WALL WT.} = 20 \text{ PSF} \times 11.67 \text{ FT} = \underline{230 \text{ PLF}}$$

$$E = 455 \text{ PLF}$$

$$M_{RES.} = 455 \text{ PLF} \times 4.00' \times 2.00' = 3640 \text{ ft-lbs}$$

$$M_{net.} = 15,405 \text{ ft-lbs} - 3640(0.60) = 13,220 \text{ ft-lbs}$$

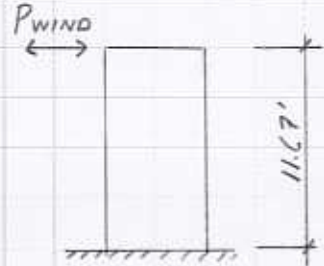
$$T/C = 13,220 \text{ ft-lbs} / 4.00' = 3305 \text{ lbs}$$

USE (3) CS16 SIMPSON
 COIL STRAP, ONE EA
 STUD. (TA = 1705 lbs/STRAP)

PLYWOOD ATTACHMENT (SHEARWALL)

$$F_v = 1320 \text{ lbs} / 4.00' = 330 \text{ PLF}$$

* USE 1/2" PLYWOOD W/ Bd COMMON @ 4IN O.C.
 (F_v = 380 PLF ≥ 250 PLF)



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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (146)CALCULATED BY: T. WILDA DATE: 3/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: WOOD SHEARWALLS

WOOD SHEARWALL ③; HT. = 11.67', L = 4.83'

$$P_{WIND} = \left(\frac{2.67}{6.67} \right) 2200 \text{ lbs} = 880 \text{ lbs}$$

$$M_o = 880 \text{ lbs} \times 11.67' = 10,270 \text{ ft-lbs}$$

$$M_n = 455 \text{ PLF} \times 2.67' \times 1.34 = 1630 \text{ ft-lbs}$$

$$M_{net} = 10,270 \text{ ft-lbs} - 0.60 (1630 \text{ ft-lbs}) = 9292 \text{ ft-lbs}$$

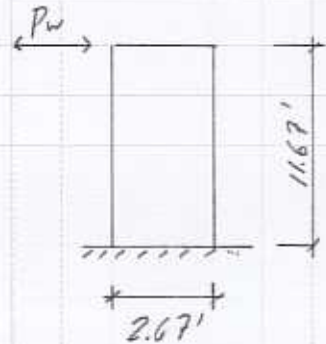
$$T_{lc} = 9292 \text{ ft-lbs} / 2.67' = 3480 \text{ lbs}$$

USE (3) CS16 SIMPSON
COIL STRAPS, ONE ED.
STUD (T_A = 1705 lbs/STRAP)

PLYWOOD SHEATHING:

$$F_v = 880 \text{ lbs} / 2.67' = 330 \text{ PLF}$$

* USE 1/2" PLYWOOD W/ 8d COMMON @ 4in o.c.
(F_v = 380 PLF = 330 PLF)

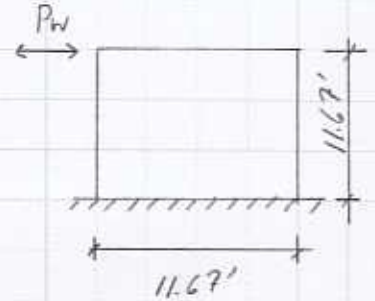


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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (147)CALCULATED BY: T. WILDA DATE: 03/2/11

CHECKED BY: _____ DATE: _____

SUBJECT: WOOD SHEAR WALLSWOOD SHEARWALL \odot ; HT. = 11.67' L = 16.67'

$$P_w = 2245 \text{ lbs}$$

$$M_o = 2245 \text{ lbs} \times 11.67' = 26,200 \text{ ft-lbs}$$

$$M_{res.} = 455 \text{ PCF} \times 11.67' \times \frac{1}{2}(11.67') = 30,980 \text{ ft-lbs}$$

$$M_{net} = 26,200 \text{ ft-lbs} - 0.60(30,980) = 7615 \text{ ft-lb}$$

$$T/C = 7615 \text{ ft-lbs} / 11.67'$$

$$= 655 \text{ lbs}$$

(3) CS16 SIMPSON COIL STRAPS
 ONE EA. STUD. (TA = 1705 lbs
 PER STRAP)

PLYWOOD ATTACHMENT:

$$f_v = 2245 \text{ lbs} / 11.67' = 195 \text{ PCF}$$

* USE $\frac{1}{2}$ " PLYWOOD w/ 8d COMMON
 @ 4" O.C. MAX (FV = 380 PCF \geq 195 PCF)

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (148)CALCULATED BY: T. WILDA DATE: 3/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: WOOD SHEARWALLS

ATTACHMENT OF WOOD SHEARWALL BASE TO WOOD BM.

$f_v = 330 \text{ PLF (WORST-CASE)}$

• ASSUME 16d @ 4" O.C. MAX.

$C_D = 1.6$ $C_M = 1.0$ $C_E = 1.0$

$Z' = 113 \text{ lbs} \times 1.6 = 180 \text{ lbs} \times 3 \text{ NAILS/FT} = 540 \text{ PLF} \geq 330 \text{ PLF}$

ATTACH BOIT. PLATE TO WOOD BM W/
16d COMMON @ 4" O.C. MAX.



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JOB SOLAR DECATHLON LOHA042

SHEET # _____ OF (149)

CALCULATED BY: T. WILDA DATE: 03/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: LATERAL ANALYSIS

LATERAL WIND LOADS & FOUNDATIONS:

FOR WALLS ① ; ⑤, SEE POP-OUT FLAMING!

WALLS ② ; ③

$$\text{FROM POP-OUT} = 130 \text{ plf} \times 2 \times \frac{1}{2}(9.17') = 1195 \text{ lbs}$$

$$\text{FROM MAIN STRUCT.} = 165 \text{ plf} \times 2 \times \frac{1}{2}(15.83') = 2615 \text{ lbs}$$

$$\text{FROM SOLAR RACK} = \underline{295 \text{ lbs}}$$

$$E = 4105 \text{ lbs}$$

WALL ④

$$\text{FROM POP-OUT} = 130 \text{ plf} \times 2 \times \frac{1}{2}(8.67') = 1130 \text{ lbs}$$

$$\text{FROM MAIN STRUCT.} = 165 \text{ plf} \times 2 \times \frac{1}{2}(15.83') = 2615 \text{ lbs}$$

$$\text{FROM SOLAR RACK} = \underline{375 \text{ lbs}}$$

$$E = 4120 \text{ lbs}$$



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (150)

CALCULATED BY: T. WILDA DATE: 03/2/11

CHECKED BY: _____ DATE: _____

SUBJECT: LATERAL ANALYSIS

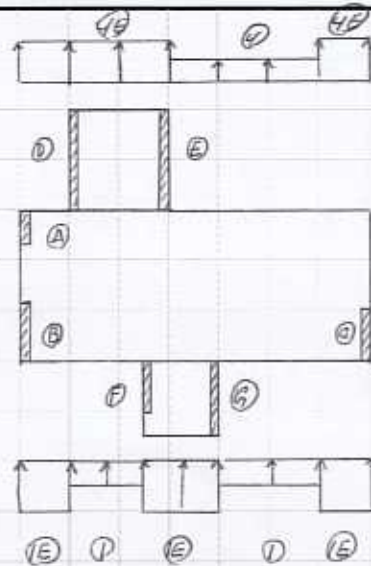
MAIN WIND FORCE RESISTING SYSTEM:

$$IE: 16.3 \text{ PSF}$$

$$I: 10.6 \text{ PSF}$$

$$4E: -11.5 \text{ PSF}$$

$$4: -7.7 \text{ PSF}$$

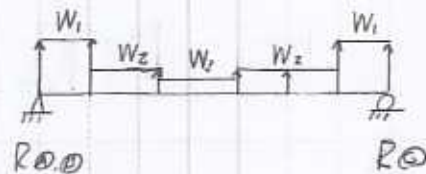


WIND LOADS TO WALLS A, B, C: (WINDWARD)

$$W_1 = \frac{1}{2}(11.67') \times 16.3 \text{ PSF} = 95 \text{ PLF}$$

$$W_2 = \frac{1}{2}(11.67') \times 10.6 \text{ PSF} = 62 \text{ PLF}$$

$$W_3 = (2.17') \times 10.6 \text{ PSF} = 23 \text{ PLF}$$



(WINDWARD ONLY)

$$R_{@, \text{⊙}} = 1555 \text{ lbs} \quad R_{\text{⊙}} = 1600 \text{ lbs} \quad (\text{WINDWARD ONLY})$$

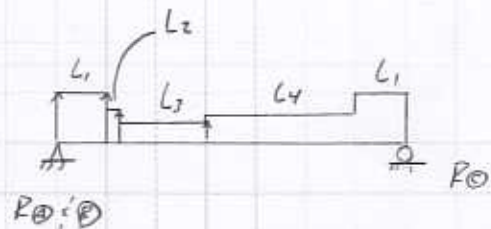
WIND LOADS TO WALLS A, B, C: (LEEWARD)

$$L_1 = \frac{1}{2}(11.67') \times -11.5 \text{ PSF} = -70 \text{ PLF}$$

$$L_2 = 2.83' \times -11.5 \text{ PSF} = -35 \text{ PLF}$$

$$L_3 = 2.83 \times -7.7 \text{ PSF} = -25 \text{ PLF}$$

$$L_4 = \frac{1}{2}(11.67') \times -7.7 = -45 \text{ PLF}$$



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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (151)CALCULATED BY: T. WILDA DATE: 03/2/11

CHECKED BY: _____ DATE: _____

SUBJECT: LAT. ANALYSIS / WOOD SHEARWALLS

$$R_{D, \textcircled{A}} = 1100 \text{ lbs} \quad R_{\textcircled{B}} = 1215 \text{ lbs} \quad (\text{LEE WIND ONLY})$$

MAIN WIND FORCE WIND LOADS FROM SOLAR RACK:

$$SW_{\textcircled{A}} \text{ \& \# } \textcircled{B} = SW_{\textcircled{C}} = 1400 \text{ lbs EA. END.}$$

$$E SW_{\textcircled{A}} \text{ \& \# } \textcircled{B} = 4055 \text{ lbs} \quad E SW_{\textcircled{C}} = 4215 \text{ lbs}$$

WOOD SHEARWALL \textcircled{A} \& \# \textcircled{B} :

$$P_{\text{LAT}} = 4055 \text{ lbs}$$

$$W_D = 10.83' \times 20 \text{ PSF} = 220 \text{ PLF}$$

$$M_D = 4055 \text{ lbs} \times 10.83' = 43915 \text{ ft-lbs}$$

$$M_K = 220 \text{ PLF} \times 10.17' \times \frac{1}{2}(10.17') = 11,370 \text{ ft-lbs}$$

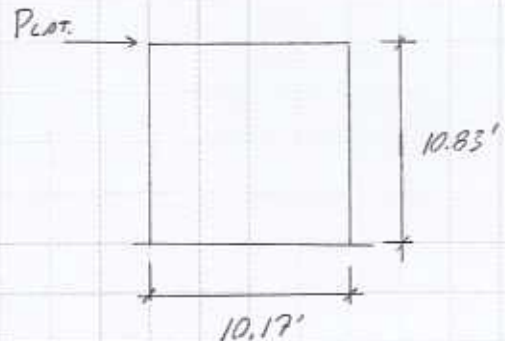
$$M_{\text{net}} = 43915 \text{ ft-lbs} - 0.60(11,370 \text{ ft-lbs}) = 37095 \text{ ft-lbs}$$

$$TIC = 37095 \text{ ft-lbs} / 10.17' = 3650 \text{ lbs}$$

(USE (3) CS16 COIL
 STRAPS, ONE PER STUD
 $F_E = 1705 \text{ lbs (STRAP)}$)

PLYWOOD ATTACHMENT: $F_V = 4055 \text{ lbs} / 10.17' = 400 \text{ PLF}$

.. USE B_d @ 4" o.c. $F_V = 430 \text{ PLF} \geq 400 \text{ PLF}$





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JOB SOLAR DELATHLON 10HA042

SHEET # _____ OF (152)

CALCULATED BY: T. WILDA DATE: 03/9/11

CHECKED BY: _____ DATE: _____

SUBJECT: WOOD SHEARWALLS

WOOD SHEARWALL @:

$$PLAT. = 4215 \text{ lbs}$$

$$WD = 20 \text{ PSF} \times 10.83' = 220 \text{ PLF}$$

$$M_o = 4215 \text{ lbs} \times 10.83' = 45650 \text{ ft-lbs}$$

$$M_L = 220 \text{ PLF} \times 14.75' \times \frac{1}{2}(14.75') = 23,900 \text{ ft-lbs}$$

$$M_{net} = 45650 \text{ ft-lbs} - 0.60(23,900) = 31,310 \text{ ft-lbs}$$

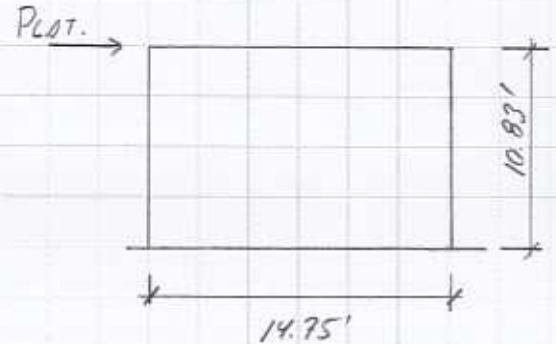
$$T/C = 31,310 \text{ ft-lbs} / 14.75' = 2125 \text{ lbs}$$

USE (3) CSIC COIL STRAPS
(ONE PER EA. END STUD)
FL = 1705 lbs / STRAP

$$\text{SHEATHING ATTACHMENT: } F_v = 4215 \text{ lbs} / 14.75' = 285 \text{ PLF}$$

USE 8d COMMON @ 4in o.c. (BLOCKED @ ALL EDGES)

$$F_v = 450 \text{ PLF} \geq 285 \text{ PLF}$$



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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (153)CALCULATED BY: T. WILDA DATE: 03/7/11

CHECKED BY: _____ DATE: _____

SUBJECT: WOOD SHEAR WALLS

SHEARWALL BOTT PLATE ATTACHMENT:

FV = 400 PLF

• ASSUME 16d COMMON @ 4 IN O.C. MAX.

 $C_D = 1.6$ $C_M = 1.0$ $C_L = 1.0$

$$Z' = 113 \text{ lbs} \times 1.6 = 180 \text{ lbs} \times 3 \text{ NAILS / FT} = 540 \text{ lbs / FT} > 400 \text{ PLF}$$

USE 16d COMMON @ 4 IN O.C. MAX.

Lateral Analysis
Washington D.C.



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JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (55)

CALCULATED BY: T. WILDA DATE: 03/8/11

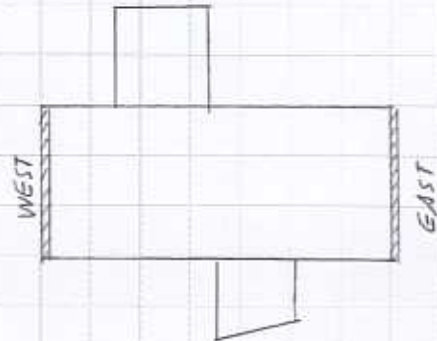
CHECKED BY: _____ DATE: _____

SUBJECT: LAT ANALYSIS (D.C.)

MAIN WIND FORCE (60 mph)

$$q = 0.00256 (60 \text{ mph})^2 (0.85)(0.85)(1.00)$$

$$q = 6.65 \text{ PSF} \quad a = 3.0 \text{ FT}$$



ZONE ①: 0.40 ; P = 2.7 PSF

②: 0.61 ; P = 4.1 PSF

③: -0.29 P = -2.0 PSF

④: -0.45 P = -2.9 PSF

ZONE ②: -0.69 ; P = -5.8 PSF

②: -1.07 ; P = -8.3 PSF

MAIN STRUCTURE, WIND ON CONV. FACE:

$$\text{②} \text{ \& \#39; } \text{④} = 11.83' \times (4.1 \text{ PSF} + 2.9 \text{ PSF}) = 85 \text{ PLF}$$

$$\text{①} \text{ \& \#39; } \text{③} = 11.83' \times (2.7 \text{ PSF} + 2.0 \text{ PSF}) = 60 \text{ PLF}$$

ROOF UPLIFT: (MWFRS)

$$\text{②} = (-1.07 - 0.18) 6.65 \text{ PSF} = -8.3 \text{ PSF}$$

SOLAR PANEL UPLIFT (MWFRS):

$$\text{②} = (-1.07) 6.65 \text{ PSF} = -7.1 \text{ PSF}$$

JOB SOLAR DECATHLON LOHA042

SHEET # _____ OF (56)

CALCULATED BY: T. WILDA DATE: 03/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: LAT. ANALYSIS (DC)

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FOUNDATIONS @ 60 mph:

TOTAL WIND LOAD ON LONG FACE: (LATERAL)

$$0 \rightarrow 6 \text{ FT} = 85 \text{ PLF} \times 6.0 \text{ FT} = 510 \text{ lbs}$$

$$6 \text{ FT} \rightarrow 50 \text{ FT} = 60 \text{ PLF} \times 44.0 \text{ FT} = 2640 \text{ lbs}$$

$$\ast 3150 \text{ lbs}$$

• ADDITIONAL LATERAL FROM SOLAR FRAME (LATTICE)

$$q = 6.65 \text{ PSF} \quad G = 0.85 \quad \text{GROSS AREA} = 1.0 \text{ FT}^2$$

$$\text{SOLID AREA} = 0.375 \text{ FT}^2$$

$$E = 0.375 \therefore Cf = 1.6 \Rightarrow P = 6.65 \text{ PSF} (0.85) (1.6)$$

$$= 9.0 \text{ PSF}$$

$$\text{AVE. LOAD TO LATTICE} = 9.04 \text{ PSF} / 3 = 3.0 \text{ PSF}$$

$$P_{\text{LAT.}} = 3.0 \text{ PSF} \times 52.0 \text{ FT} \times 3.75 \text{ FT} = 585 \text{ lbs} \ast$$

$$E_{\text{LATERAL}} = 3150 \text{ lbs} + 585 \text{ lbs} = 3735 \text{ lbs}$$

$$\text{LOAD PER FT} = 3735 \text{ lbs} / 14 \text{ FT} = 270 \text{ lbs / FT}$$

JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (157)CALCULATED BY: T. WILDA DATE: 03/2/11

CHECKED BY: _____ DATE: _____

SUBJECT: LAT ANALYSIS (D.C)**HEES & ASSOCIATES, INC.**

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FOUNDATIONS @ 60 mph (CORNER COL.)

$$\text{ROOF LOADS} = \frac{1}{2}(14.75') \times \frac{1}{2}(8.00') \cdot 29.5 \text{ ft}^2$$

$$P_D = 29.5 \text{ ft}^2 \times 30 \text{ PSF} = 885 \text{ lbs}$$

$$P_L = 29.5 \text{ ft}^2 \times 20 \text{ PSF} = 590 \text{ lbs}$$

$$\text{WALL LOADS} = 20 \text{ PSF} \times 10.83' \times (4.0 \text{ ft} + \frac{1}{2}(7.5 \text{ ft})) = 1680 \text{ lbs}$$

$$\text{FLOOR LOADS} = \text{T.A.} \cdot 29.5 \text{ ft}^2$$

$$P_D = 29.5 \text{ ft}^2 \times 20 \text{ PSF} = 590 \text{ lbs}$$

$$P_L = 29.5 \text{ ft}^2 \times 50 \text{ PSF} = 1475 \text{ lbs}$$

$$\text{LATTICE FRAMING} = 520 \text{ lbs}$$

$$\Sigma P_D = 3675 \text{ lbs}$$

$$\Sigma P_L = 590 \text{ lbs} \quad \Sigma P_L = 1475 \text{ lbs}$$

$$\text{UPLIFT} = 29.5 \text{ ft}^2 \times -8.3 \text{ PSF} = -245 \text{ lbs (BLDG ROOF)}$$

$$\text{UPLIFT} = 36.0 \text{ ft}^2 \times -7.1 \text{ PSF} = -255 \text{ lbs (SOLAR RACK)}$$

$$\Sigma = -500 \text{ lbs}$$

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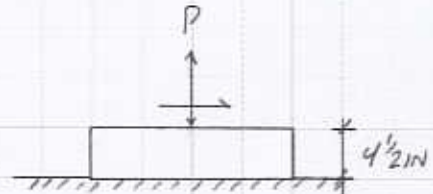
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FOUNDATIONS @ 60 mph DESIGN:

$$P_D = 3675 \text{ lbs} \quad P_u = -500 \text{ lbs} \quad P_{LAT} = 270 \text{ lbs}$$



SLIDING ANALYSIS:

$$0.60 (3675 \text{ lbs}) - 500 \text{ lbs} = 1705 \text{ lbs} (0.35) = 600 \text{ lbs} \geq 270 \text{ lbs} \times 2.0 \\ \geq 540 \text{ lbs}$$

BEARING PRESSURE:

GOOD FOR SLIDING

$$M_o = 270 \text{ lbs} \times 0.375 \text{ ft} = 101 \text{ ft-lbs}$$

$$EP = 3775 \text{ lbs} + 0.75(590 \text{ lbs}) + 0.75(1475 \text{ lbs}) - 0.75(500 \text{ lbs}) = 4950 \text{ lbs}$$

$$e_r = \frac{101 \text{ ft-lbs}}{4950 \text{ lbs}} = 0.02 \quad L/6 = 3.0/6 = 0.50$$

$$p_{max} = \frac{4950 \text{ lbs}}{9 \text{ ft}^2} \left(1 + \frac{6(0.02)}{3.0} \right) = 572 \text{ psf} \leq 1500 \text{ psf}$$

GOOD FOR
SOIL BEARING

OVERTURNING ANALYSIS:

$$M_o = (270 \text{ lbs} \times 1.5') + (500 \text{ lbs} \times 1.5') = 1155 \text{ lbs} \times 2.0 \text{ (F.S.)} = 2310 \text{ lbs}$$

$$M_u = 0.60(3775 \text{ lbs}) \times 1.5' = 3400 \text{ lbs} \leq 2310 \text{ lbs} \quad \text{GOOD FOR OVERTURNING}$$



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JOB SOLAR DELATHLON 10HA0412

SHEET # _____ OF (159)

CALCULATED BY: T WILDA DATE: 03/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOUNDATIONS (D.C)

Worst Case FTS BEDRMS:

$$\text{ROOF LOADS} = \frac{1}{2}(14.75') \times \frac{1}{2}(16.00') = 59 \text{ FT}^2$$

$$P_D = 30 \text{ PSF} \times 59 \text{ FT}^2 = 1770 \text{ lbs}$$

$$P_L = 20 \text{ PSF} \times 59 \text{ FT}^2 = 1180 \text{ lbs}$$

$$\text{WALL WT.} = 220 \text{ plf} \times \frac{1}{2}(16.00') = 1760 \text{ lbs}$$

$$\text{FLOOR LOADS} = 59 \text{ FT}^2$$

$$\Sigma P_D = 4710 \text{ lbs}$$

$$\Sigma P_L = 1180 \text{ lbs}$$

$$P_D = 20 \text{ PSF} \times 59 \text{ FT}^2 = 1180 \text{ lbs}$$

$$\Sigma P_L = 2950 \text{ lbs}$$

$$P_L = 50 \text{ PSF} \times 59 \text{ FT}^2 = 2950 \text{ lbs}$$

$$E_D = 4710 \text{ lbs} \quad E_L = 5310 \text{ lbs} \quad \Sigma \text{TOTAL} = 10,000 \text{ lbs}$$

$$\text{UPLIFT: } 59 \text{ FT}^2 \times -8.3 \text{ PSF} = -490 \text{ lbs} \quad (\text{ROOF})$$

$$39 \text{ FT}^2 \times -7.1 \text{ PSF} = -280 \text{ lbs} \quad (\text{SOLAR RACK})$$

$$\Sigma = -770 \text{ lbs}$$

$$E_P = 4710 \text{ lbs} + 0.75(1180 \text{ lbs}) + 0.75(2950 \text{ lbs}) = 7807 \text{ lbs}$$

$$\text{AREA} = \sqrt{\frac{7807 \text{ lbs}}{1500 \text{ lbs}}} = 2.28 \text{ FT}^2$$

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (160)CALCULATED BY: T. WILDA DATE: 03/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOUNDATIONS (D.C.)

Worst-Case Fty. Bearings: (cont'd)

$$EP = 4710 \text{ lbs} + 0.75(1180 \text{ lbs}) + 0.75(2950 \text{ lbs}) - 0.75(-770 \text{ lbs}) = 7230 \text{ lbs}$$

$$Mo = (270 \text{ lbs} \times 1.5') + (770 \text{ lbs} \times 1.5') = 1500 \text{ ft-lbs} \times 2.0 = 3000 \text{ ft-lbs}$$

$$Mr = (4710 \text{ lbs})(0.60)(1.5') = 4240 \text{ ft-lbs} > \frac{3000 \text{ ft-lbs}}{3210 \text{ ft-lbs}} \quad \text{GOOD FOR OVERTURNING}$$

GOOD, USE 3'-0" x 3'-0" TEMP. FOUNDATION.

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JOB SOLAR DECATHLON 10HA042SHEET # _____ OF (61)CALCULATED BY: T. WILDA DATE: 05/8/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOUNDATIONS (D.C.)FOOTING DESIGN & ENDS OF POP-OUTS:

$$PLAT = 7.0 \text{ PSF} \times 9.67' \times \frac{1}{2}(9.17') = 310 \text{ lbs}$$

$$PLAT / FTG. = 310 \text{ lbs} / 2 \text{ FTG.'s} = 155 \text{ lbs} \times 1.5 = 235 \text{ lbs}$$

$$\text{GRAVITY LOADS: } T.A. = \frac{1}{2}(12.17') \times \frac{1}{2}(9.17') = 28 \text{ FT}^2$$

$$P_D = 30 \text{ PSF} \times 28 \text{ FT}^2 = 840 \text{ lbs}$$

$$\text{WALL WT.} = 20 \text{ PSF} \times 8.83' \times \left[\frac{1}{2}(9.17') + \frac{1}{2}(12.17') \right] = 1885 \text{ lbs}$$

$$UPLIFT = 28 \text{ FT}^2 \times -8.3 \text{ PSF} = -235 \text{ lbs}$$

SLIDING CHECK:

$$0.6(2725 \text{ lbs}) - 235 \text{ lbs} = 1400 \text{ lbs} \times 0.25 = 350 \text{ lbs} \geq 235 \text{ lbs}$$

GOOD FOR SLIDING!

JOB SOLAR DECATHLON 10HA042

SHEET # _____ OF (162)

CALCULATED BY: T. WILDA DATE: 03/19/11

CHECKED BY: _____ DATE: _____

SUBJECT: FOUNDATION (D.C.)

HEES & ASSOCIATES, INC.

1381 Fifth Street • Sarasota, Florida 34236
Telephone: (941) 955-4555 • Fax: (941) 955-9333
karl@heesassociates.com • www.heesassociates.com
C.O.A. #27043

WORST CASE TEMP FOUNDATION SHEAR ANALYSIS:

MAX. LOADS:

SOLAR ROOF LOADS: $P_D = 450 \text{ lbs}$

ROOF LOADS: T.A. = 59 ft^2 $P_D = 1770 \text{ lbs}$
 $P_L = 1180 \text{ lbs}$

WALL LOADS: $W_D = 220 \text{ PLF} \times 8.0 \text{ FT} = 1760 \text{ lbs}$

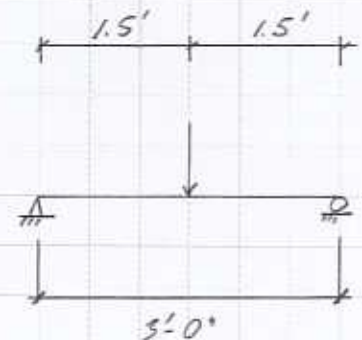
DECK LOADS: T.A. = 24 ft^2 $P_D = 240 \text{ lbs}$
 $P_L = 1200 \text{ lbs}$

$\Sigma P_D = 4220 \text{ lbs}$ $\Sigma P_L = 2380 \text{ lbs}$

$$F_v = \frac{(3)(220 \text{ lbs} + 2380 \text{ lbs})}{(2)(6.0 \text{ in} \times 36.0 \text{ in})} = 45.9 \text{ psi}$$

$$F_v = 175 \text{ psi} \geq 45.9 \text{ psi}$$

FTS. GOOD IN SHEAR!



APPENDIX B: PV INSTALLATION GUIDE

PHOTOVOLTAIC INSTALL

MOUNTING SYSTEM

Mounting system 'Pro Solar' will be assembled on site. Support rails are to be spliced together in order to create a longer rail. The splice will be put into the channel and installed with two 5/6" bolts / lock washers; using a 1/2" socket. Rails will be attached to the umbrella structure. The span between the support rails will be no less than 48". The support rails will be mounted with an orientation of south facing at 35 degrees.

ATTACHING MICRO-INVERTERS/JUNCTION BOX

2 - Junction boxes will be installed at the end of corresponding rail beginning with the Enphase adapter plate. Junction box will be connected to the plate. The location for each Enphase D-380 will be marked under every other PV module (planned placement) on the racking system. They will be attached with the washers, clamps and screws given.

ATTACHING MODULES

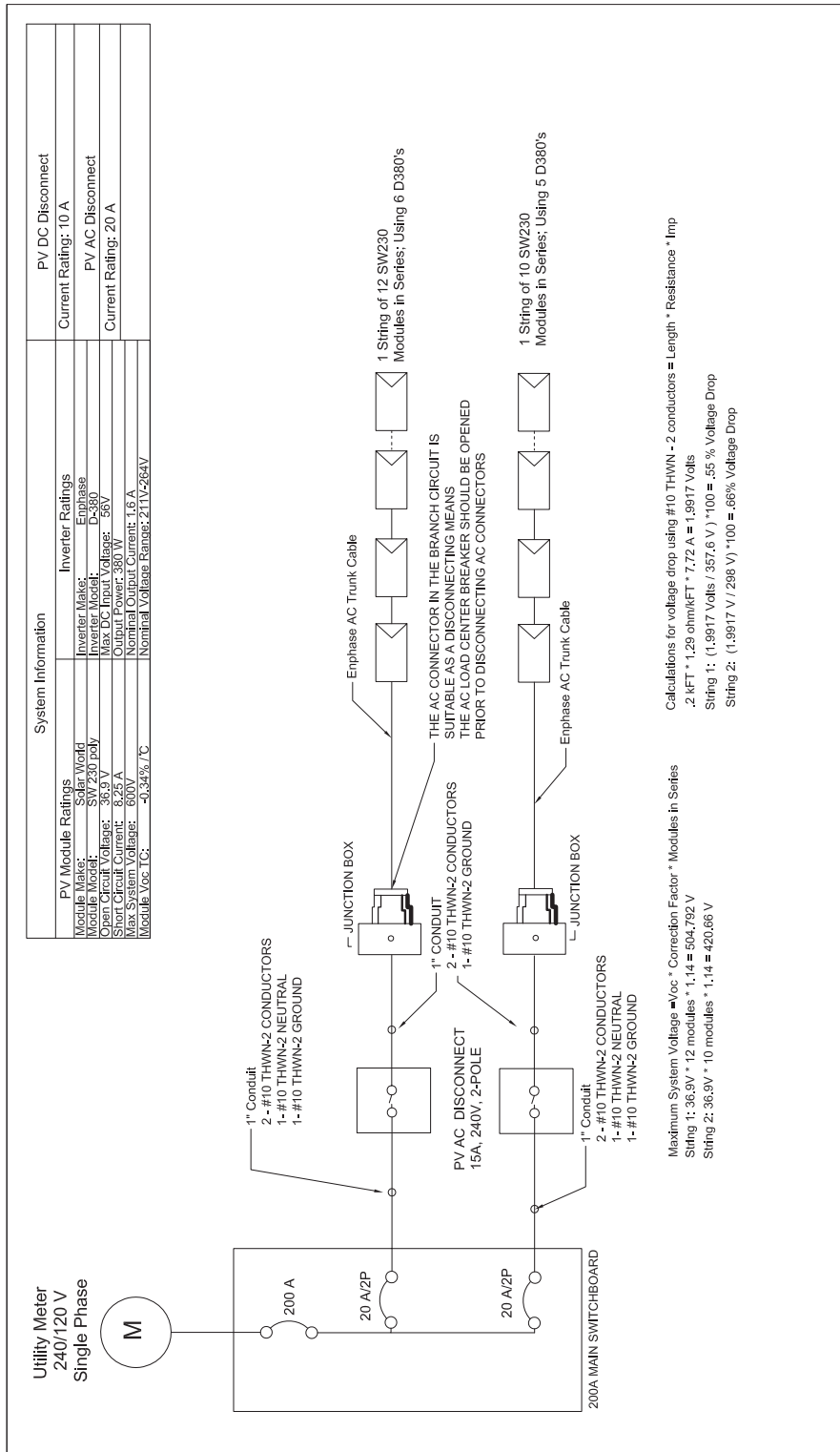
Each module will have four points of connection to the racking system, clamping hardware will serve this purpose. There are two sets of clamps; the outside clamps (end clamps) and the inter-module clamps that install between the modules. Clamps will be tightened using a 1/2" socket.

CONNECTING MODULES TO INVERTERS

Photovoltaic modules will be connected in series, in compliance with Enphase D-380 Micro- Inverter. Connections will be made from each module to a micro-inverter (positive to positive / negative to negative). There will be two 'trunk cables' one containing 5, D-380's and the other containing 6, D-380's. Trunk cables will be oriented so male pin is facing the junction box.

WIRING TO PANEL

A continuous ground cable will connected to each Enphase micro-inverter with the ground clamps given; it will then run to the junction box. Each trunk cable will run to their own junction box attached on the end of the corresponding mounting rack; transitioning into 2, #8- conductors, 1 - # 8 neutral, and 1 - #8 ground which will go inside 1" conduit. Each conduit will run to a 20 Amp, 240 V, 2-pole AC Disconnect. Then they will be connected to the circuit breaker.



APPENDIX C: LIQUID DESICCANT SYSTEM

Specifications for liquid desiccant system components. (Rule 8-4)

Casing Material: Clear Acrylic

Minor Parts: ½" NPT fittings, ¼" NPT fittings, Teflon tubing

Air rate: 0.079 m³/s (2.79 ft³/s) continuous for entire house

Flow rate of desiccant: 1 gpm per zone

Total Volume of Desiccant: 15-20 gal for entire house

Liquid Desiccant Storage Tank: <http://www.plastic-mart.com/class.php?item=3288>

Part Number: GRN25-23TT

25 Gallon Plastic Water Tank

23" dia. x 18" H

Liquid Desiccant Pump: http://www.northerntool.com/shop/tools/product_792_792

Wel-Bilt Submersible Pump — 21.13 GPM, 1/8 HP, 1in.

Flow (GPH) 1,268

Volts 110

Amps 2.5

HP 1/8

Max. Suction Lift (ft.) 22.96

Suction Type Bottom

Discharge Port (in.) 1 (1/2", 3/4", and 1" adapters included)

Impeller Shaft Clog-Preventing, Vortex-Style

Power Cord (ft.) 10

Dimensions L x W x H (in.) L x 6 x 10 1/2

Ship Weight 8.0 lbs

Item # 10898

Suggested methods to test liquid desiccant compliance with rules.

1. Check Electrical Conductivity of the solution.
2. Measure Salinity.

Composition of the liquid desiccant:

Combine a ratio of 3:1 of calcium chloride to water, by weight, mix well.

Liquid Desiccant Regeneration:

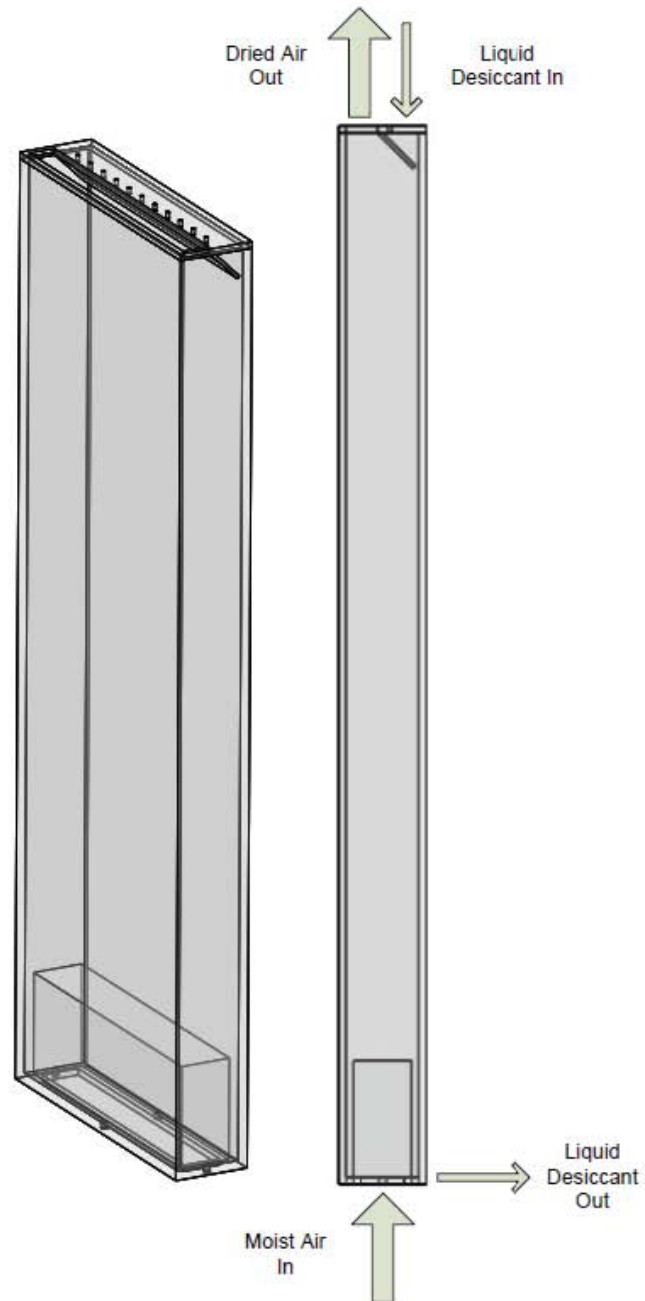
- Air flows across the desiccant to the desiccant absorbs water from the air.
- The desiccant flows into a storage tank.
- Warm/hot dry air flows into storage tank and absorbs water from desiccant.
- Repeat cycle.

LIQUID DESICCANT SYSTEM FUNCTIONALITY.

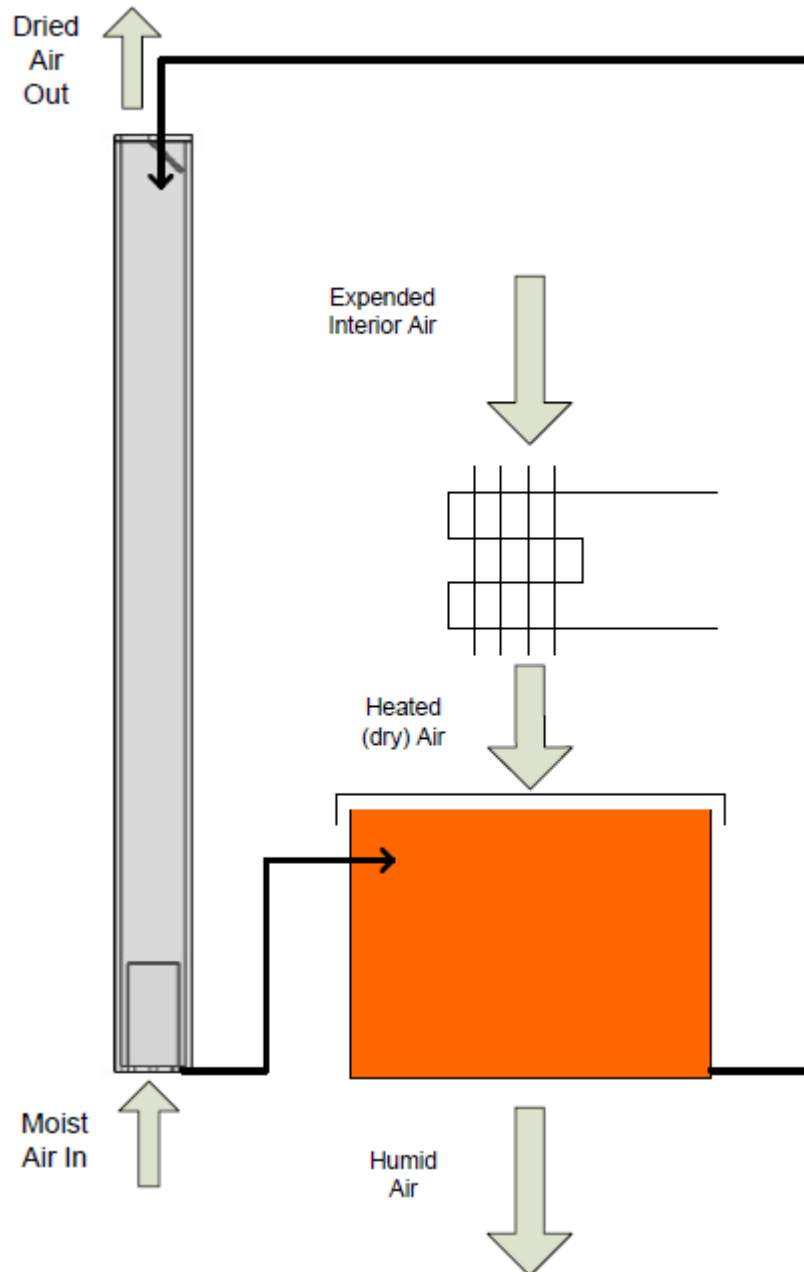
FIGURE 1

Rule 8-4 Drawings describing the liquid desiccant system and how it works.

The air enters the waterfall system and comes in contact with the liquid desiccant. This draws moisture out of air, lowering the absolute humidity. The air then exits through the top of the casing which is then directed to be conditioned further. The liquid desiccant exits through the bottom of the casing to be regenerated inside the main desiccant storage tank.



**LIQUID DESICCANT SYSTEM FUNCTIONALITY.
FIGURE 2**



APPENDIX D: SPECIFICATIONS FOR GENERATORS

**Inverter generator series
 P3200ie**



Features and benefits

- 2800 watts running, 3200 watts peak
- 6.5 hour continuous operating time (at rated load)
- Electric start with recoil back-up (battery not included)
- 7 HP, 4-stroke overhead camshaft engine
- Large 11 litre fuel tank
- LED display
- Multi-meter w/LED display - voltmeter, hour meter, frequency and overload condition
- Auto idle, power save mode for running light loads
- 4 wheel kit including brake
- 2 year limited warranty
- Whisper quiet operation
- Commercially “clean power” via sinewave inverter
- 12 V DC battery charging outlet

Weight, size and sound level

- Weight:** 130 lbs (58.9 kg)
- Size:** Length 21 in (525 mm), width 19 in (482.6 mm), height 23 in (584.2 mm)
- Sound:** 58 dB(A) at 7 m

Application

- Suits applications that require a whisper quiet generator that provides clean power to run sensitive electronic equipment
- Ideal for running caravan appliances and air-conditioner, coffee machine, bread maker or medical equipment rated up to 2800 watts

Models and ratings

AC rated output	2800 VA	DC voltage	12 V
AC max output	3200 VA	Engine horsepower	7.0 HP
AC Voltage	240 V	Fuel type	Unleaded petrol
AC frequency	50 Hz	Fuel tank capacity	11 L
240 V AC rated amp – Rated/max	11.6/13.3 A		

Ratings apply to altitudes up to 1000 ft (304.8 m), 85 °F (30 °C). Total power available will decrease 3.5% for each 1000 ft (304.8 m) above 1000 ft and 2.0% for each 10 °F (5.5 °C) increase in ambient temperature above 85 °F (30 °C).

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 A-1524a (9/08) (formerly F-1696)



TEAM FLORIDA:

University of South Florida, University of Florida, Florida State University & the University of Central Florida
USF School of Architecture & Community Design • 4202 E. Fowler Avenue, HMS 301 • Tampa, FL 33620

APPENDIX E: ENERGY CALCULATIONS

Florida Energy Efficiency Code For Building Construction

Florida Department of Community Affairs

EnergyGauge Summit® Fla/Com-2008, Effective: March 1, 2009 -- Form 400A-2008

Method A: Whole Building Performance Method for Commercial Buildings

PROJECT SUMMARY

Short Desc: 1054

Owner: Team Florida

Address1: University of South Florida

Address2: 4202 E. Fowler Avenue

Type: Multi-Family

Jurisdiction: TAMPA, HILLSBOROUGH COUNTY, FL (391200)

Conditioned Area: 890 SF

No of Stories: 1

Permit No: 0

Description: Solar Decathlon

City: Tampa

State: FL

Zip: 33620

Class: New Finished building

Conditioned & UnConditioned Area: 930 SF

Area entered from Plans 0 SF

Max Tonnage 2.7

If different, write in: _____

Compliance Summary

Component	Design	Criteria	Result
Gross Energy Cost (in \$)	615.0	706.0	PASSED
LIGHTING CONTROLS			PASSES
EXTERNAL LIGHTING			None Entered
HVAC SYSTEM			PASSES
PLANT			PASSES
WATER HEATING SYSTEMS			None Entered
PIPING SYSTEMS			PASSES
Met all required compliance from Check List?			Yes/No/NA
 IMPORTANT MESSAGE Info 5009 -- -- -- An input report of this design building must be submitted along with this Compliance Report			

CERTIFICATIONS

I hereby certify that the plans and specifications covered by this calculation are in compliance with the Florida Energy Code

Prepared By: RCI Engineering, Inc.

Building Official: _____

Date: _____

Date: _____

I certify that this building is in compliance with the FLorida Energy Efficiency Code

Owner Agent: Team Florida

Date: _____

If Required by Florida law, I hereby certify (*) that the system design is in compliance with the FLorida Energy Efficiency Code

Architect: _____

Reg No: _____

Electrical Designer: RCI Engineering, Inc.

Reg No: FL CA # 27662

Lighting Designer: University of South Florida

Reg No: _____

Mechanical Designer: RCI Engineering, Inc.

Reg No: FL CA # 27662

Plumbing Designer: RCI Engineering, Inc.

Reg No: FL CA # 27662

(*) Signature is required where Florida Law requires design to be performed by registered design professionals.

Project: 1054
Title: Solar Decathlon
Type: Multi-Family
(WEA File: FL_TAMPA_INTERNATIONAL_AP.tm3)

Building End Uses

	1) Proposed	2) Baseline
Total	47.70	56.90
	\$615	\$830
ELECTRICITY(MBtu/kWh/\$)	38.40	56.90
	11287	16673
	\$569	\$830
AREA LIGHTS	3.60	9.10
	1062	2679
	\$54	\$133
HEAT REJECT	2.00	0.00
	598	0
	\$30	\$0
MISC EQUIPMT	6.80	6.80
	2006	2006
	\$101	\$100
PUMPS & MISC	0.90	0.30
	262	85
	\$13	\$4
SPACE COOL	18.40	28.20
	5405	8258
	\$272	\$411
SPACE HEAT	0.50	0.40
	132	104
	\$7	\$5
VENT FANS	6.20	12.10
	1822	3541
	\$92	\$176
NATURAL-GAS(MBtu/therm/\$)	9.30	
)	93	0
	\$47	\$0

	1) Proposed	2) Baseline
SPACE HEAT	9.30	0.00
	93	0
	\$47	\$0
Passing requires Proposed Building cost to be at most 85% of Baseline cost. This Proposed Building is at 74.1%		PASSES

External Lighting Compliance						
Description	Category	Tradable?	Allowance (W/Unit)	Area or Length or No. of Units (Sqft or ft)	ELPA (W)	CLP (W)
						None

Project: 1054
Title: Solar Decathlon
Type: Multi-Family
(WEA File: FL_TAMPA_INTERNATIONAL_AP.fm3)

Lighting Controls Compliance						
Acronym	Ashrae ID	Description	Area (sq.ft)	Design CP	Min CP	Compliance
Extended Bed	16.001	Private Living Space	108	1	1	PASSES
Main Bed	16.001	Private Living Space	175	1	1	PASSES
Bath	6	Toilet and Washroom	88	1	1	PASSES
Entry	12	Lobby (General) - Reception and Waiting	44	1	1	PASSES
Living	16.001	Private Living Space	290	1	1	PASSES
Kitchen	7	Food Service - Kitchen	185	1	1	PASSES
Utility	1	Electrical Mechanical Equipment Room - General	40	1	1	PASSES
PASSES						PASSES

Water Heater Compliance

Description	Type	Category	Design Eff	Min Eff	Design Loss	Max Loss	Compliance
<div style="border: 1px solid black; padding: 5px; display: inline-block;">None</div>							

Project: 1054
Title: Solar Decathlon
Type: Multi-Family
(WEA File: FL_TAMPA_INTERNATIONAL_AP.tm3)

Piping System Compliance

Category	Pipe Dia [inches]	Is Runout?	Operating Temp [F]	Ins Cond [Btu-in/hr .SF.F]	Ins Thick [in]	Req Ins Thick [in]	Compliance
Heating System (Steam, Steam Condensate, & Hot Water)	1.00	False	180.00	0.28	1.00	1.00	PASSES
Domestic and Service Hot Water Systems	0.50	False	120.00	0.28	0.50	0.50	PASSES
Cooling Systems (Chilled Water, Brine and Refrigerant)	1.00	False	44.00	0.28	1.00	0.50	PASSES
<div style="border: 1px solid black; padding: 5px; display: inline-block;">PASSES</div>							

Project: 1054

Title: Solar Decathlon

Type: Multi-Family

(WEA File: FL_TAMPA_INTERNATIONAL_AP.tm3)

Other Required Compliance

Category	Section	Requirement (write N/A in box if not applicable)	Check
Report	13-101	Input Report Print-Out from EnergyGauge FlaCom attached	<input type="checkbox"/>
Operations Manual	13-102.1, 13-410, 13-413	Operations manual provided to owner	<input type="checkbox"/>
Windows & Doors	13-406.AB.1.1	Glazed swinging entrance & revolving doors: max. 1.0 cfm/ft ² ; all other products: 0.4 cfm/ft ²	<input type="checkbox"/>
Joints/Cracks	13-406.AB.1.2	To be caulked, gasketed, weather-stripped or otherwise sealed	<input type="checkbox"/>
Dropped Ceiling Cavity System	13-406.AB.3	Vented: seal & insulated ceiling. Unvented seal & insulate roof & side walls	<input type="checkbox"/>
Reheat	13-407	HVAC Load sizing has been performed	<input type="checkbox"/>
HVAC Efficiency	13-407.B	Electric resistance reheat prohibited	<input type="checkbox"/>
HVAC Controls	13-407, 13-408	Minimum efficiencies: Cooling Tables 13-407.AB.3.2.1A-D; Heating Tables 13-407.AB.3.2.1B, 13-407.AB.3.2.1D, 13-408.AB.3.2.1E, 13-408.AB.3.2F	<input type="checkbox"/>
HVAC Controls	13-407.AB.2	Zone controls prevent reheat (exceptions); simultaneous heating and cooling in each zone; combined HAC deadband of at least 5°F (exceptions)	<input type="checkbox"/>
Ventilation Controls	13-409.AB.3	Motorized dampers reqd, except gravity dampers OK in: 1) exhaust systems and 2) systems with design outside air intake or exhaust capacity ≤300 cfm	<input type="checkbox"/>
ADS	13-410	Duct sizing and Design have been performed	<input type="checkbox"/>
HVAC Ducts	13-410.AB	Air ducts, fittings, mechanical equipment & plenum chambers shall be mechanically attached, sealed, insulated & installed per Sec. 13-410 Air Distribution Systems	<input type="checkbox"/>
Balancing	13-410.AB.4	HVAC distribution system(s) tested & balanced. Report in construction documents	<input type="checkbox"/>
Piping Insulation	13-411.AB	In accordance with Table 13-411.AB.2	<input type="checkbox"/>
Water Heaters	13-412.AB	Performance requirements in accordance with Table 13-412.AB.3. Heat trap required	<input type="checkbox"/>
Swimming Pools	13-412.AB.2.6	Cover on heated swimming pools: Time switch (exceptions); Readily accessible on/off switch	<input type="checkbox"/>
Hot Water Pipe Insulation	13-411.AB.3	Table 13-411.AB.2 for circulating systems, first 8 feet of outlet pipe from storage tank and between inlet pipe and heat trap	<input type="checkbox"/>
Water Fixtures	13-412.AB.2.5	Shower hot water flow restricted to 2.5 gpm at 80 psi. Public lavatory fixture hot water flow 0.5 gpm max; if self-closing valve 0.25 gallon recirculating, 0.5 gallon non recirculating	<input type="checkbox"/>
Motors	13-414	Motor efficiency criteria have been met	<input type="checkbox"/>
Lighting Controls	13-415.AB	Automatic control required for interior lighting in buildings >5,000 s.f.; Space control; Exterior photo sensor; Tandem wiring with 1 or 3 linear fluorescent lamps>30W	<input type="checkbox"/>

EnergyGauge Summit® v3.22
INPUT DATA REPORT

Project Information

Project Name: 1054

Orientation: North

Project Title: Solar Decathlon

Building Type: Multi-Family

Address: University of South Florida
 4202 E. Fowler Avenue

Building Classification: New Finished building

State: FL

No. of Stories: 1

Zip: 33620

GrossArea: 930 SF

Owner: Team Florida

Zones

No	Acronym	Description	Type	Area [sf]	Multiplier	Total Area [sf]	
1	Bed	Zone 1 - Bedroom Area	CONDITIONED	371.0	1	371.0	<input type="checkbox"/>
2	Living	Zone 2 - Living/Kitchen Area	CONDITIONED	519.0	1	519.0	<input type="checkbox"/>
3	Utility	Zone 3 - Utility Closet	UNCONDITIONED	40.0	1	40.0	<input type="checkbox"/>

Spaces

No	Acronym	Description	Type	Depth [ft]	Width [ft]	Height [ft]	Multiplier	Total Area [sf]	Total Volume [cf]	
In Zone: Bed										
1	Extended Bed	Extended murphy bed area	Private Living Space	1.00	108.00	8.00	1	108.0	864.0	<input type="checkbox"/>
2	Main Bed	Main bed area	Private Living Space	1.00	175.00	10.00	1	175.0	1750.0	<input type="checkbox"/>
3	Bath	Bathroom	Toilet and Washroom	1.00	88.00	10.00	1	88.0	880.0	<input type="checkbox"/>
In Zone: Living										
1	Entry	Entry Vestibule	Lobby (General) - Reception and Waiting	1.00	44.00	8.00	1	44.0	352.0	<input type="checkbox"/>
2	Living	Living Room area	Private Living Space	1.00	290.00	10.00	1	290.0	2900.0	<input type="checkbox"/>
3	Kitchen	Kitchen area	Food Service - Kitchen	1.00	185.00	10.00	1	185.0	1850.0	<input type="checkbox"/>
In Zone: Utility										
1	Utility	Utility Closet	Electrical Mechanical Equipment Room - General	1.00	40.00	8.00	1	40.0	320.0	<input type="checkbox"/>

Lighting

No	Type	Category	No. of Luminaires	Watts per Luminaire	Power [W]	Control Type	No. of Ctrl pts	
In Zone: Bed								
In Space: Extended Bed								
1	Compact Fluorescent	General Lighting	1	13	13	Manual On/Off	1	<input type="checkbox"/>
In Space: Main Bed								
1	Compact Fluorescent	General Lighting	4	13	52	Manual On/Off	1	<input type="checkbox"/>
In Space: Bath								
1	Compact Fluorescent	General Lighting	4	13	52	Manual On/Off	1	<input type="checkbox"/>
In Zone: Living								
In Space: Entry								
1	Compact Fluorescent	General Lighting	1	13	13	Manual On/Off	1	<input type="checkbox"/>

In Space: Living									
1	Compact Fluorescent	General Lighting	6	13	78	Manual On/Off	1	<input type="checkbox"/>	
In Space: Kitchen									
1	Compact Fluorescent	General Lighting	7	13	91	Manual On/Off	1	<input type="checkbox"/>	
In Zone: Utility									
In Space: Utility									
1	Compact Fluorescent	General Lighting	2	13	26	Manual On/Off	1	<input type="checkbox"/>	

Walls

No	Description	Type	Width [ft]	H (Effec) [ft]	Multi plier	Area [sf]	Direction	Conductance [Btu/hr. sf. F]	Heat Capacity [Btu/sf.F]	Dens. [lb/cf]	R-Value [h.sf.F/Btu]	<input type="checkbox"/>
In Zone: Bed												
1	Pr0Zo1Wa1	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	17.00	10.00	1	170.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
2	Pr0Zo1Wa1	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	15.80	10.00	1	158.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
3	Pr0Zo1Wa1	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	4.40	10.00	1	44.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
4	Pr0Zo1Wa1	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	9.00	8.00	1	72.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
5	Pr0Zo1Wa1	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	12.00	8.00	1	96.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
6	Pr0Zo1Wa1	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	9.00	8.00	1	72.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
In Zone: Living												

1	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	30.20	10.00	1	302.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
2	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	22.10	10.00	1	221.0	South	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
3	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	6.20	8.00	1	49.6	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
4	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	7.60	8.00	1	60.8	South	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
5	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	5.50	8.00	1	44.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
In Zone: Utility												
1	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	2.60	10.00	1	26.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
2	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	15.80	10.00	1	158.0	East	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
3	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	15.80	10.00	1	158.0	North	0.0471	1.449	13.99	21.2	<input type="checkbox"/>
4	Pr0Zo1Wa1	Metal siding/furring/2x4@ 24"+R21 Batt/1/2"Gyp	2.60	10.00	1	26.0	South	0.0471	1.449	13.99	21.2	<input type="checkbox"/>

Windows

No	Description	Type	Shaded	U [Btu/hr sf F]	SHGC	Vis.Tra	W [ft]	H (Effec) [ft]	Multi plier	Total Area [sf]	<input type="checkbox"/>
In Zone: Bed											
In Wall: North											
1	Pr0Zo1Wa5Wi1	User Defined	No	0.6000	0.30	0.60	10.70	7.90	1	84.5	<input type="checkbox"/>
In Wall: West											
1	Pr0Zo1Wa2Wi1	User Defined	Yes	0.6000	0.30	0.60	4.00	1.00	1	4.0	<input type="checkbox"/>
In Zone: Living											
In Wall: North											
1	Pr0Zo1Wa5Wi1	User Defined	Yes	0.6000	0.30	0.60	27.30	7.90	1	215.7	<input type="checkbox"/>
In Wall: South											
1	Pr0Zo1Wa5Wi1	User Defined	Yes	0.6000	0.30	0.60	10.60	7.90	1	83.7	<input type="checkbox"/>
In Wall: SSW											
1	Pr0Zo1Wa5Wi1	User Defined	Yes	0.6000	0.30	0.60	6.20	7.90	1	49.0	<input type="checkbox"/>
In Wall: West											
1	Pr0Zo1Wa5Wi1	User Defined	Yes	0.6000	0.30	0.60	3.40	7.90	1	26.9	<input type="checkbox"/>

Doors

No	Description	Type	Shaded?	Width [ft]	H (Effec) [ft]	Multi plier	Area [sf]	Cond. [Btu/hr. sf. F]	Dens. [lb/cf]	Heat Cap. [Btu/sf. F]	R-Value [h.sf.F/Btu]	<input type="checkbox"/>
In Zone:												
In Wall:												

Roofs

No	Description	Type	Width [ft]	H (Effec) [ft]	Multi plier	Area [sf]	Tilt [deg]	Cond. [Btu/hr. Sf. F]	Heat Cap [Btu/sf. F]	Dens. [lb/cf]	R-Value [h.sf.F/Btu]	<input type="checkbox"/>
In Zone: Bed												
1	Pr0Zo1Rf1	PV/Air/Metal roof/10" Batt in trusses/1/2"Gyp	371.00	1.00	1	371.0	0.00	0.0288	1.85	13.15	34.7	<input type="checkbox"/>

In Zone:	Living												
1	Pr0Zo1Rf1	PV/Air/Metal roof/10" Batt in trusses/1/2"Gyp	519.00	1.00	1	519.0	0.00	0.0288	1.85	13.15	34.7	<input type="checkbox"/>	
In Zone:	Utility												
1	Pr0Zo1Rf1	PV/Air/Metal roof/10" Batt in trusses/1/2"Gyp	40.00	1.00	1	40.0	0.00	0.0288	1.85	13.15	34.7	<input type="checkbox"/>	

Skylights

No	Description	Type	U [Btu/hr sf F]	SHGC	Vis.Trans	W [ft]	H (Effec) [ft]	Multiplier	Area [Sf]	Total Area [Sf]	
In Zone:	In Roof:										<input type="checkbox"/>

Floors

No	Description	Type	Width [ft]	H (Effec) [ft]	Multi plier	Area [sf]	Cond. [Btu/hr. sf. F]	Heat Cap. [Btu/sf. F]	Dens. [lb/cf]	R-Value [h.sf.F/Btu]	
In Zone:	Bed										
1	Pr0Zo1F11	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	371.00	1.00	1	371.0	0.0471	1.45	13.99	21.24	<input type="checkbox"/>
In Zone:	Living										
1	Pr0Zo1F11	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	519.00	1.00	1	519.0	0.0471	1.45	13.99	21.24	<input type="checkbox"/>
In Zone:	Utility										
1	Pr0Zo1F11	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	40.00	1.00	1	40.0	0.0471	1.45	13.99	21.24	<input type="checkbox"/>

Systems

FCU-1	Fan Coil Unit #1	Constant Volume Two Pipe Fan-Coil Built-up System			No. Of Units 1
Component	Category	Capacity	Efficiency	IPLV	
1	Cooling System	10700.00			<input type="checkbox"/>
2	Heating System	21000.00			<input type="checkbox"/>
3	Air Handling System -Supply	340.00	0.35		<input type="checkbox"/>

FCU-2	Fan Coil Unit #2	Constant Volume Two Pipe Fan-Coil Built-up System			No. Of Units 1
Component	Category	Capacity	Efficiency	IPLV	
1	Cooling System	17000.00			<input type="checkbox"/>
2	Heating System	41700.00			<input type="checkbox"/>
3	Air Handling System -Supply	650.00	0.32		<input type="checkbox"/>

Plant

Equipment	Category	Size	Inst.No	Eff.	IPLV		
1	Hermetic screw or scroll chiller	Cooling Equipment	2.7 [Tons]	1	2.95 [COP]	3.20	<input type="checkbox"/>
2	Hot Water Boiler (Fuel)	Heating Equipment	0.1 [Million Btu/h]	1	100.00 [AFUE or Ec]		<input type="checkbox"/>
3	Domestic hot-water heater	Water Heating Equipment	0.1 [Million Btu/h]	1	100.00 [Et]		<input type="checkbox"/>

Water Heaters

W-Heater Description	CapacityCap.Unit	I/P Rt.	Efficiency	Loss	
					<input type="checkbox"/>

Ext-Lighting

Description	Category	No. of Luminaires	Watts per Luminaire	Area/Len/No. of units [sf/ft/No]	Control Type	Wattage [W]
<input type="checkbox"/>						

Piping

No	Type	Operating Temperature [F]	Insulation Conductivity [Btu-in/h.sf.F]	Nomonal pipe Diameter [in]	Insulation Thickness [in]	Is Runout?
1	Heating System (Steam, Steam Condensate, & Hot Water)	180.00	0.28	1.00	1.00	No <input type="checkbox"/>
2	Domestic and Service Hot Water Systems	120.00	0.28	0.50	0.50	No <input type="checkbox"/>
3	Cooling Systems (Chilled Water, Brine and Refrigerant)	44.00	0.28	1.00	1.00	No <input type="checkbox"/>

Fenestration Used

Name	Glass Type	No. of Panels	Glass Conductance [Btu/h.sf.F]	SHGC	VLT
ApLbWnd13	User Defined	1	0.6000	0.3000	0.6000
<input type="checkbox"/>					

Materials Used

Mat No	Acronym	Description	Only R-Value Used	RValue [h.sf.F/Btu]	Thickness [ft]	Conductivity [Btu/h.ft.F]	Density [lb/cf]	SpecificHeat [Btu/lb.F]
264	Mat1264	ALUMINUM, 1/16 IN	No	0.0002	0.0050	26.0000	480.00	0.1000
<input type="checkbox"/>								

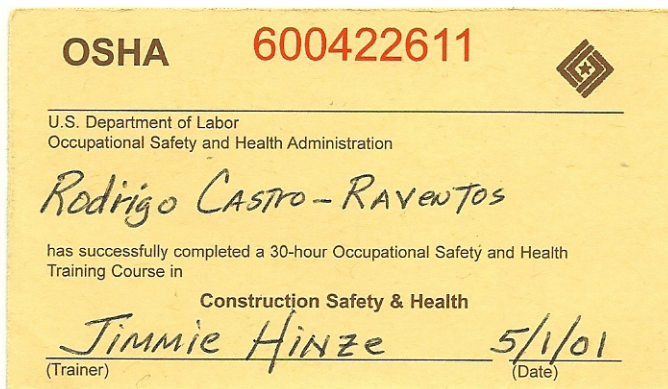
187	Matl187	GYP OR PLAS BOARD,1/2IN	No	0.4533	0.0417	0.0920	50.00	0.2000	<input type="checkbox"/>
72	Matl72	AIR LAYER, 3/4IN OR LESS, VERT. WALLS	Yes	0.9000					<input type="checkbox"/>
23	Matl23	6 in. Insulation	No	20.0000	0.5000	0.0250	5.70	0.2000	<input type="checkbox"/>
4	Matl4	Steel siding	No	0.0002	0.0050	26.0000	480.00	0.1000	<input type="checkbox"/>
271	Matl271	2x4@24" oc + R21 Batt	No	19.8893	0.5569	0.0280	7.11	0.2000	<input type="checkbox"/>
80	Matl80	AIR LAYER, 4IN OR MORE, HORIZ. ROOFS	Yes	0.9200					<input type="checkbox"/>

Constructs Used

No	Name	Simple Construct	Massless Construct	Conductance [Btu/h.sf.F]	Heat Capacity [Btu/sf.F]	Density [lb/cf]	RValue [h.sf.F/Btu]	
1060	Metal siding/furring/2x4@24"+R21 Batt/1/2"Gyp	No	No	0.05	1.45	13.99	21.2	<input type="checkbox"/>
	Layer	Material No.	Material	Thickness [ft]	Framing Factor			
	1	4	Steel siding	0.0050	0.000			<input type="checkbox"/>
	2	72	AIR LAYER, 3/4IN OR LESS, VERT. WALLS		0.000			<input type="checkbox"/>
	3	271	2x4@24" oc + R21 Batt	0.5569	0.000			<input type="checkbox"/>
	4	187	GYP OR PLAS BOARD,1/2IN	0.0417	0.000			<input type="checkbox"/>

No	Name	Simple Construct	Massless Construct	Conductance [Btu/h.sf.F]	Heat Capacity [Btu/sf.F]	Density [lb/cf]	RValue [h.sf.F/Btu]	
1061	PV/Air/Metal roof/10" Batt in trusses/1/2"Gyp	No	No	0.03	1.85	13.15	34.7	<input type="checkbox"/>
	Layer	Material No.	Material	Thickness [ft]	Framing Factor			
	1	4	Steel siding	0.0050	0.000			<input type="checkbox"/>
	2	23	6 in. Insulation	0.8330	0.000			<input type="checkbox"/>
	3	187	GYP OR PLAS BOARD,1/2IN	0.0417	0.000			<input type="checkbox"/>
	4	80	AIR LAYER, 4IN OR MORE, HORIZ. ROOFS		0.000			<input type="checkbox"/>
	5	264	ALUMINUM, 1/16 IN	0.0050	0.000			<input type="checkbox"/>

APPENDIX F: PROOF OF OSHA CERTIFICATIONS



APPENDIX G: FORKLIFT AND CRANE SPECIFICATIONS

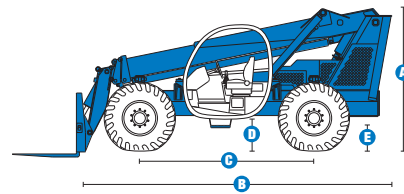
HIGH REACH ROUGH TERRAIN TELEHANDLER

GTH™-844



Specifications

MODEL	GTH™-844	
MEASUREMENTS	US	Metric
Maximum lift height	44 ft	13.41 m
Reach	27 ft	8.23 m
Reach at maximum height	3 ft 6 in	1.07 m
A Height, stowed	8 ft 11 in	2.72 m
B Length, stowed (without forks)	20 ft	6.10 m
Width	8 ft 6 in	2.59 m
C Wheelbase	10 ft 10 in	3.30 m
D Ground clearance, center	1 ft 5 in	0.43 m
E Ground clearance, axle	1 ft 5 in	0.43 m
Fork cross section	2 x 4 in	51 x 101 mm



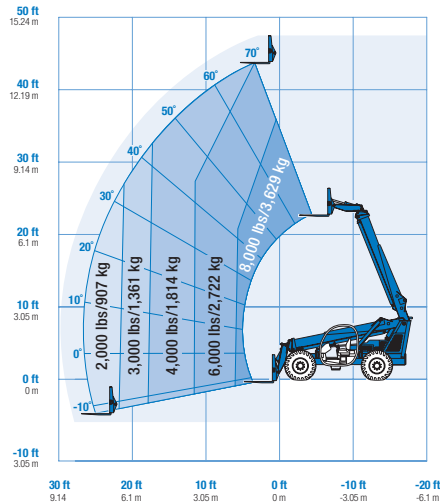
PRODUCTIVITY		
Maximum lift capacity	8,000 lbs	3,629 kg
Lift capacity at maximum height	6,000 lbs	2,722 kg
Lift capacity at maximum reach	2,000 lbs	907 kg
Drive speed	17 mph	27.4 km/h
Boom up/down	15/11 seconds	15/11 seconds
Boom extend/retract	18/14 seconds	18/14 seconds
Draw bar pull	19,200 lbs	8,709 kg
Turning radius, outside (4WS)	14 ft 9 in	4.50 m
Auxiliary hydraulic flow	3-7 gpm	11-26 lpm
Auxiliary hydraulic pressure	3,000 psi	207 bar
Tires, standard size	13 x 24 in, 12 ply	

POWER	
Power source	Perkins 1104C-44T turbo-charged diesel 99 hp (73.8 kW) John Deere 4045TF270 4 cylinder turbo-charged diesel 99 hp (73.8 kW) Deutz BF 4 2012 99 hp turbo-charged diesel
Electrical system	System voltage 12 volt Alternator 95 amp Battery 1000 CCA at 0°F (-18°C)
Hydraulic tank capacity	34 gal / 129 L
Hydraulic system capacity (w/tank)	50 gal / 189 L
Fuel tank capacity	30 gal / 114 L

WEIGHT	
Weight*	22,500 lbs / 10,206 kg

STANDARDS COMPLIANCE ASME B 56.6, ISO 3471, ISO 3449

LOAD CHART GTH™-844**



* Weight will vary depending on options and/or country standards.
 ** Load ratings vary depending on attachment.

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 **TEREX | DEMAG**

AC 80-2 | All Terrain Crane 80 t Lifting Capacity



AC 80-2
ALL TERRAIN CRANE

Bigge



This information is for reference use only. Operators manual should be consulted and adhered to.
Please contact Bigge Crane and Rigging Co. at 888-337-BIGGE or email info@bigge.com for further information.



Bigge

APPENDIX H: SPILL CONTAINMENT EQUIPMENT & SPECIFICATIONS



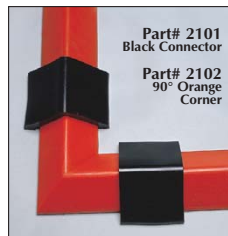
Temporary Berm Seals Off Spills From The Environment, Nearby Drains And Doorways



Part# 2100

- Standard 10-foot sections can be cut to various lengths to meet custom needs.
- Unique, urethane material “weeps” into small cracks and crevices to seal off liquid flow.
- Spill Berm is non-absorbing and is easily cleaned for repeated use.
- Applications include:
 - Spill response
 - Temporary secondary containment
 - Sealing off of doorways during washdown operations
- Flexible Ultra-Spill Berm will bend and turn to form almost any shape while temporarily “bonding” to any smooth surface.
- **Helps comply with NPDES and SPCC.**

ULTRA-SPILL BERM
Part# 2100: Orange • Part# 2050: Black
Dimensions: 10' x 4" x 2 1/4" (3,048 mm x 102 mm x 58 mm)
Weight: 31 lbs. per unit (14 kg)
Material: Non-absorbing polyurethane
Optional Connectors (Part# 2101) used to connect 10' (3,048 mm) sections
Optional Corners (Part# 2102) are used with Connectors to make 90° corners
Optional Carrying Case (Part# 2104)



Part# 2101
Black Connector
Part# 2102
90° Orange
Corner

Decide what shape or configuration is required and use optional Connectors and 90° Corners to complete the area.



U.S. Patent No. 5,236,281



Taller Spill Berm Helps Contain or Divert Larger Volume Spills

- Flexible polyurethane construction is non-absorbent and chemical resistant — easily cleans with soap and water for repeated uses.
- Built-in connectors allow multiple 5-foot units to be quickly and easily connected.
- **Helps comply with NPDES and SPCC.**

ULTRA-SPILL BERM PLUS
Part# 2054
Dimensions: 5' x 4" x 4 1/2" (1,524 mm x 102 mm x 114 mm)
Weight: 16 lbs. (7 kg) per unit
Material: Non-absorbing polyurethane



Part# 2054



U.S. Patent No. 5,236,281

UltraSpill Berm-Low Profile®

Non-Absorbing Berm Stops Machine Leaks From Spreading



- 1 3/8" tall berm contains leaks, reduces slip hazards.
- Allows quick and easy cleanup or recycling of liquids.
- Flexible, urethane design will bend to follow any curve or angle needed.

Part# 2052

U.S. Patent No. 5,236,281

ULTRA-SPILL BERM-LOW PROFILE
Part# 2052
Dimensions: 10' x 2 1/4" x 1 3/8" (3m x 58 mm x 35 mm)
Weight: 13 lbs. (6 kg) per unit
Material: Non-absorbing polyurethane



Interlocking end joints help create longer lengths and are self-sealing.

UltraSpill Table Top Spill Berm®

Capture Small Spills Before They Hit The Floor!

- 3/4" tall "mini berm" bends to form any shape.
- Non-absorbing urethane design allows easy clean up.
- Designed for use in laboratory, research, medical and industrial applications.

ULTRA-TABLE TOP SPILL BERM
Part# 2051
Dimensions: 4' x 1" x 3/4" (1,220 mm x 25 mm x 19 mm)
Weight: 2 lbs. (1 kg) per unit



Part# 2051

U.S. Patent No. 5,236,281

Ultra Containment Berms®

Economy Model

Economical Design Offers Cost Savings And Secure Containment

- L-shaped aluminum brackets provide sturdy sidewall support
- Easy assembly — Brackets are quickly and easily inserted into sleeves spaced around perimeter of Berm
- No frames, components or excess material outside of sidewalls — excellent for use inside storage sheds and other buildings or structures where floor space is a premium.
- Meets SPCC and EPA Container Storage Regulations 40 CFR 264.175.



Compact shipping and storage — with frames removed, Berm requires very little space (10' x 10' unit shown).



ULTRA-CONTAINMENT BERMS, ECONOMY MODEL

Part#	Dimensions	Weight	Containment Capacity
8250	4' x 6' x 1' (1.2 m x 1.8 m x .3 m)	21 lbs. (9.5 kg)	179 gallons (678 L)
8251	6' x 6' x 1' (1.8 m x 1.8 m x .3 m)	26 lbs. (12 kg)	269 gallons (1,018 L)
8252	10' x 10' x 1' (3.0 m x 3.0 m x .3 m)	52 lbs. (23.5 kg)	748 gallons (2,831 L)
8253	12' x 60' x 1' (3.7 m x 18.3 m x .3 m)	268 lbs. (121.5 kg)	5,385 gallons (20,382 L)
8254	15' x 50' x 1' (4.6 m x 15.2 m x .3 m)	259 lbs. (117.5 kg)	5,610 gallons (21,234 L)
8255	15' x 66' x 1' (4.6 m x 20.1 m x .3 m)	334 lbs. (151.5 kg)	7,405 gallons (28,028 L)

Material of Construction: Copolymer 2000™ an ethylene copolymer, is standard. Copolymer 3000™, XRS, polyurethane and other materials are also available on a custom basis.
 Options: Ground Tarps, Track Belts, Pull Over Covers. Self Bailer, see page 31.

Ultra Drum Lifter®



ULTRA-DRUM LIFTER

Part# 0409
Load Capacity: 1,000 lbs. (455 kg)
Weight: 20 lbs. (9 kg)

- Securely grips 55 gallon steel drums when loading and unloading salvage drums.
- Rugged, all-steel construction.

Ultra Drum Tipper®



ULTRA-DRUM TIPPER

Part# 0851
Dimensions: 11 1/2" x 11 1/2" (292 mm x 292 mm)
Weight: 3 lbs. (1.5 kg)



- Residual liquids flow to one side of drum for efficient pumping — valuable chemicals can be used, not wasted.
- Durable, all polyethylene construction — designed for use with 30 gallon or 55 gallon drums.

Teal-Sorb EQ General All Purpose Absorbent

<http://www.teal-sorb.com/teal-sorbeq.html>



Teal-Sorb EQ All Purpose Absorbent

TEAL-SORB EQ All Purpose Absorbent is the most popular of the Teal-Sorb product line. **Teal-Sorb EQ** is a general, all purpose absorbent that is great for cleaning up oil spills, greases, diesel fuel spills, gasoline, racing fuels, antifreeze, inks & dyes, solvents, pesticides, alcohols, aldehydes, acids (except Hydrofluoric Acid), caustic soda, aromatic hydrocarbons, paints, blood, vomit, urine, stool, polymer monomers, mercury, and much more.

Unlike clay, cellulose, polypropylene, and other agricultural based solutions such as Oil-Dri, TEAL-SORB is designed to bring virtually any liquid into its structure and "lock" it away.

Teal-Sorb is non-toxic and passes all regulatory guidelines such as paint filter test when properly applied. Use of TEALSORB, will greatly reduce your overall cost of reclamation by having the lowest treatment dosages obtainable, lowest overall mass to landfill, reduced trucking rates and will lead to the quickest clean up time.

					
Part#37WTS0 Teal-Sorb EQ - 1 Gallon Bag	Part#37WTS1 Teal-Sorb EQ - 1 Gallon Shaker	Part#37WTS2 Teal-Sorb EQ - 2 Gallon Bag	Part#37WTS3 Teal-Sorb EQ - 5 Gallon Bag	Part#37WTS4 Teal-Sorb EQ - 5 Gallon Pail	Part#37WTS5 Teal-Sorb EQ - 30 Gallon Fiber Drum

For More Information email sales@teal-sorb.com

Teal-Sorb Video



Spill Apply Mix Dispose

TEAL-SORB Usage Instructions:

TEAL-SORB is best applied to a spill by opening the container on or near the ground next to the spill. With a stiff bristle brush or broom, push TEAL-SORB into the spill. Brush back and forth over the spill in a circular motion until the spill is removed. Should more fluid or residue be present, add more TEALSORB to the area and repeat the process. Absorbed product must then be disposed according to local, state, federal, and international regulations and guidelines. The application of TEAL-SORB in extreme wind conditions should be avoided due to the lightweight properties of the product. **NOTE ABOUT COMBUSTIBLE & FLAMMABLE LIQUIDS:** When absorbing any flammable or combustible liquid, TEAL-SORB will greatly reduce the vapor trail associated with that liquid. TEAL-SORB may reduce the ability of the absorbed liquid to ignite or explode but will not prevent it completely. Use plenty of absorbent on such spills. After such liquids are absorbed, store in an appropriate container, outside, and with good ventilation. Add plenty of water to the container to greatly reduce the risk of fire or an explosion. Should a fire break out after TEAL-SORB has absorbed a flammable liquid, plenty of water may be used to successfully extinguish the flames. For routine absorption of flammable and combustible liquids, TEAL-SORB FR must be used (Product Patent Pending)! TEAL-SORB FR has "fire resistant" properties and is much safer to use on combustible & flammable liquid spills. *Never absorb Hydrofluoric Acid with any TEAL-SORB product. **Warranty Disclaimer:** Because conditions of use are beyond our control, no representation of warranty is made in connection with the use of this product. Technical information and recommendations

Teal-Sorb EQ General All Purpose Absorbent

<http://www.teal-sorb.com/teal-sorbeq.html>

Also Available:



Teal-Sorb EQ
All Purpose Absorbent



Teal-Sorb FR
Fire Retard Absorbent



Teal-Sorb SR
Disinfecting Absorbent



Teal-Sorb AC
for Acidic Spills



Teal-Sorb BS
for Base or Alkaline
Spills



Spill Kits



**Super Absorbent Teal
Pillows**



Absorbent Pads & Rolls



**Teal Absorbent Socks &
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APPENDIX H: 3RD PARTY TESTING OF ELECTRONIC EQUIPMENT

**SD 2011 – Team Florida
 July 18, 2011**

Nationally Recognized Testing Laboratories (NRTL) Analysis – Flexhouse

Table: Nationally Recognized Testing Laboratories (NRTL) Analysis per Specification

Section #	Description	Item	NRTL
11 31 00	Appliances	1. Bosch Induction Cooktop NIT8065UC 2. Bosch Single Wall Oven HBN5450UC 3. Bosch Downdraft DHD3014UC 4. Bosch Dishwasher SRX53C15UC 5. Bosch Washing Machine WAS20160UC 6. Bosch Dryer WTV76100US	1. CSA 2. CSA 3. CSA, UL 4. CSA, UL 5. UL, VDE 6. CSA, UL
26 50 00	Lighting	1. Lithonia Reality 6 REAL6D6MWUSSQ 2. IKEA Godmorgon Vanity Light 901.921.70 3. IKEA Jansjo Work lamp 101.287.34 4. IKEA Jansjo Clamp Spotlight 501.287.13 5. IKEA Vate Floor lamp 801.620.03 a. With Sparsam E26 Bulb 700.403.71 6. IKEA Dioder Multipurpose Lighting 001.194.24 7. IKEA Inreda Spotlgiht 101.921.07 8. IKEA 365+ Lunta 101.411.46 a. With Sparsam E26 Bulb 700.403.71 9. IKEA Vate Pendant Lamp Shade with Hemma Cord 101.758.10 10. IKEA Samtid Floor Lamp 801.521.17	1. CSA 2. UL-1598, CSA C22.2 No.250 3. UL-153, CSA C22.2 No. 12 4. UL-153, CSA C22.2 No.12 5. UL-153, CSA C22.2 No.12 a. UL-1993, CSA C22.2 No 74 6. UL-153, CSA C22.2 No. 12 7. UL-153, CSA C22.2 No. 12 8. UL-1598, CSA-C22.2 No. 250 a. UL-1993, CSA C22.2 No 74 9. UL-153, CSA C22.2 No. 12 10. UL-153, CSA-C22.2 No. 12