



U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON 2011  
Team SCI-Arc/Caltech

# CHIP

COMPACT HYPER\_INSULATED PROTOTYPE

## Project Manual

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## Summary of Changes

Section 11: The garbage disposal was added, and other appliances (washer, dryer) were updated to the final equipment selections.

Section 21: The fire suppression system was updated to reflect the new PEX loop system, as designed by Uponor.

Section 22: PVC wastewater lines were removed because all wastewater lines in the house are ABS. Plumbing fixtures were also substantially changed to reflect the final equipment selection. Greywater and rainwater irrigation equipment was also added.

Section 23: Sensors were updated to reflect final equipment, and additional HVAC controls were added.

Section 32: New rainwater and grey water irrigation systems have been added.

Water budget: The budget has been updated to reflect the need to fill a thermal storage tank and rainwater tank in the period between the initial fill and the secondary top-off fill.

### Rules Compliance Checklist

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 4-2	Construction Equipment	Assembly Sequence Plans Departure Sequence Plans	O-101 → O-103 (amended to new site)
Rule 4-2	Construction Equipment	Construction Equipment Schedule	O-102
Rule 4-3	Ground Penetration	Ground Penetration- 2 grounding rods	E-103
Rule 4-4	Impact on the Turf	Foundation Plan Foundation Sections Foundation Detail Deck Details Load Bearing	A-311, A-312, S-101, S-201, S-502 L-102, L-103 S-101, structural calcs
Rule 4-5	Generators	Construction Equipment Schedule	O-102, H-101
Rule 4-6	Spill Containment	Liquid Location and Spill Containment Plan	H-101
Rule 4-6	Spill Containment	Schedule of Liquid Containment Devices	H-101
Rule 4-7	Lot Conditions	Foundation Plan_Elevation Change	S-502 (Detail Q)
Rule 4-7	Lot Conditions	Foundation Plan_Elevation Change	S-502 (Detail Q)
Rule 5-2	Solar Envelope Dimensions	Solar Envelope Compliance Elevations	A-201, A-202
Rule 5-2	Solar Envelope Dimensions	No Exemptions	
Rule 6-1	Structural Design Approval	Structural Drawing Set	S-101 → S902
Rule 6-2	Finished Square Footage	Finished Square Footage Compliance Plan	G-301

Rule 6-2	Finished Square Footage	No operable features will alter square footage	
Rule 6-3	Entrance and Exit Routes	ADA Tour Route Compliance Plan	G-302
Rule 7-1	Placement	Not currently applicable	
Rule 7-2	Watering Restrictions	Not currently applicable	
Rule 8-1	PV Technology Limitations	Solar Plan PV Wiring Plan Three-Line Diagram	A-112 E-103 E-602
Rule 8-3	Batteries	Not currently applicable	
Rule 8-3	Batteries	Not currently applicable	
Rule 8-4	Desiccant Systems	Not currently applicable	
Rule 8-4	Desiccant Systems	Not currently applicable	
Rule 8-5	Village Grid	Included in project manual	
Rule 8-5	Village Grid	Electrical Distribution Plan Exterior Connection Plan	E-101, E-102 E-103
Rule 8-5	Village Grid	Electrical Distribution Plan 3 Line Diagram	E-101 E-602
Rule 8-5	Village Grid	One-line electrical diagram	E-601
Rule 8-5	Village Grid	Calculation of service/feeder net computed load per NEC 220	
Rule 8-5	Village Grid	Exterior Connection Plan	A-202
Rule 8-5	Village Grid	Exterior Connection Plan	A-202
Rule 9-1	Container Locations	Liquid Location and Spill Containment Plan	H-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	A-202 (see sheet notes for shading of tanks)

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	Refrigerant only-see Division 23 of specifications in Project Manual
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### Structural Calculations

See attached Appendix I (Attached)

### Detailed Water Budget

Day	Competition	Hot Water (gal)	Cold Water (gal)
10	Clothes Washer	-	13.14
	Dishwasher	5.3	-
	Cooking	-	1
	Hot Water Draw	15	-
	<b>Total</b>	<b>18.3</b>	<b>14.14</b>
11	Clothes Washer		13.14
	Hot Water Draw (2)	30	
	<b>Total</b>	<b>30</b>	<b>13.14</b>
12	Clothes Washer		13.14
	Hot Water Draw (2)	30	
	Cooking		1
	Dishwasher	5.3	
	<b>Total</b>	<b>35.3</b>	<b>14.14</b>
13	Hot Water Draw (3)	45	
	Dinner Parties		5
	<b>Total</b>	<b>45</b>	<b>5</b>
14	Clothes Washer (2)		26.28
	Dishwasher	5.3	
	Hot Water Draw (2)	30	
	<b>Total</b>	<b>35.3</b>	<b>26.28</b>
15	Cooking		1
	Dinner Parties		5
	Hot Water Draw (2)	30	
	<b>Total</b>	<b>30</b>	<b>6</b>
16	Dishwasher	5.3	
	Hot Water Draw (2)	30	

	Clothes Washer (2)		26.28
	<b>Total</b>	35.3	26.28
17	Dishwasher	5.3	
	Clothes Washer		13.14
	Cooking		1
	Hot Water Draw (2)	30	
	<b>Total</b>	35.3	14.14
	Thermal Storage Tank		120
	<b>Competition Total</b>	264.5	260.4

<b>Water Budget Total</b>	<b>Gallons</b>
House Usage	404.9
Thermal Storage Tank	120
Rainwater Tank	90
<b>Total</b>	614.9

<b>Tank Level Summary</b>	<b>Gallons filled</b>
Initial fill	+615
Thermal Storage Tank	-120
Rainwater Tank	-90
Top off	+145
<b>Final</b>	550

**Initial fill requested:** 615 gallons

**Top-off fill requested:** 145 gallons

## Summary of Unlisted Electrical Components

Please note: All electrical components are listed.

## Article I. Summary of Reconfigurable Features

### Fold out end walls

Located at the south aperture of the house, these two fold-in walls are able to live in two positions. In the open position they allow for the large southern exposure to be open to the exterior terrace. Within the home, these walls have the ability to further transform themselves by opening up to allow access and usability to the services beyond. In the closed position, these walls serve to black out the living room space (for privacy, movie night, study night, etc) and to provide further thermal protection on cold nights.

### Pull out Furniture

Living in the stowed position, the furniture of the house always has a place to hide. Intelligently and precisely fit into the east wall, each piece of furniture can be removed from its hiding place when needed to activate the space. The living room features emerge from the wall to create a comfortable, flexible living area while the space that the furniture is removed from is activated to become a living space of its own. The dining room furniture tucks away neatly when not in use as well. The spaces below the floor and in the wall are utilized for optimal use of space. Similarly, the dressing/bedroom space is fitted with pullout features to maximize the amount of storage space while allowing for the ability to “put the bedroom away” and clear the platform for alternative activities.

## Article II. Interconnection Application Form

Team SCI-Arc/Caltech – Lot 402

Module Manufacturer	Short Description of Array	DC Rating of Array
Hanwha Solarone SF-160-M190	12 modules flat and parallel to roof 30 modules at a 15° tilt and parallel to roof	7980 W

Total DC power of all arrays is 8.0 kW

### INVERTERS

Inverter Manufacturer	Model Number	Voltage	Rating	Quantity
SMA America	SB7000US	561.8 V	7 kW	1

Total AC power of all inverters is 7.0 kW

1. Three-Line Electrical schematic – E602
2. Calculations of service/feeder net computed load and neutral load – E602, E603
3. Plan Views – A112 and E103

### Maximum String Length:

Voc: 44.8 V

Correction factor for Washington DC: 1.14

$$44.8 \text{ V} * 1.14 = 51.1 \text{ V}$$

$$600 / 51.1 = 11.8$$

At most we can have 11 modules in a string to remain below 600V, the maximum voltage of the modules in series.

### Wire Size:

Module Isc: 5.78 A

Correction factor required: 1.56

$$5.78 \text{ A} * 1.56 = 8.86 \text{ A}$$

Each string will require a conductor that can handle 9 A; 10AWG wire is more than sufficient to meet this requirement.

Inverter max output: 29 A

$$29 \text{ A} * 1.56 = 45.2 \text{ A}$$

The appropriate wire size for the <4 foot run from inverter to main load center is #6AWG. A 45A backfeed capable breaker shall be used.

**Engineering Strategy and Energy Analysis of CHIP**  
**SCI-Arc/Caltech Solar Decathlon 2011**

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## Executive Summary

The house is designed from the start to be attractive, efficient, and net-zero-energy. We realize that to our potential homeowners, nothing is more important than having a home that reliably generates as much energy as it consumes. We set out to design a house that lives like a home, but functions like a well-tuned car. To achieve our goal, we follow an overall engineering strategy by adhering to a rigorous energy budget, optimizing each design choice based on energy efficiency and cost, testing and prototyping every engineering system, and intelligently monitoring and controlling the house energy usage.

Our house runs entirely on solar power from the photovoltaic panels on the roof. To ensure that the house is reliably energy-net-zero without sacrificing the comfort and the normal lifestyle of the homeowner, extensive modeling of photovoltaic (PV) panels and analysis of weather patterns were done to determine the optimal PV selection. We selected a 7.8 kW system that ensures net-zero-energy over 90% of the time. In addition to generating electricity, the house is filled with technologies that reduce its energy footprint. One innovative technology inside our house is the thermal integration between the HVAC heat pump, which extracts heat from the interior of the house, and the domestic hot water heat pump, which dumps heat into hot water. By using the waste heat from our air-source heat pump to heat our hot water, we can realize tremendous energy savings while fully satisfying air conditioning and hot water demands. The electrical system of the house is highlighted by the prevalent use of day lighting and judicious selection of consumer electronics and appliances. The lighting strategy takes maximum advantage of day lighting and satisfies nighttime lighting using efficient LED's and CFL's. The wide range of consumer electronics and appliances selection not only covers basic amenities, such as refrigeration and laundry washing, but offers homeowners the latest technology in home entertainment and comfort. A sophisticated home automation system monitors every watt of electricity consumed and visually communicates the information to homeowners. It also plays a central role in optimizing the behavior of the house at all times, such as by controlling operation of the active thermal mass, shutting down appliances or lights that are no longer used, and of course giving the homeowners an instant understanding of how their own behaviors affect their energy use and in turn their energy bill.

## Article III. Systems Overview

A house is someone’s home, the place where one expects comfort, privacy, peace, and other mental images that one would associate with the word ‘home’. Now, we are striving to add an additional image - a zero-dollar electricity bill. The house that we are building is not just any home, but an appealing, efficient, and net zero-energy home. We realize from the beginning that to a potential homeowner of our house, nothing is more important than having a home that reliably generates as much energy as it consumes. To achieve that, the house has to be designed and developed as a single system.

How do we do that? First, we follow a rigorous energy budget. From the start of the design process, we ensured that not a single watt of electricity will be expended without been accounted for, so we can ensure that there will be sufficient energy generation for the house to be energy-net-zero under practically all weather conditions. Next, we optimize. Every design choice is informed by energy analysis and simulation. We made sure that we did not design just an energy-net-zero house, but also an ultra-energy efficient house. Finally, we monitor and control. Extensive computing software and control backbones are integrated into the house for two specific reasons – to monitor and effectively communicate to the homeowners how much energy the house is consuming and producing; and to allow homeowners to intuitively and intelligently control how energy is used by the house at all times.

### Section 3.01 1.1 Net-Zero Energy

Whether a house can achieve energy-net-zero depends upon various factors, namely the weather climate in which the house resides and the energy consumption habits of the homeowners. To design a net-zero-energy house is to identify those factors, and fulfill the various consumption needs. Our house is designed for a couple living at the LA urban area. However, it must also compete at Washington D.C satisfying previously specified consumption tasks. Those are two sets of different energy demands and generations. In the ensuing energy analysis discussion set forth, graphs, tables, and numbers represent consumption or generation analysis for a 9-day period during September at Washington D.C.

To effectively account for the energy usage and production of the house from the beginning of and throughout the design process, an energy budget for each subsystem is created. The energy specification is based upon energy usage estimation of the most current baseline design of a subsystem. All energy specifications are given as an average in the unit of kWh/day, where the average is defined as

$$\frac{\sum_{i=1}^n \text{Energy}_i}{n} = \text{Average Energy}$$

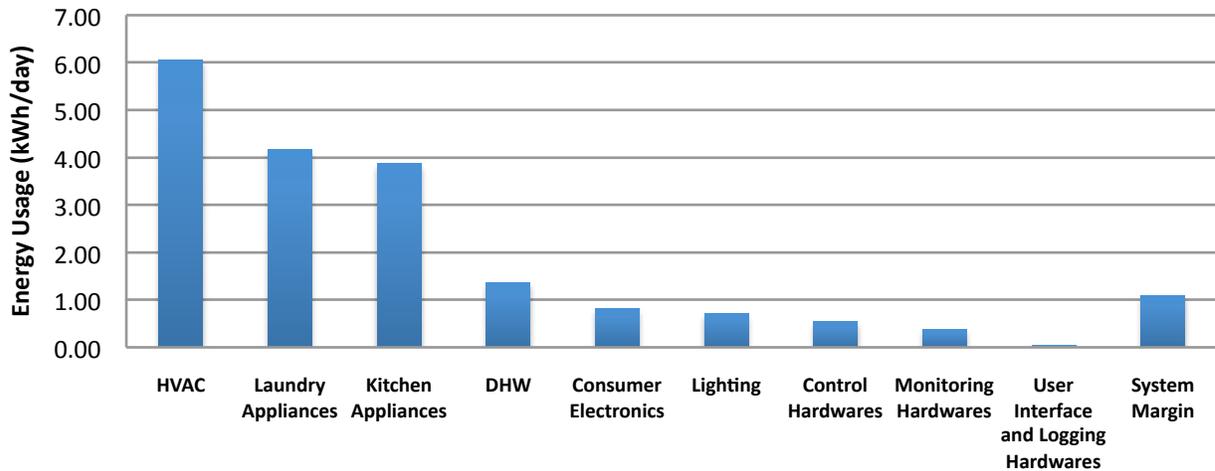


Figure 1. Energy Budget, version 1.5

The energy budget represents the uppermost limit that the energy consumption of a particular system can be. It serves two functions. First, it specifies and tracks the designed energy usage of each component of the house during development phase. The energy specification in turn encourages innovations within subsystem to meet the specified energy consumption limit. Second, it internalizes the uncertainty and fluctuation of the energy consumption of each subsystem to ensure net-zero energy performance overall.

The uncertainty and risk are manifested as margins at both the subsystem level and the system level. Figure 1 shows the system margin bar. Part of the system margin accounts for the potential increase in HVAC energy consumption if the thermal mass fails. While subsystem margins are not shown in figure 4, they play an integral part in determining the overall energy consumption of the house. For example, on top of the 6.0 kWh/day of budget currently assigned to HVAC, there exists a 29% margin accounting for weather uncertainty and performance uncertainty. Taking into account each subsystem's margin, the overall energy consumption of the house is broken down as shown in figure 2.

The total net energy consumption of the house is 21 kWh/day, and corresponding amount of energy generation needed to reach net-zero is sized to be 24 kWh/day. The extra generation tab takes into account of weather fluctuations and other uncertainties. Further analysis done to reach the consumption and production number is discussed in more detail in section 2 and 3. In addition to engineering for a net-zero-energy house as a system through the energy budget, we also engineer for an energy efficient house through simulation and analysis.

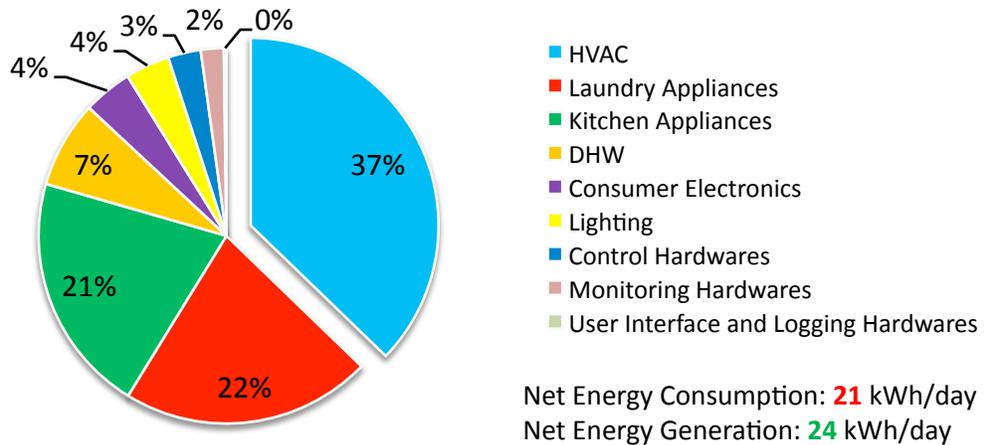


Figure 2. Energy Consumption Breakdown, version 1.5

### Section 3.02 1.2 Optimization

Energy analysis software such as DOE 2.2, Trane Trace, and Solar Advisor Model (SAM) are instrumental in analyzing and optimizing design decisions made for the house. Architecture decisions on window size, insulation thickness, PV placement, etc are made after conducting thorough sensitivity analysis and physically modeling using various software. In short, we designed a house to use the least amount of energy and do the most with them.

### Section 3.03 1.3 Monitoring and Control

While energy budget, optimization, and validation are necessary to design a house that would be an efficient net-zero-energy house, monitoring and control ensure that the house would perform as a net-zero-energy house. Monitoring serves the primary function of not only interfacing energy consumption and production data with the homeowner, but also communicating necessary information to the relevant control hardware. Extensive control infrastructure in the house relates all areas of the house, from HVAC to home electronics, to a central decision maker that decides the optimal way to operate the house that maintains net-zero without compromising performance. Monitoring and control give the homeowners the necessary tools to in real time observe and affect the energy behaviors of their house, much like they can with their cars.

## Article IV. 2. Energy Consumption

The designs of all subsystems that consume electricity are driven by an energy specification set out in the budget. Designs are chosen for optimal efficiency and cutting-edge innovations. They are also tightly integrated with control systems to allow homeowners to actively manage their energy consumption. The following section details the choices, analysis and modeling that inform the design decision of the mechanical, electrical and computing system.

### Section 4.01 2.1 Air Conditioning and Hot Water

#### (a) 2.1.1 Goals and Challenges

All mechanical systems in our house design have been selected to optimize the tradeoff between energy savings and cost of added photovoltaic (PV) energy generation. The HVAC (heating, ventilation, and air conditioning) and DHW (domestic hot water) systems have been designed from the ground up to maximize occupant comfort and energy savings at minimum cost. Using extensive software modeling and theoretical work, we have identified and fully leveraged the most promising sources of energy savings. The overall design of the house has been optimized for the Southern California target market. Because of the mild and sunny weather in our target market throughout the year, our design choices should perform well without any significant issues.

#### (b) 2.1.2 Design

##### (i) 2.1.2.1 Integrated Domestic Hot Water and HVAC System

The core of our system is a 120-gallon thermal storage water tank, sized for both optimum storage of thermal energy and heat transfer between our mechanical systems. The HVAC system consists of a Mitsubishi ductless heat pump, which consists of the MXZ-2B20NA outdoor unit and two MSZ-FE09NA fan coil units totaling 1.5 tons in cooling capacity. This off-the-shelf system boasts both remarkably high energy efficiency due to its variable-speed compressor and appropriate sizing relative to the thermal load of our house. The DHW system consists of a 38-gallon Rheem electric resistive water tank retrofitted with an AirGenerate heat pump water heater, which was selected over solar thermal systems to maximize PV roof area and minimize system costs. This was chosen because of a conscious realization that electrical energy is more easily stored and widely utilized than thermal energy throughout the year. In addition, cooling loads dominate mechanical energy consumption in the hot California climate, which reduces the effectiveness of solar thermal technology when that hot water cannot be used for radiant heating.

The primary innovation in our mechanical design came about by identifying thermal synergies between systems and by applying energy-efficient commercial technologies to residential-scale systems. Central to our design is a thermal integration between our HVAC heat pump, which extracts heat from the interior of the house, and our DHW heat pump, which dumps heat into hot water. By using the waste heat from our air-source HVAC heat pump to heat our hot water, we can realize tremendous energy savings.

As this happens, the daytime energy consumption of the HVAC system drops substantially because of two factors:

- The condenser fan does not need to operate much because most heat is being dumped into the thermal storage tank and not through the condenser.
- The variable speed compressor in the ductless heat pump HVAC system can run more slowly because of the increased cooling capacity of a refrigerant-to-water heat exchanger.

Furthermore, because the thermal storage tank is being heated to a high temperature during the day, it can also preheat municipal water intended for DHW usage. Any residual DHW loads will be made up by our energy-efficient DHW heat pump. At night in California, the ambient temperature drops significantly, and cooling loads usually disappear.

When the house needs to be heated (rare in California), there is no longer any synergy between the HVAC and DHW systems. Thus, the thermal loop between the HVAC outdoor unit and the thermal storage tank ceases operation, so the thermal tank no longer preheats the DHW. All DHW heating loads are covered by the DHW heat pump system, and any HVAC heating loads will be covered by the high-efficiency ductless heat pump system in the house.

All functions of the HVAC and DHW systems have been integrated seamlessly into a custom-designed home automation system. A homeowner is able to use a variety of touchscreen devices to control every aspect of the HVAC system, from the air conditioner to the ventilation fans. On the back end, a sophisticated thermal control system, integrated into the home automation system and seamless to the user, constantly monitors important parameters of the system. Customized algorithms, created based on both modeling and prototyping data, control the operation of the integrated HVAC/DHW system and automatically keep the system running at peak efficiency.

#### (ii) 2.1.2.2 Ventilation

In addition, our ventilation strategy also focuses on optimizing occupant comfort in the Californian climate at minimum cost. A whole-house fan can push a complete air change through our house in less than twenty minutes, thus taking advantage of the large diurnal temperature variations in California to reduce cooling loads at night. In addition, the whole-house fan also improves indoor air quality by purging the house of stale, humid air. Furthermore, an energy recovery ventilator will introduce fresh air throughout the day with minimal sensible or latent load into the home to maintain indoor air quality. This represents a significant improvement in both comfort and energy efficiency over a poorly sealed home, in which infiltration of unconditioned air into the interior space is the primary form of fresh air intake. In other words, the energy savings of conditioning a house with minimal infiltration far outweigh the additional energy cost of a dedicated ventilation system.

#### (c) 2.1.3 Modeling

Extensive software modeling has been done to ensure that our design choices are optimal for our target market. All thermal modeling has been done in TRACE 700, which is a software package designed by Trane to perform HVAC sizing and energy analysis for complex commercial systems. Because of the flexibility and power of the software, we have been able to input almost all known variables of our system into our model, and as a result, we have gained many useful insights from the software.

Features implemented in the model include: slant and direction of all building surfaces, window orientation and type, insulation thickness, occupant and appliance loads, infiltration, custom weather, ventilation rates, humidity, heat pump HVAC system, ventilation system, and custom schedules. For the purposes of analysis, TMY3 weather data from the NSRDB for Pasadena was used to simulate expected weather conditions for our target market.

**(d) 2.1.4 Analysis**

The software model developed for our house design can be used to perform parametric studies on almost any relevant variable of the design. Variables tested so far include: insulation R-value, window U-factor, window solar heat gain coefficient (SHGC), appliance loads, and weather. Unless otherwise specified, all simulations make use of the TMY3 weather data for Burbank Airport and reflect typical weather conditions in our target market.

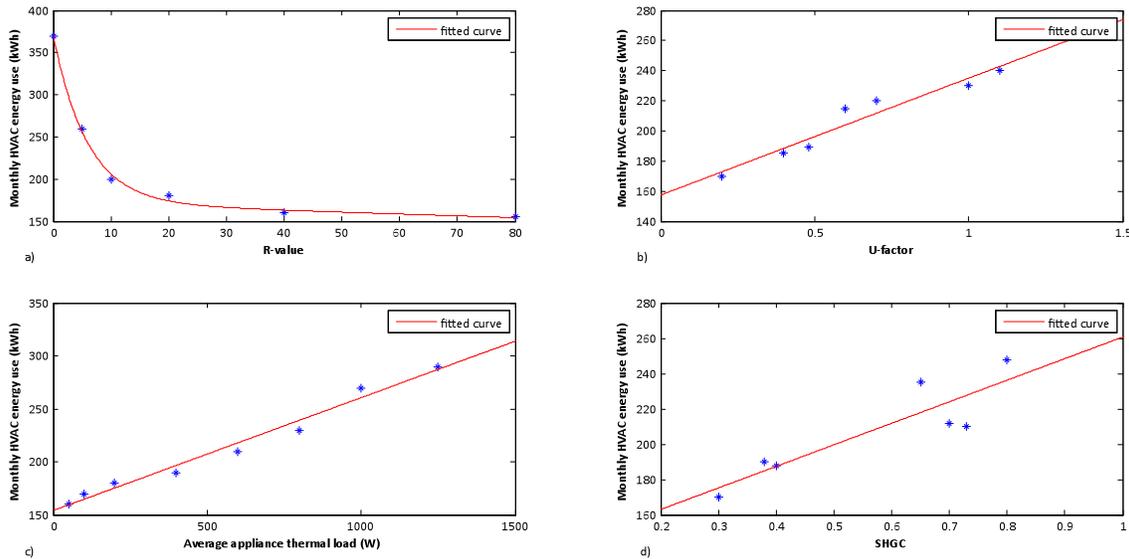


Figure 3. a) R value’s effect on September HVAC energy use. b) Window U-factor’s effect on September HVAC energy usage. c) Appliance load’s effect on September HVAC energy use. d) Window SHGC’S effect on September HVAC usage

Extensive analysis of modeling work on insulation thickness and its effect on HVAC energy consumption was done to determine the optimal R-values for the ceiling, walls, and floor. Because of the mild climate in California throughout the year, we found rapidly diminishing returns for additional insulation and realized that insulating our house to typical Passivhaus or other high-efficiency building standards did not make sense. As a result, we went with R-40 on the walls and ceiling and R-20 on the floor. Along with a well-sealed envelope and a radiant barrier around the entire building shell, this amount of insulation ensures energy efficiency at a minimal cost when balanced against the cost of adding additional PV to power the HVAC system.

Our software analysis also demonstrated a strong correlation between window quality, as defined by U-factor and solar heat gain coefficient (SHGC), and HVAC energy consumption. Despite the limited size of our windows and the substantial south-facing overhang to protect from direct insolation, our analysis still showed the majority of our thermal loads coming from our windows. SHGC is particularly important in the hot California climate for shielding the house from both direct and indirect infrared radiation, so we selected double-pane windows with low-E coatings and strong SHGC numbers.

The analysis was also applied to thermal loads from appliances and other electrical loads inside the house. Because there are very few heating loads throughout the year in California for our house, all appliance loads translate directly into increased cooling loads on the HVAC system. Thus, increased appliance loads lead to increased HVAC energy consumption on a fairly linear basis. We balanced the increased cost of efficient appliances with the cost of additional PV to optimize our appliance selections.

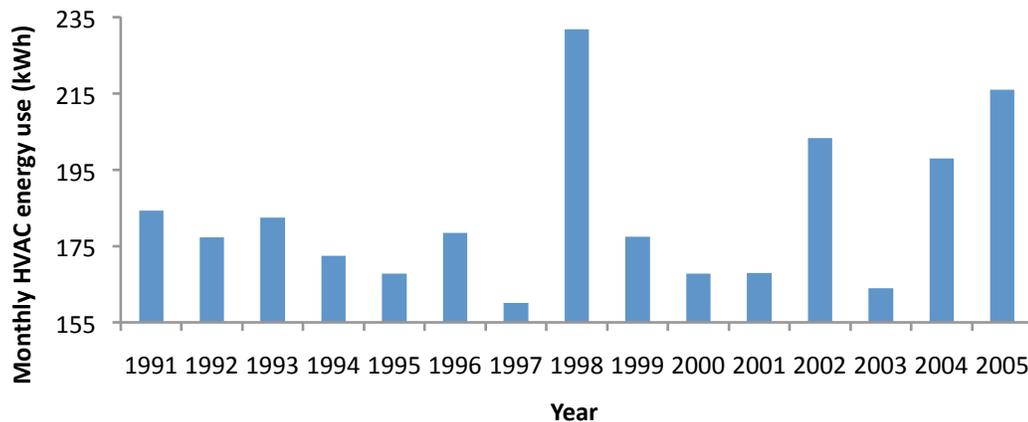


Figure 4. Weather's effect on September HVAC energy use

We assumed that HVAC energy consumption as a function of weather follows a normal distribution; historical data indicates energy consumption with a mean of 6.09 kWh/day and a standard deviation of 0.66 kWh/day. Our energy budgets were designed to accommodate uncertainties of up to two-sigma days, or roughly 23% of the mean energy usage. Statistical weather analysis such as this quantifies uncertainty in the overall energy budget, and ensures that the house performs net-zero under all expected weather conditions.

Extensive prototyping has been performed to verify performance and energy consumption of this custom-designed system. Prolonged testing of the customized desuperheater coil that allows waste heat to be drawn from the refrigerant line of an off-the-shelf ductless HVAC unit has demonstrated the design's long-term reliability and performance. Extensive tests integrating the condenser unit with a thermal tank under varying conditions have also established a set of performance criteria that have been used to optimize the thermal controls of the system. Tests of a water-water heat exchanger for using the thermal tank to preheat hot water have assisted in optimizing the everyday operation of the system. Finally, full system tests under varying weather conditions have demonstrated the energy savings that can be achieved by the system and have established reliable performance and energy consumption criteria for the system.

## Section 4.02 2.2 Lighting, consumer electronics and appliances

Lighting, consumer electronics and appliances combine to consume more than 50% of all energy, as shown in figure 2. Hence, throughout the design process, those off-the-shelf products are carefully selected to reduce overall energy demand while been cost-effective.

The lighting of the house during daytime hours is based on pulling natural light in through the two large windows on the North and South ends of the house, as well as through a skylight in the bathroom. During the night, photo-luminescent stair nosing allows occupants to navigate the house without turning on lights – an advantage when there are very few dividing walls in the structure. LED fixtures and CFLs produce light during the night. The products were tested for power consumption, heat dissipation, and light intensity. Obviously, the product with the lowest power consumption and heat dissipation, but the highest light intensity would be the preferred choice. However, development testing reveals a more complex picture of trade-offs that in addition need to match interior design. Lighting are closely integrated with control systems to automate and even intelligently decipher when and where lights should be turned on.

Consumer electronics and home appliances were chosen based on a metric of cost and energy consumption. Thorough considerations of the trade-offs went into the selections that are most energy efficient but also cost-effective. Furthermore, thorough tests were conducted to verify and log energy consumption. This level of detailed understanding is crucial to the controlling overall energy behavior of the house. Just like the weight of each bracket is known on a plane, whose total weight is an important design consideration, the energy consumption of every electronics and appliances is taken into consideration to design a reliable net-zero-energy house.

## **Section 4.03      2.3 Home control**

CHIP features a state of the art computing system or as we prefer to call it an intuitive user experience. In designing CHIP's user experience we have pushed the boundaries of technology while eliminating clumsy antiquated technologies common place in today's homes. This usability makes it painlessly easy (or automatic) for the homeowner to turn off lights, TVs, projectors, ovens, and many other energy hogs as they track and reduce their carbon footprint. We have also built a layer of intelligence into our home, allowing the home to turn everything off when people leave, turn the TV on when someone sits on their favorite foam furniture, or close the shades when the sun shines into your eyes.

CHIP's brain resides in a Control4 home controller. We have integrated an energy monitoring, HVAC control, decathlon point optimization, and home interface systems around our home's brain. We have developed a custom designed iPad application that will be used as the primary interface with the home, letting you toggle lights, change the channel, and even lower your shades. The iPad app will display real time energy usage data giving the user instant feedback on their energy use. We are also utilizing 3d cameras to track users as they walk through the house and adjusting lights accordingly. Using these cutting edge technologies we are eliminating the clutter of superfluous remote controls, the carelessness with which electronics are often left on, and the chore of turning off lights all by creating an intuitive user experience. Most importantly, we hope this intuitive user experience will enable homeowners to be more actively aware of and in control of their home energy usage.

### **(a) 2.3.1 Homeowner Interface**

CHIP features a Control4 home controller that acts as the home's brain. Connected through this brain gives homeowners a seamless interface to monitor and control their homes' energy usage. The energy monitoring system eGauge is constantly logging the energy use of CHIP's most energy intensive systems including lights, HVAC, and the laundry appliances. Those information are displayed clearly and precisely on an iPad, a computer, a TV, or anything else with a display and connected to the internet. Homeowners can actively manage the use of its air conditioning units, or just let the HVAC control monitor CHIP's temperature and humidity and actively cools the home, heats the home, lowers shades, or exhausts the home's air based on their past preferences.

CHIP cannot only control nearly everything in the home, but it also allows the homeowner to access all this information and control with relative ease. We have developed a custom built iPad application where energy use and home control are just a swipe away. The approach will be incredibly intuitive for children, guests, and the homeowner alike. The ease of use allows the homeowner to actively turn off lights or equipment that they are not using to save energy with relative ease. In addition we will use 3D cameras to track users as they walk around the house and automatically turn lights on behind them and off in front of them. Giving the homeowner intuitive ways to control and monitor their CHIP makes it incredibly easy to save energy.

### **(b) 2.3.2 Energy Usage Optimization**

Computationally and rigorously affirming that CHIP is reliably net-zero is crucial in our energy strategy. We have developed custom scripts that model our home's PV production simultaneous to our HVAC and energy

consumption. We are modeling CHIP's PV production using the Solar Advisory Model (SAM) and our HVAC energy consumption using DOE2.2. Both PV energy production and HVAC energy consumption are heavily dependent on the weather conditions. Lastly we also tabulate the energy consumption of all the electrical equipment in CHIP. Finally we take weather forecast to determine our PV production, subtract our HVAC energy consumption, and subtract the rest of the energy loads in our home to determine if we would "go net zero". Using weather data combined with Solar and HVAC modeling software we can determine our house's net-zero performance.

This model has been incredibly useful during the design process, but we are currently modifying it so we can actively use it during the competition. We modified the software so that we can use predictive weather data in the Solar and HVAC models. This will allow us, on any day of the competition, to calculate the probability that our home will achieve its goal of "going net zero". If our model determines that it is unlikely we will "go net zero" then the system will recommend we not perform a given competition task.

The system analyzes which competition tasks reward our team with the fewest points per energy used. As described in Table 3, we are able to reduce our energy demand by the most without sacrificing many points by not performing the Laundry Appliances task. The tasks in table 3 with the fewest points per (kWh/day) will be cut if our models predict CHIP will not attain net-zero, ultimately resulting in an increase of points. When we cut a task we lose fewer points by cutting the task than we gain by ensuring net-zero operation. This system can also work in the opposite direction, where if our model predicts a surplus of energy at the end of the competition then we can demonstrate some of our more energy intensive feature during our tour like the iPad application the gesture home interface.

Energy Load	Points per (kwh/day)
District Hot Water	143
Home Entertainment	50
<b>Energy Balance</b>	<b>50</b>
Lighting	29
HVAC	18
Kitchen Appliances	14
Laundry Appliances	11

Table 1. Points per energy density

## Article V. 3. Energy Generation

The design of the PV array has one goal in mind, and that is to fulfill energy demand under all designed conditions. The size of energy production dictates the design and selection of PV arrays. The following section discusses extensively the analysis and modeling that go to providing a reliable source of energy to satisfy all energy consumption.

### Section 5.01 3.1 Goals and Challenges

We realize that, in many cases, people are not willing to switch over to environmentally-friendly products because of the potential negative effect on their lifestyle. Thus, one of our goals became to design a system that would be a net-zero consumer or a net surplus producer in any scenario presented to us. No sacrifices would have to be made on the part of the consumer to embrace life without fossil fuels.

The design of the house does present challenges in its geometry. Non-rectangular roofs and sub-optimal tilts limit the amount of square footage available for the system and the amount of power than can be extracted from it. However, the geometry does open up many options for the position of the array itself.

## Section 5.02      3.2 Design and Modeling

The first step of designing the system was to create an energy budget. An initial estimate was that we would consume 21.5 kWh per day in the house, and a 5% margin placed on that meant we needed to produce 24 kWh per day on average to ensure we met that target whether or not our consumption rose or the weather was inclement. Using the System Advisor Model (SAM), a software tool developed by NREL, the Sandia National Laboratories, and the Department of Energy's Solar Energy Technologies Program, we modeled several theoretical systems that could meet our requirements based on monthly timescales. This rough first pass gave us an idea of which direction to head.

One particular aspect that we paid close attention to was the cost per watt of each system. While we want to provide a consumer with a net-zero house, we can't let the photovoltaic system powering it drive up the cost too far. From a cost perspective, an enormous array of thin film material would have been the ideal solution, but roof area is a limiting factor. Thus a wide range of panels from mid-range efficiencies up to the best on the market were analyzed to see which ones could work, and of those, which ones could cost the least.

Due to the constantly changing nature of our energy requirements and the roof space of our house during the design process, we created a script tool that could let us quickly compare different photovoltaic systems given roof geometry and an energy budget. We also refined the output data, incorporating 15 years of weather data from the National Solar Radiation Database (NSRDB) into the model instead of the default of just one year's data, and extracted hourly numbers rather than monthly values. This flexibility allowed us to explore many options in a short time frame, compare them, see how likely they would be to produce our energy demand, and then make a justified decision on which system to use.

The model itself carries many assumptions, including a 92.5% pre-inverter derate factor, and a total derate factor of 89%. It also assumes acceptable amounts of air flow to keep the panels cool and operating at higher efficiencies. The derate factors we used represent some worst-case assumptions and are most likely more strict than they need to be.

## Section 5.03      3.3 Analysis

In the end we decided on 42 Hanwha Solarone 190W modules based on our a 21.5 kWh/day consumption requirement. The 190 W modules near the top of a series of panels produced by Hanwha Solarone that range from 170 to 195W, and represent some of the best value modules available on the market. Given our roof design, this arrangement represents the most cost-efficient solution – all the other manufacturers we looked into would have resulted in a more expensive system. Our analysis suggests that during the competition, this 7.9 kW system will be able to produce 24 kWh per day on average and hit the target 21.5 kWh per day over 90% of the time, based on historical weather data. In Los Angeles, the system averages nearly 32 kWh per day over the entire year, more than meeting the energy requirements of a typical California house. The following chart shows the predicted system output during the competition period:

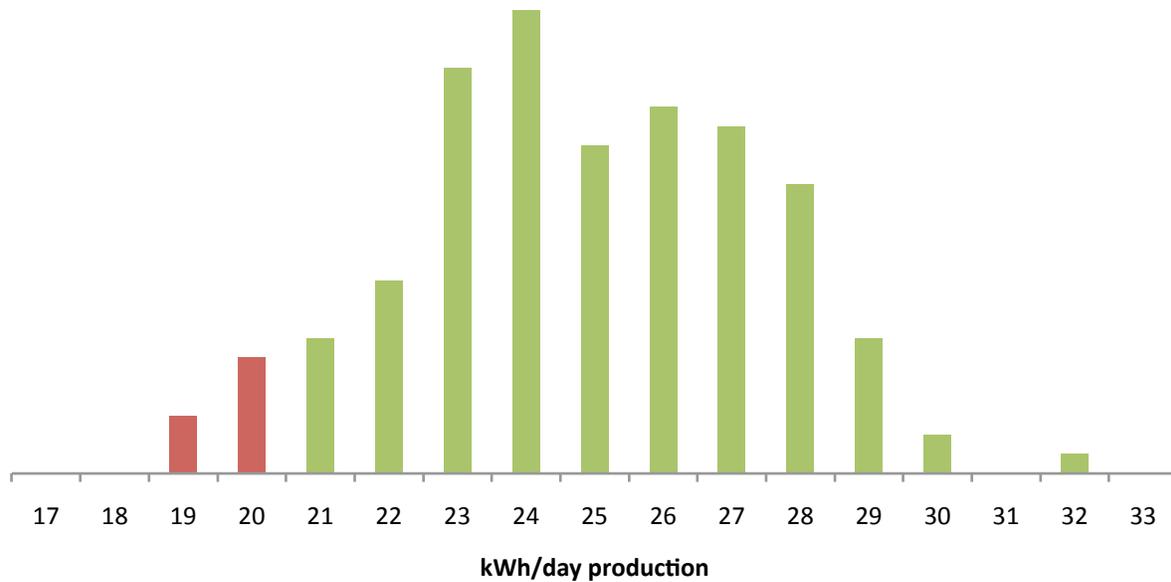


Figure 5. Weather uncertainty in PV energy generation for DC in September

Solar modules are not perfect devices – the Hanwha modules come in bins of +/- 3W. In many cases, this can degrade the total power output of the system, since the less efficient modules drag the entire system down. This loss is typically calculated into derate losses, and normally it is considered an unavoidable part of designing a system. However, there are emerging products that can mitigate this problem, such as Tigo Module Maximizers. We determined that the 3-5% efficiency increase for maximum power-point tracking each module individually was cost effective – between a system using Tigo and fewer panels, or a system producing the same output with more modules, the Tigo system comes in at a lower cost. This loss reduction method pays off even more as the system ages, since inefficiencies due to different levels of wear are mitigated with individual power point tracking.

Of the 42 panels, 12 are mounted horizontally and 30 are at a tilt. Tigo Module Maximizers allow us to create strings across the slope, which opens the option for us to use a single inverter for the entire system. Many different inverters were modeled in SAM to choose the best system to work with the panels. A single SB7000US inverter came out as the ideal product, with its high efficiency and integrated DC disconnect switch, which can combine all 4 of our photovoltaic strings without an additional combiner box and eliminate the need for an external DC disconnect switch mounted on our wall. The positioning of the inverters, disconnect switches, solar load center and main panel was chosen to minimize the amount of wires necessary to connect the system to the grid – slightly reducing wiring losses and reducing the total cost of cabling.

## Article VI. 4. Conclusion

### Section 6.01 4.1 Net-Zero-Energy

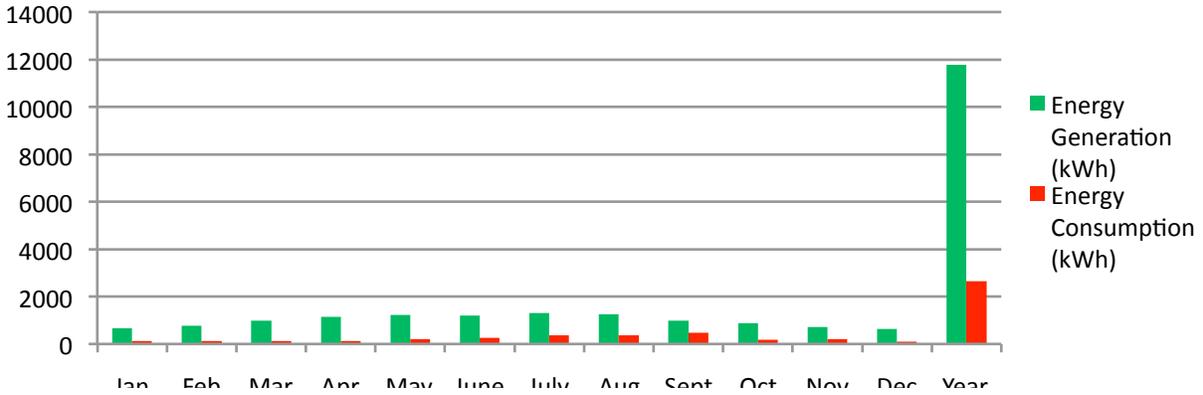


Figure 6. Monthly energy generation and consumption comparison in LA in a representative year. Generation data are obtained through SAM modeling using representative year weather in LA, while consumption data are obtained from a Trace Trane analysis also conducted using LA weather.

CHIP is designed to achieve net-zero-energy, and figure 6. convincingly indicates that CHIP not only achieves net-zero energy but generates energy to actually power another average Californian household. CHIP generates significant amount of surplus energy throughout and at all times of the year in LA, because it is currently installed with extra solar panels to achieve net-zero-energy in DC where solar irradiance is much lower than at LA. We put in an incredible amount of flexibility for CHIP to adapt and expand its generation capacity to different climate and weather zones and still reach net-zero-energy. In this particular case, we designed CHIP with the location of Washington DC in mind, and followed a rigorous budget to achieve net-zero-energy at all conditions in DC and consequently a surplus of energy in LA. However, net-zero-energy would not be possible if CHIP was also not energy efficient.

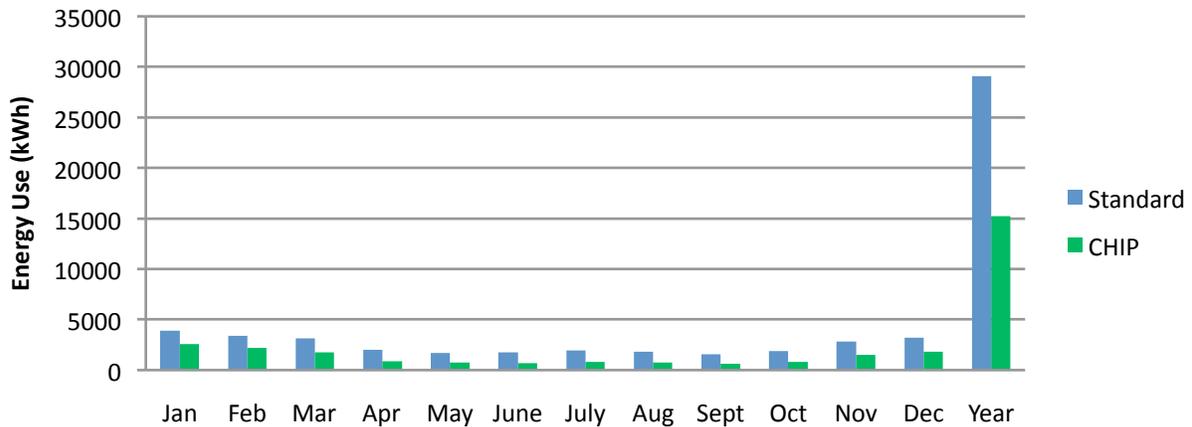


Figure 7. Title 24 Standard and CHIP monthly and annual energy use comparison. All analysis was done by a certified energy analyst at Energy Impact using DOE 2.2 model. Details of the Title 24 analysis can be found in the appendix.

## **Section 6.02**      **4.2 Energy Efficiency**

CHIP is designed to be ultra-energy efficient, and figure 7. Indicates that CHIP roughly uses half of the annual energy use of a comparable house that meets the California Title 24 standard, which is the most demanding building efficiency standard in the country. CHIP reduces energy usage throughout the year at DC, whether it is winter or summer. In another word, CHIP uses energy more efficient to do practically everything in a home. A very effective building envelope reduces infiltration and heat loss and hence air conditioning load. A very efficient integrated hot water and air conditioning system reduces cooling, heating and hot water energy usage even further. An easy-to-use and intelligent control system will no doubt facilitate the homeowners to manage and maintain highly efficient performances of their homes.

In conclusion, CHIP is designed to be an efficient and net-zero-energy house by following an energy budget, conducting countless modeling and simulations, and creating an intelligent and intuitive home control and monitoring system.

## Division 01 – General Requirements

### SECTION 01 15 13 – TEMPORARY ELECTRICAL

#### Part 1 - General

##### 1.1 Section requirements

- 1.01 Use Charges: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated.
- 1.02 Electric Power: Available from site generator system without metering and without payment of use charges during construction and assembly period. Provide connections and extensions of services as required for construction operations.
- 1.03 Electric Power: Available from site operators existing system with metering and without payment of use charges. Provide connections and extensions of services as required for construction operations and exhibition operations.
- 1.04 Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

#### Part 2 - Products

##### 2.1 Temporary Electrical Distribution Boxes

- i. CEP 6506GU "G" Series GFCI Protected
  1. "Power On" indicator lights on GFCI's
  2. 240V High Voltage Shut-Off with indicator light
  3. 1 - 50 AMP 125/250 Volt feed through receptacle
  4. 1 - 30 Amp 250 Volt non-GFCI receptacle
  5. 6 - 20 Amp 125 Volt GFCI individually protected receptacles

##### 2.2 Generator

- i. DCA25USI2 WhisperWattGenerator
  1. Standby Output: 22kW
  2. Prime Output: 20kW
  3. Voltage - switchable single phase 120/240
  4. frequency 60Hz
  5. sound level 59dB(A) full load at 23 feet
  6. Maximum Amps: 60amp main line circuit breaker
  7. Fuel System Capacity: 41.7 gallons

#### Part 3 - Execution

##### 3.1 Temporary utility installation

- i. General: Install temporary service or connect to existing service.
  1. Arrange with utility company, site operations manager, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

##### 3.2 Operation, Termination, and Removal

- i. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- ii. 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.

**End of section**

SECTION 01 54 23 – TEMPORARY SCAFFOLDING AND PLATFORMS

**Part 1 - General**

1.1 Section includes

1. 01 54 23 70 - Scaffolding
2. Submittals: Product Data

1.2 References

- i. OSHA 1915 Subpart E: Scaffolds, Ladders, and Other Working Surfaces

**Part 2 - Products**

2.1 Scaffolding

- i. Will have minimum 29 inches working space for safe operation room for workers.
- ii. Will have a minimum load capacity of 25 lbs. per square foot, and a maximum load of 500 lbs. per deck.
- iii. Structural bars are made from Aluminum.
- iv. Manufacturer assured compliance to ANSI Standards.
- v. Manufacturer assured compliance to OSHA Requirements
- vi. UL listed.

**Part 3 - Execution**

3.1 Installation

- i. Install according to manufacturer's instructions.

3.2 Execution

- i. Assure that when in use all safety measures are followed.
- ii. Before each shift of use, make sure to inspect scaffold for any safety risks including:
  - a. Level and sturdy footing
  - b. Secure linkages at every point

**End of section**

## SECTION 01 74 13 – PROGRESS CLEANING

### Part 1 - General

#### 1.1 Summary of work

- i. This section includes:
  - 1. Cleaning requirements during construction operations
  - 2. Final cleaning prior to turning project over.

#### 1.2 Quality Assurance

- i. Utilize non-toxic cleaning materials and methods.
  - i. Comply with GS 37 for General purpose cleaning and bathroom cleaning
  - ii. Use natural cleaning materials where feasible. Natural cleaning materials include:
    - a. Abrasive cleaners: substitute ½ lemon dipped in borax
    - b. Ammonia: substitute vinegar, salt and water mixture, or baking soda and water
    - c. Disinfectants: substitute ½ cup borax in gallon water
    - d. Drain cleaners: substitute ¼ cup baking soda and ¼ cup vinegar in boiling water
    - e. Upholstery cleaners: substitute dry cornstarch.

#### 1.3 Final Cleaning

- i. At completion of Work, remove all remaining waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces; leave Project clean and ready for occupancy.
  - 1. Provide final cleaning in accordance with ASTM E1971 and the approved IPM plan.

### End of section

## Division 05 – Metals

### SECTION 05 05 23 – METAL FASTENINGS

#### Part 1 - General

##### 1.1 Summary

###### A. Includes but not limited to:

1. Quality of structural bolts used on project

##### 1.2 References

###### A. American National Standards Institute / American Welding Society

1. ANSI/AWS D11-92 “Structural Welding Code – Steel”
2. ANSI/AWS d1.3-89, “Structural Welding Code – Sheet Steel”

###### B. American Society for Testing and Materials

1. ASTM A 36-00 “Standard Specification for Carbon Structural Steel”
2. ASTM A 307-00, “Standard Specification for Carbon Steel Bolts and Studs over 60,000 psi Tensile Strength”

#### Part 2 - Products

##### 2.1 Manufactured Units

###### A. Bolts And Threaded Fasteners:

1. Anchor Rods For Module Connections: Conform with ASTM A 36
2. Bolts conform to requirements of ASTM A 307, Grade A

#### Part 3 - Execution

##### 3.1 Performance

- ###### A. Installation of bolts shall meet AISC requirements

#### END OF SECTION

## SECTION 05 12 00 – STRUCTURAL STEEL FRAMING

### 1. General

#### 1.1 Summary

##### A. Structural Steel

1. Steel Angles
2. Plates
3. Pipe Clamps

#### 1.2 Section Requirements

##### A. Submittals:

1. Product data: for each type of product indicated:
2. Shop drawings: show fabrication of structural-steel components.
  - a. Includes details of cuts, connections, and other pertinent data
  - b. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Welding certifications

##### 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 325 or A 490 Bolts"

##### C. Quality Insurance

1. Qualifications: Welders shall be certified 30 minimum before beginning work on Project. If there is doubt to proficiency of welder, Architect may require welder to take another test, at no expense to Owner. Certification shall be by Los Angeles Department of Building and Safety or other authority approved by Architect.
2. Certifications: Maintain welder's certification on job-site.

### Part 2 - Products

#### 2.1 Metals

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M
- B. Aluminum Extrusions: ASTM B 221M, Alloy 6063-T6
- C. Angles 2"x2"x5/16" (Ramps and East/West Platforms)
- D. Channel 12"x30, ramps, 4"x7 (South Deck)
- E. Tube 5"x3" x 3/16", 2"x2"x5/16" (Ramps and East/West Platforms)
- F. Tube 3"x2" x 3/16", 4"x2"x3/16" (South Deck)  
Above referenced products supplied by Industrial Metal Supply:  
<http://www.industrialmetalsupply.com/>
- G. 026-21x2 2" Pipe Clamp (<http://www.jrclancy.com/pipeclamps.asp>)

#### 2.2 Accessories

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325M, Type 1, heavy-hex steel structural bolts; ASTM A 563M, Class 8S heavy-hex carbon-steel nuts; and ASTM F 436M, Type 1, hardened carbon-steel washers.
- B. Anchor Rods: ASTM F 1554, Grade 36.
  1. Configuration: Straight
  2. Nuts: ASTM A 563M -hex carbon steel.

- 3. Plate Washers: ASTM A 36/A 36M carbon steel.
- 4. Washers: ASTM F 436M, 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.

### 2.3 Fabrication

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
- B. Weld Connections: Comply with AWS D1.1/D1.1M 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 0.038 mm. Do not prime surfaces to be embedded in concrete or mortar or to be field welded

## Part 3 - Execution

### 3.1 Erection

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360
- B. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- C. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M].
- D. 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.
- E. 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**

## SECTION 05 14 13 – ARCHITECTURALLY EXPOSED STRUCTURAL ALUMINUM FRAMING

### Part 1 - General

#### 1.1 Summary

- A. Photovoltaic System Mounting
- B. Related Sections:
  - 1. Section 26 31 00 – Photovoltaic Generation

#### 1.2 Section Requirements

- A. Comply with applicable provisions of the following:
  - 1. International Residential Code
  - 2. International Building Code
  - 3. National Electric Code
  - 4. American Society of Civil Engineers 7.05
- B. Submittals
  - 1. Product Data: specifications, manufacturer information and installation instructions.
  - 2. Shop Drawings
  - 3. Welding Certificates

### Part 2 - Products

#### 2.1 Structural Aluminum

- A. 2" Aluminum T ASTM B 221M, Alloy 6063-T6
- B. 2" Aluminum angle ASTM B 221M, Alloy 6063-T6
- C. Iron Ridge XRS Flush Mounting System for Photovoltaic Panels  
<http://www.ironridge.com/roof>

#### 2.2 Accessories

- A. Bolts, Nuts, Washers, Pipe Clamps
  - 1. Provided in kits with major Structural Aluminum products
- B. Panel Top-down Clamps
  - 1. End: 1.81" Mill
  - 2. Mid: 2.5" Mill
- C. Grounding: WEEB Bonding Jumper, WEEB Compression Lug, WEEB Grounding Lug
  - 1. For more information, see  
[http://www.ironridge.com/assets/files/IronRidge\\_WEEB\\_Product\\_Instructions.pdf](http://www.ironridge.com/assets/files/IronRidge_WEEB_Product_Instructions.pdf)

### Part 3 - Execution

#### 3.1 Installation

- A. Follow Manufacturer's Instructions.

### END OF SECTION

## SECTION 05 15 00 WOVEN GALVANIZED STEEL CABLE ASSEMBLIES

### Part 1 - General

#### 1.1 Summary

Cabling at the Exterior of the Continuous Vinyl Coated Polyester Membrane(Section 13 31 33)

##### A. Section Includes:

1. Galvanized Wire Rope Assemblies
2. Galvanized Steel Fittings, End Terminals, Hardware, and Accessories

#### 1.2 References

- A. ASTM A380 - Practice for Cleaning and Descaling Stainless Steel Parts, Equipment and Systems.
- B. ASTM A492 - Specification for Stainless Steel Rope Wire.
- C. Section 13 31 33 Continuous Vinyl Coated Polyester Membrane

#### 1.3 Submittals

A. Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit Manufacturer's product data sheet for specified products.

### Part 2 - Products

#### 2.1 Materials, General

A. Galvanized Cable

#### 2.2 Exterior Metals

- A. 3/32" Woven Galvanized Cable with clear vinyl coating
- B. for supplier see <http://versales.com/> 2509 N. Naomi St, Burbank CA, 91504

#### 2.3 Fabrication

A. Stainless Steel Cables and Fittings shall be dimensioned and fabricated to specified size and labeled according to shop drawings and installer's specifications.

B. Preassemble items in shop to greatest extent practicable to minimize assembly at project site. Disassemble units only to extent necessary for shipping and handling limitations. Mark units for reassembly.

### Part 3 - Execution

#### 3.1 Installation

A. Install rope assemblies in accordance with manufacturer's instructions and the approved shop drawings.

B. Provide anchorage devices and fittings to secure to in-place construction; including threaded fittings for concrete inserts, toggle bolts and through-bolts.

- C. Anchor rope assemblies to mounting surfaces as indicated on the drawings.
- D. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

## SECTION 05 50 00 – METAL FABRICATION

### Part 1 - General

#### 1.1 Summary

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

### Part 2 - Products

#### 2.1 Metals

- A. Angles, ASTM A36/A36M
- B. Channel ASTM A36/A36M
- C. Tube ASTM A36/A36M
- D. Plate and Bar ASTM A36

#### 2.2 Fabrication

- A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
- B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.
- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
- D. Fabricate nosings from cast iron with an integral abrasive finish
- E. Apply bituminous paint to concealed surfaces of units set into concrete

### Part 3 - Execution

#### 3.1 Installation

- A. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.
- B. Fit exposed connections accurately together to form hairline joints

### END OF SECTION

## SECTION 05 52 00 – METAL RAILINGS

### Part 1 - General

#### 1.1 Summary

- A. Submittals: Product Data

### Part 2 - Products

#### 2.1 Railing Systems

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

#### 2.2 Metals

- A. Steel Plates, Shapes, and Bars ASTM A36/A
- B. Steel Tubing ASTM A513

#### 2.3 Fabrication

- A. Assemble railing systems in shop to the greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Form changes in direction of railing members by mitering at elbow ends

### Part 3 - Execution

#### 3.1 Installation

- A. Fit Exposed connections accurately together to form tight, hairline joints
- B. Set railings accurate in location, alignment, and elevation free of rack.
- C. Coordinate with shop drawings the size and shape drawings of individual metal pieces.
- D. Install metal level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.

**END OF SECTION**

## SECTION 05 53 00 – METAL GRATING

### Part 1 - General

- 1.1. Summary
  - A. Submittals: Product Data

### Part 2 - Products

- 2.1 Materials, General
  - A. Galvanized Steel Grating
- 2.2. Exterior Metal
  - A. Product:
    - 1. 1" x ½" Steel Grating: PD-11-4 Galvanized Steel ADA compliant pressure locked grating
  - B. Product:
    - 1. ¾" x ½" Steel Grating: PD-11-4 Galvanized Steel ADA compliant pressure locked grating
    - 2. See Manufacturer's specifications for details: Grating Pacific <http://www.gratingpacific.com/>

### Part 3 - Execution

- 3.1 Installation
  - A. Coordinate with shop drawings the size and shape drawings of individual metal pieces.
  - B. Install metal level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.
  - C. Select and arrange decking panels for best match of adjacent units. Install with uniform tight joints.

**END OF SECTION**

## SECTION 05 58 00 – FORMED METAL ENCLOSURES

### Part 1 - General

- 1.1. Summary
  - A. Submittals: Product Data

### Part 2 - Products

- 2.1 Materials, General
  - A. Sheet metal
- 2.2. Exterior Metal
  - A. Product: 10GA CRSH CR Steel Sheet 4x10
    - 1. for supplier see <http://www.industrialmetalsupply.com>

### Part 3 - Execution

- 3.1 Installation
  - A. Coordinate with shop drawings the size and shape drawings of individual metal pieces.
  - B. Install metal level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.
  - C. Select and arrange decking panels for best match of adjacent units. Install with uniform tight joints.

**END OF SECTION**

## SECTION 05 73 00 – DECORATIVE METAL RAILINGS

### Part 1 - General

#### 1.1 Summary

- A. Submittals: Product Data

### Part 2 - Products

#### 2.1 Railing Systems

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

#### 2.2 Metals

- A. Steel Plates, Shapes, and Bars ASTM A36/A
- B. Steel Tubing ASTM A513

#### 2.3 Fabrication

- A. Assemble railing systems in shop to the greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Form changes in direction of railing members by mitering at elbow ends

### Part 3 - Execution

#### 3.1 Installation

- A. Fit Exposed connections accurately together to form tight, hairline joints
- B. Set railings accurate in location, alignment, and elevation free of rack.
- C. Coordinate with shop drawings the size and shape drawings of individual metal pieces.
- D. Install metal level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.

END OF SECTION

## SECTION 05 75 00 – DECORATIVE FORMED METAL

### **Part 1 - General**

#### 1.1 Summary

- A. Submittals: Product Data

### **Part 2 - Products**

#### 2.1 Materials, General

- A. Aluminum tube
- B. Cast Aluminum connectors

#### 2.2 Exterior Metal

- A. Product
  - 1. Interna-Rail Exterior Handrail
  - 2. Manufacturer: Hollaender
  - 3. See Manufacturer's specifications for details:

[http://www.hollaender.com/index.cfm?fuseaction=home.viewpage&page\\_id=EC2D2432-083A-028B-AA73DFF5C5F048A7](http://www.hollaender.com/index.cfm?fuseaction=home.viewpage&page_id=EC2D2432-083A-028B-AA73DFF5C5F048A7)

### **Part 3 - Execution**

#### 3.1 Installation

- A. Coordinate with shop drawings the size and shape drawings of individual metal pieces.
- B. Install metal level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.
- C. Select and arrange paneling for best match of adjacent units. Install with uniform tight joints.

**END OF SECTION**

## SECTION 05 40 00 - COLD-FORMED METAL FRAMING

### PART 2 - GENERAL

#### 2.01 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing wall framing.
2. Interior load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Floor joist framing.
5. Roof trusses.

#### 2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: as per Los Angeles, CA codes
  - a. Dead Loads: N/A
  - b. Live Loads: N/A
  - c. Roof Loads: N/A
  - d. Snow Loads: N/A
  - e. Wind Loads: as per Los Angeles, CA codes
  - f. Seismic Loads: as per Los Angeles, CA codes

#### 2.03 SUBMITTALS

A. Product Data: For each type of product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualification data.

D. Product test reports.

E. Research/evaluation reports.

## 2.04 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.
- B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code--Sheet Steel."
- C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions." Retain two subparagraphs below, as applicable, if Project includes trusses or headers for load-bearing walls.
  - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- E. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

## PART 3 - PRODUCTS

### 3.01 MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than [25] <Insert number> percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  - 1. Grade: [**ST33H (ST230H)**] Minimum coating requirement for Structural Grade, Type H steel is G60 or equivalent. Retain first option in subparagraph below if ASTM A 1003/A 1003M's listing of minimum coating thicknesses is required. This minimum coating designation assumes normal exposure conditions and construction practices. When more severe exposure conditions are probable, for example, in coastal areas, consider specifying a heavier coating. BIA recommends G90 (Z275) for stud backup applications. Verify availability of heavier-coated steel.
  - 2. Coating: **G60 (Z180)**,

### 3.02 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs (Channel): Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 20 ga.
  - 2. Flange Width: 1.5"- 3.5" as drawings indicate
  - 3. Section Properties N/A

### 3.03 FRAMING ACCESSORIES

- A. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

### 3.04 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: [SSPC-Paint 20 or DOD-P-21035] [ASTM A 780].
- B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

## PART 4 - EXECUTION

### 4.01 PREPARATION

- A. Install load bearing shims the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting wood construction.
- B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

### 4.02 INSTALLATION, GENERAL

- A. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
- C. Install framing members in one-piece length if applicable.
- D. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- F. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

- H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of **1/8 inch in 10 feet (1:960)** and as follows:
  - 1. Space individual framing members no more than plus or minus **1/8 inch (3 mm)** from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

#### 4.03 EXTERIOR NON-LOAD-BEARING CHANNEL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to **[top and]** bottom track, unless otherwise indicated. Space studs as follows:
  - 1. Stud Spacing: **[12 inches (305 mm)] [16 inches (406 mm)] [19.2 inches (488 mm)] [24 inches (610 mm)] [As indicated]**.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Connect vertical deflection clips to **[bypassing] [infill]** studs and anchor to primary building structure using mechanical fasteners.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than **48 inches (1220 mm)** apart. Fasten at each stud intersection.
  - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  - 2. Bridging: Proprietary Kwik-Bridge Punch System installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

#### 4.04 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.

- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

#### 4.05 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

## Division 06 – Wood, Plastics, and Composites

### SECTION 06 05 23 - WOOD AND PLASTIC FASTENINGS

#### Part 1 - GENERAL

##### 1.1 Summary

This section includes hardware devices for the integrated automation network. It covers integrated automation network servers, routers, bridges, switches, hubs, modems, and operator workstations. . Pre-engineered metal connectors used to support a wood, plated truss, or composite wood member(s) from a concrete, masonry, steel, wood, or composite wood supporting member(s).

##### 1.2 Related Sections

- A. Section 03300 - Cast-in-place Concrete - Concrete provides support or anchorage Section 251300 Integrated Automation Control and Monitoring Network
- B. Section 04050 - Basic Masonry Materials and Methods - Masonry provides support or anchorage Section 251500 Integrated Automation Software
- C. Section 05120 - Structural Steel - Steel provides support or anchorage
- D. Section 05120 - Structural Steel - Steel provides support or anchorage
- E. Section 05120 - Structural Steel - Steel provides support or anchorage

##### 1.3 References

- A. ASTM A36 - Carbon Structural Steel
- B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- C. ASTM A193-B7 - Alloy Steel and Stainless
- D. ATM A-307 Carbon Steel Bolts and Studs
- E. ASTM A653 – Steel Sheet, Zinc-Coated (Galvanized) or Zinc-iron Alloy-Coated (Galvannealed) by Hot-Dip process
- F. ASTM A706 – Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- G. ASTM 924/A 924M – General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process
- H. ASTM A1011 - Steel, Sheet, and Strip, Hot-rolled, Carbon, Structural, High-strength Low Alloy and High Strength Low-Alloy with Improved Formability
- I. ASTM F1667 – Driven Fasteners: Nails, Spikes, and Staples
- J. ASTM D1761 – Standarad Test Methods for Mechanical Fasteners in Wood
- K. ICBO AC13 – Acceptance Criteria for Joist Hangers and Similar Devices
- L. ICBO AC95 – Acceptance Criteria to Determine Bending Yield Moment for Nails
- M. ICBO AC120 – Acceptance Criteria for Wood Screws
- N. AISI 1996 – Cold-formed Steel Specifications
- O. 1997 NDS – National Design Specification

##### 1.4 Delivery, Storage and Handling

- A. Deliver products to the job site in manufacturer’s or distributor’s packaging unharmed, complete with installation instructions.
- B. Protect and handle materials in accordance with manufacturer’s recommendations to prevent damage and deterioration.

#### Part 2 - Products

##### 2.1 Manufacturers

A. Manufacturer: Simpson Strong-Tie CO, Inc.

2.2 Materials

A. Simpson Tie model SDS25600 screws with hot-dip zinc coating complying with ASTM A 153/A 153M or ASTM F 2329 unless otherwise indicated.

1. Complies with:

- a. Complies with 2006 International Building Code® (IBC)
- b. 2006 International Residential Code® (IRC)
- c. 2003 International Building Code® (2003 IBC)
- d. 2003 International Residential Code® (2000 IRC)
- e. 2000 International Residential Code® (2000 IRC)
- f. 1997 Uniform Building Code™ (UBC)

2. Rolled threads (10 threads per inch, approx. 2/3 of nominal screw length), unslotted hex washer head, type 17 droll point or proprietary four-cut point

3. Data is in accordance with the ICC-ES Acceptance Criteria for Alternate Dowel-type Threaded Fasteners (AC233), dated February 2007.

4. Carbon-Steel Bolts: ASTM F 568M with ASTM A 563M hex nuts and, where indicated, flat washers all hot-dip zinc coated.

5. Product found at: [http://www.icc-es.org/reports/pdf\\_files/ICC-ES/ESR-2236.pdf](http://www.icc-es.org/reports/pdf_files/ICC-ES/ESR-2236.pdf)

B. Simpson Tie Hangers model U310

1. Complies with:

- a. 2006 International Building Code® (IBC)
- b. 2006 International Residential Code® (IRC)
- c. 2003 International Building Code® (2003 IBC)
- d. 2003 International Residential Code® (2000 IRC)
- e. 2000 International Residential Code® (2000 IRC)

2. Manufactured from galvanized steel complying with ASTM A 653, SS designation, Grade 33, with a minimum yield strength, F of 33,000 psi and minimum tensile strength 45,000 psi.

3. Have minimum G90 zinc coating specification in accordance with ASTM A 653

4. Product found at: [http://www.icc-es.org/reports/pdf\\_files/ICC-ES/esr-2549.pdf](http://www.icc-es.org/reports/pdf_files/ICC-ES/esr-2549.pdf)

C. Simpson Tie straps model ST series

1. Complies with:

- a. 2003 International Building Code® (2003 IBC)
- b. 2003 International Residential Code® (2000 IRC)
- c. 2000 International Residential Code® (2000 IRC)
- d. 2000 International Building Code® (2000 IBC)
- e. 1997 Uniform Building Code™ (UBC)

2. Simpson Tie straps are fabricated from ASTM A 635, SS, Grade 33, galvanized steel

3. Product found at: [http://www.icc-es.org/reports/pdf\\_files/ICC-ES/esr-2105.pdf](http://www.icc-es.org/reports/pdf_files/ICC-ES/esr-2105.pdf)

D. Simpson Tie hold downs model HDU2-SDS2.5

1. Complies with:

- a. 2003 International Building Code® (2003 IBC)
- b. 2003 International Residential Code® (2000 IRC)
- c. 2000 International Residential Code® (2000 IRC)
- d. 2000 International Building Code® (2000 IBC)
- e. 1997 Uniform Building Code™ (UBC)

2. HDU hold downs are fabricated from ASTM A 635, SS, Grade 33, galvanized steel with a minimum yield strength of 33,000 psi and a minimal tensile strength of 45,000 psi.

3. The load transfer base plates are manufactured from ASTM A 1101, SS, Grade 33, steel with a minimum yield

4. Product found at: [http://www.icc-es.org/reports/pdf\\_files/ICC-ES/esr-2330.pdf](http://www.icc-es.org/reports/pdf_files/ICC-ES/esr-2330.pdf)

E. Simpson Tie A35 Framing Angles

1. Complies with:

- a. 2006 International Building Code® (IBC)
- b. 2006 International Residential Code® (IRC)
- c. 2003 International Building Code® (2003 IBC)
- d. 2003 International Residential Code® (2000 IRC)
- e. 2000 International Residential Code® (2000 IRC)

2. Framing angles are manufactured from galvanized steel complying with ASTM A 653, SS designation, Grade 33, with a minimum yield strength, F of 33,000 psi and minimum tensile strength 45,000 psi.

F. Standard threaded rod, 5/8"

1. Complies with ASTM standards

2. Product ordered from: <http://www.pineconelumber.com/>

G. 1997 Uniform Building Code™ (UBC)

1. Sheet: ASTM A625, ASTM A653, ASTM A1011

2. Fasteners: ASTM F1667, SAE C1022 (SDS Screws)

H. Stainless Steel:

1. Sheet: ASTM A 167

I. Finishes:

1. Gray paint
2. Hot-dipped galvanized or electro-plated galvanized: G60, G90, G185 (ZMAX)
3. Powder-coated paint.
4. Zinc and dichromate for SDS screws

### Part 3 - Execution

#### 3.1 Fabrication

- A. Shop assembly to occur per the manufacturer's approved production drawings.
- B. Fabrication tolerances per manufacturer.
- C. Fabrication requiring welding shall be performed in accordance with the current American Welding Society's standards.
- D. The Manufacturer's identification shall be stamped into the metal part and/or a label may be attached to the part with adhesive.

#### 3.2 Testing

- A. Allowable loads published in manufacturer's catalog to be determined using the minimum load from static and/or cyclic analysis and one or more of the following test methods:
  1. Static load tests in wood assemblies
  2. Static load tests in steel jigs
  3. Static load tests of products embedded in concrete or masonry
  4. Cyclic or static load tests in wood assemblies (Anchor Tiedown System)

- B. Testing to determine allowable loads shall be performed as per ICBO Acceptance Criteria 13 (AC13) and/or ASTM D1761
- C. Allowable loads for hangers are determined by a static load test resulting in not more than a 1/8" deflection of the joist relative to the header, or the lowest test ultimate load divided by 3, or the fastener allowable load as determined by the NDS, whichever is lower.
- D. Testing shall be conducted under the supervision of an independent laboratory.
- E. Manufacturer to provide code testing data on all products that have been code tested upon request.

### 3.3 Examination

- A. Unless otherwise noted in the manufacturer's catalog, allowable loads are for Douglas Fir-Larch under continuously dry conditions. Allowable loads for other species or conditions must be adjusted according to the code. See manufacturer's catalog for additional notes and requirements.
- B. Built-up lumber (multiple members) must be fastened together to act as one unit to resist the applied load.
- C. Verify that the dimensions of the supporting member are sufficient to receive the specified fasteners.

### 3.4 Installation

- A. Unless otherwise noted in the manufacturer's catalog, bolts and nails shall not be combined.
- B. All nails shall be common unless otherwise noted in the manufacturer's catalog or substituted, by the engineer of record, with a reduction taken.
- C. Unless otherwise noted in the manufacturer's catalog, bending steel in the field may cause fractures at the bend line. Fractured steel will not carry load and must be replaced. When bending is allowed or required in the catalog, the connector shall be allowed one cycle bend, one time only.
- D. Galvanized connectors should not be placed in contact with treated wood unless the treated wood is adequately verified to be suitable for such contact. Some wood treatments may accelerate metal deterioration. See wood material supplier for specific recommendations.
- E. A fastener that splits the wood will not take the design load. Evaluate splits to determine if the connection will perform as required. Dry wood may split more easily and should be evaluated as required. If wood tends to split, consider pre-boring holes with diameters not exceeding 0.75 of the nail diameter (1997 NDS 12.1.3.1).
- F. SDS series wood screws are installed with a 3/8-inch hex head driver and a low-speed drill. Predrilling wood members is not required for installation. Edge distances, end distances, and spacing of the screws must be sufficient to prevent splitting the wood and must be within the parameters described in the following table:

CONDITION		MIN. DISTANCE OR SPACING (in.)
EDGE DISTANCE	PERPENDICULAR TO GRAIN LOADING	1 D
	PARALLEL TO GRAIN LOADING	1
END DISTANCE	PERPENDICULAR TO GRAIN LOADING	4
	PARALLEL TO GRAIN LOADING	3
SPACING	BETWEEN FASTENERS IN A ROW	3
	BETWEEN ROWS	3
	BETWEEN STAGGERED ROWS	1 D

- G. Wood shrinkage shall be taken into account when designing and installing connections.
- H. Built-up lumber (multiple members) must be fastened together to act as one unit to resist the applied load.
- I. Top flange hangers may cause unevenness. Possible remedies should be evaluated by a professional and include using a face mount hanger, routing the beam, or cutting the subfloor to accommodate the top flange thickness.
- J. Do not overload by exceeding the manufacturer's catalog allowable load values.
- K. Unless otherwise noted in the manufacturer's catalog, fill all fastener holes with fastener types as specified in the manufacturer's catalog.
- L. All specified fasteners must be installed according to the instructions in the manufacturer's catalog.
- M. Bolt holes shall be a minimum of 1/32" and a maximum of 1/16" larger than the bolt diameter (NDS 8.1.2.1)
- N. Install all specified fasteners before loading the connection.
- O. Use proper safety equipment.
- P. Welding shall be in accordance with the American Welding Society (AWS) standards.
- Q. Welding galvanized steel may produce harmful fumes; follow proper welding procedures and safety precautions.
- R. Nail tools with hole-location mechanisms may be used to install connectors, provided the correct quantity and type of nails are properly installed in the nail holes.
- S. Joist shall bear completely on the connector seat, and the gap between the joist end and the header shall not exceed 1/8".
- T. Installer of ATS system to cut rods to length as required.
- U. Modifications to products or changes in installation procedures should only be made by a qualified designer. The performance of such modified products or an altered installation procedure is the sole responsibility of the designer.

### 3.5 Field Quality Control

- A. Determine that the proper part is being used in the correct application and has been fabricated by the approved manufacturer by observation of the stamp into the metal part and/or the adhesive label on the product denoting part and manufacturer name.
- B. Before substituting another brand, confirm load capacity based on published testing data and calculations per section 2.04. The engineer/designer of record shall evaluate and give written approval for substitution prior to installation.

### END OF SECTION

## SECTION 06 10 53 – MISCELLANEOUS ROUGH CARPENTRY

### PART 1 – GENERAL

#### 1.1 Summary

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

### Part 2 - PRODUCTS

#### 2.1 Wood Products, General

- A. Lumber: provide dressed lumber, S4S, marked with grade stamp of inspection agency
- B. All lumber will be No. 2: Douglas fir-larch, (north): NLGA with maximum moisture content of 15% U.O.N.

#### 2.2 Treated Materials

- A. Preservative-Treated Materials: AWPA C2 except that lumber not in ground contact and not exposed to the weather may be treated according to AWPA C31 with inorganic boron (SBX).
  - 1. Use Treatment containing no arsenic or chromium
  - 2. Kiln-dry lumber after treatment to a maximum moisture content of 15 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 soil
  - 2. Concealed members in contact with masonry or concrete
  - 3. Wood framing members that are less than 24 in above the ground
- 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) 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

#### 2.3 Plywood Backing Panels

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

#### 2.4 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.

### 3.1 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:

### END OF SECTION

## SECTION 06 10 63 - EXTERIOR ROUGH CARPENTRY

### PART 1 – GENERAL

#### 1.1 Summary

- A. Submittals: ICC-ES evaluations reports for preservative-treated wood, plastic decking, expansion anchors, and metal framing anchors
- B. For decking fasteners see related section 060523

### Part 2 - Products

#### 2.1 Wood Products, General

- A. Lumber: Provide dressed lumber, s4s, marked with grade stamp of inspection agency
- B. For supplier, see <http://www.stockbuildingsupply.com>

#### 2.2 Treated materials

- A. Preservative-Treated Boards and Dimension Lumber: AWPA C2.
  - 1. Use treatment containing no arsenic or chromium.
- B. Preservative-Treated Timber: AWPA C15, waterborne preservative.
  - 1. Use treatment containing no arsenic or chromium.
  - 2. Treatment with CCA shall include post-treatment fixation process.
- C. After treatment, re-dry boards, dimension lumber, and timber to 19 percent maximum moisture content.
- D. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
- E. Provide preservative-treated materials for all exterior rough carpentry unless otherwise indicated, items indicated on drawings, and the following:
  - 1. Framing members less than 18 in above grade
  - 2. Sills and ledgers
  - 3. Posts
  - 4. Decking
  - 5. Stair treads

#### 2.3 Lumber

- A. Dimensional Lumber:
  - 1. Maximum Moisture Content: 19 percent
  - 2. Deck and Stair Framing:
    - a. Interior Floor decking framed with Douglas Fir 2 x 12, NLGA, WCLIB
    - b. exterior Floor decking framed with composite lumber 2 x 6
  - 3. Dimension Lumber Decking and Stair treads: composite lumber
  - 4. Dimension Lumber Railing Members: composite lumber
- B. Boards
  - 1. Maximum moisture content: 19 percent
  - 2. Board decking and Stair treads: composite lumber 1x6

#### 2.4 Miscellaneous Products

- A. Fasteners: see section 060523
  - 1. Provide nails or screws, in sufficient length, to penetrate not less than 1.5 in into wood substrate

2. Power-driven fasteners: CABO NER-272
3. Carbon-Steel bolts: ASTM F 568M with ASTM A 563M hex nuts, and, where indicated, flat washers all hot-dip zinc coated

### **Part 3 - Execution**

#### **3.1 Installation**

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. 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. Published requirements of metal framing anchor manufacturer.
- D. Secure decking to framing with concealed decking fasteners.
- E. Secure stair treads and risers by gluing and screwing to carriages. Countersink fastener heads, fill flush, and sand filler. Extend treads over carriages.
- F. Railing Installation: Countersink fastener heads, fill flush, and sand filler.
  1. Fit balusters to railings, glue, and screw in place.
  2. Secure newel posts to stringers and risers with through bolts.
  3. 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**

## SECTION 06 11 00 – WOOD FRAMING

### PART 1 – GENERAL

#### 1.1 Summary

- A. Submittals: ICC-ES evaluations reports for wood-preservative treated wood, fire-retardant treated wood, and engineered wood products and metal framing anchors.
- B. For decking fasteners see related section 060523 Wood, Plastic, and Composite Fasteners.

### Part 2 - Products

#### 2.1 Wood Products, General

- A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.
- B. Engineered Wood products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
- C. For supplier see <http://www.stockbuildingsupply.com>

#### 2.2 Treated Materials

- A. Preservative-Treated Materials: AWPA C2, except that lumber not in ground contact and not exposed to the weather may be treated according to AWPA C31 with inorganic boron (SBX).
  - 1. 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).
  - 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 soil.
  - 2. Concealed members in contact with masonry or concrete.
  - 3. Wood framing members that are less than 460 mm above the ground.
  - 4. Wood floor plates that are installed over concrete slabs-on-grade.
- 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, 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.
- E. Provide preservative-treated materials for all exterior rough carpentry unless otherwise indicated, items indicated on drawings, and the following
  - 1. Framing members less than 18 in above grade.
  - 2. Sills and ledgers.
  - 3. Posts
  - 4. Decking.
  - 5. Stair treads

#### 2.3 Lumber

- A. Dimension Lumber:
  - 1. Dimension lumber will be No. 2: Douglas fir-larch (north): NLGA with 19% maximum moisture content.
  - 2. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
    - a. See SECTION 061063 Exterior rough carpentry

3. Deck and Stair framing with composite lumber 2x6
- 2.4 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.
  - B. Parallel Stand Lumber: Manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.
    1. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12 in nominal depth members
    2. Modulus of Elasticity, Edgewise: 2,000,000 psi
  - C. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
    1. Material: Any veneer product, glued-laminated wood or product made from any combination solid lumber, wood strands, and veneers.
- 2.5 Plywood Backing Panels
  - A. Telephone and Electrical Equipment Backing Panels: Plywood, Exterior AC, not less than ½" nominal thickness.
  - B. See SECTION 061600 – Sheathing
- 2.6 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 F 568, Property Class 4.6; with ASTM A 563M hex nuts and, where indicated, flat washers.
  - B. Metal Framing Anchors: Structural capacity, type, and size indicated
    1. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, Z180 coating designation for interior locations where stainless steel is not indicated.
    2. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.

### **Part 3 - Execution**

- 3.1 Installation
  - A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
  - B. Securely attach rough carpentry to substrates, complying with the following:
    1. CABO NER-272 for power-driven fasteners.
    2. Published requirements of metal framing anchor manufacturer.
    3. Table 2304.9.1, "Fastening Schedule," in the IBC.
  - C. Secure decking to framing with concealed decking fasteners
  - D. Secure stair treads and risers by gluing and screwing to carriages. Countersink fastener heads, fill flush, and sand filler. Extend treads over carriages.
  - E. Railing Installation: Countersink fastener heads, fill flush, and sand filler.
    1. Fit balusters to railings, glue, and screw in place.
    2. Secure newel posts to stringers and risers with through bolts.
    3. 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**

## SECTION 06 14 00 PRESSURE-TREATED WOOD PRODUCTS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Preservative treatment of lumber and plywood.
- B. Fire-retardant treatment of lumber and plywood.

#### 1.2 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry.
- B. Section 06 20 00 - Finish Carpentry.

#### 1.3 REFERENCES

##### A. ASTM International (ASTM):

1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A653 / A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM D3201 Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Base Products.
4. ASTM D5516 Standard Test Method for Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to Elevated Temperatures.
5. ASTM D5664 Standard Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber.
6. ASTM D6305 Standard Practice for Calculating Bending Strength Design Adjustment Factors for Fire retardant Treated Plywood Roof Sheathing.
7. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

##### B. American Wood-Protection Association (AWPA):

1. AWPA E12 Standard method of determining the corrosion of metal in contact with wood.
2. AWPA M4 - Standard for the Care of Preservative Treated Wood Products.
3. AWPA P5 - Standard for Waterborne Preservatives.
4. AWPA P17 Fire Retardant Formulations.
5. AWPA P23 Standard for Chromated Copper Arsenate Type C (CCA-C).
6. AWPA P25 - Standard for Inorganic Boron (SBX).
7. AWPA P26 - Standard for Alkaline Copper Quat Type A (ACQ-A).
8. AWPA P27 - Standard for Alkaline Copper Quat Type B (ACQ-B).
9. AWPA P28 Standard for Alkaline Copper Quat Type C (ACQ-C).
10. AWPA P29 Standard for Alkaline Copper Quat Type D (ACQ-D).
11. AWPA P47 - Standard for DCOI/Imidacloprid/Stabilizer, Waterborne (EL2).
12. AWPA P50 Standard for Fire Retardant FR-2 (FR-2).
13. AWPA T1 - Use Category System: Processing and Treatment Standard.
14. AWPA U1 - Use Category System: User Specification for Treated Wood.

##### C. Permanent Wood Foundation (PWF) Design Specification, ANSI/AF&PA PWF-2007.

- D. Permanent Wood Foundations, Design and Construction Guide, Southern Pine Council. Publication #400.
- E. National Fire Protection Association (NFPA) 255 Method of Test of Surface Burning Characteristics of Building Materials.
- F. NER 643, ACQ® Preserve® Wood Preservative Treatment; International Code Council - Evaluation Service, ICC-ES.
- G. Underwriters Laboratories, Inc. (UL) 723 Tests for Surface Burning Characteristics of Building Materials.
- H. Hawaiian Local Building Code Standards.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's instructions for use, including requirements for storage, cutting, and finishing.
- C. Preservative Treatment Certification: Treating plant's certification of compliance with specified standards, process employed, and preservative retention values.
- D. Fire-Retardant Treatment Certification: Treating plant's certification of compliance with specified requirements.

#### 1.5 QUALITY ASSURANCE

- A. Wood Treatment Plant Qualifications: Wood treatment plant experienced in performing work of this section licensed by Viance, LLC.
- B. Source Quality: Obtain treated wood products from a single approved source.
- C. Preservative Treatment: Mark each piece of plywood and lumber to show compliance with specified standards.
- D. Fire-Retardant Treatment: Mark each piece of plywood and lumber to show compliance with specified standards.
- E. Regulatory Requirements: Provide fire retardant treatment which complies with the following regulatory requirements:
  - 1. International Building Code (IBC).
  - 2. International Residential Code (IRC).
  - 3. International Code Council Evaluation Service ICC-ES ESR 2645.
  - 4. City of Los Angeles, California RR24502.
  - 5. City of New York, New York Building Code, MEA 406 and MEA 407.
- F. Independent Third Party Inspection:
  - 1. Provide plant inspections.
- G. Kiln Dry after Treatment (KDAT): Provide kiln dry material as indicated or required.
  - 1. Kiln dry after treatment to 19 percent maximum moisture content for lumber and 18 percent for plywood in accordance with AWPA T1, Section 7 - Drying After Treatment (lumber) and AWPA T1, Section :F: Pressure treated composites (3c) kiln drying after treatment.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Exposure: Prevent wood products against moisture and dimensional changes, in accordance with instructions from treating plant.

#### 1.7 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard 20-year transferable limited warranty for pressure-treated wood.
- B. Manufacturer's Warranty: Provide manufacturer's standard 40-year transferable limited warranty for pressure-treated wood.
- C. Manufacturer's Warranty: Provide manufacturer's standard 50-year limited warranty for pressure-treated wood.
- D. Manufacturer's Warranty: Provide manufacturer's standard limited lifetime warranty for pressure treated wood.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Viance, which is located at: 200 E. Woodlawn Rd. Suite 350 ; Charlotte, NC 28217; Toll Free Tel: 800-421-8661; Tel: 704-522-0825; Email: [request info \(ijohnson@viance.net\)](mailto:request info (ijohnson@viance.net)); Web: [www.treatedwood.com](http://www.treatedwood.com)
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.
- C. Substitutions: Not permitted.

### 2.2 MATERIALS

- A. Dimension Lumber: As specified in Section 06100.
- B. Structural Plywood: As specified in Section 06100.
- C. Finish Lumber and Plywood: As specified in Section 06200.
- D. Fasteners and Metal Hardware In Preservative Treated Wood : For treated wood and where wood is in ground contact, subject to high relative humidity, or exposed to weather, provide corrosion resistant steel fasteners with hot-dip zinc coating per ASTM A153/A153M, provide corrosion resistant hardware per ASTM A653 / A653M Class G-185 in compliance with building code requirements.
- E. Fasteners In Fire-Retardant Treated Wood: Use only code approved fasteners as specified in ICC-ES ESR 2645.

### 2.3 PRESERVATIVE PRESSURE TREATMENT OF WOOD

- A. Preservative treatment for above ground use continuously protected from liquid water:
  - 1. Treatment: TimberSaver<sup>®</sup> PT (SBX) in accordance with AWWA U1 and P5 and P25.
    - a. For protection against North American subterranean termites, decay and insects, 0.25 lb/cu ft (4kg/m<sup>3</sup>) Disodium Octaborate Tetrahydrate (DOT) minimum retention (0.17 lb/cu ft (2.7 kg/m<sup>3</sup>) as B2O<sub>3</sub> equivalent) retention.
    - b. For protection against North America subterranean termites, Formosan termites and insects, use 0.42 lb/cu ft. (6.7 kg /m<sup>3</sup>) Disodium Octaborate Tetrahydrate (DOT) minimum retention (0.28 lb/cu ft.(4.5 kg/m<sup>3</sup>) as B2O<sub>3</sub> equivalent) in accordance with AWWA U1 or Hawaiian building code standards as appropriate.
    - c. All lumber and Plywood treated with TimberSaver PT shall be protected from exposure to the weather during transit and storage. TimberSaver PT treated products shall be stored out of ground contact and protected against exposure to liquid water.
  - 2. Treatment: TimberSaver<sup>®</sup>40 (SBX) in accordance with AWWA U1 and P5 and P25.

- a. For protection against North American subterranean termites, Formosan termites and insects use 0.42 lb/cu ft. (6.7 kg /m<sup>3</sup>) Disodium Octaborate Tetrahydrate (DOT) minimum retention (0.28 lb/cu ft.(4.5 kg/m<sup>3</sup>) as B<sub>2</sub>O<sub>3</sub> equivalent) in accordance with AWPA U1 or Hawaiian building code standards as appropriate.
  - b. All lumber and Plywood treated with TimberSaver 40 shall be protected from exposure to the weather during transit and storage. TimberSaver 40 treated products shall be stored out of ground contact and protected against exposure to liquid water.
3. Treat wood in the following locations:
- a. All framing lumber, studs, sill plates, floor joists, roof rafters, trusses, plywood,
  - b. Interior sheathing, furring strips, flooring, moldings and wood trim.
  - c. Ecolife® is protected with a revolutionary, non-metallic preservative plus wood stabilizer system. Ecolife Stabilized Weather Resistant Wood was the first decking product to receive NAHB Research Center National Green Building Certification as a "Green Approved Product", eligible to contribute points toward certification of a building under the National Green Building Standard™. Ecolife Stabilized Weather-Resistant Wood is protected with Ecovance™ preservative-the active ingredient of which was awarded a US EPA Presidential Green Chemistry Award in 1996 for its use in other applications. Ecolife Stabilized Weather-Resistant Wood is an environmentally preferred building product that enhances the strength and long-term natural beauty of your deck projects -with significantly lower maintenance. Ecolife Stabilized Weather-Resistant Wood is not approved for use in ground contact, fresh water immersion or salt water immersion.
- B. Preservative Treatment for Above Ground Use: decking, fencing, handrails, joists and subflooring, roof decks and sheathing.
1. Treatment: ACQ as manufactured for Viance in accordance with AWPA U1 and P5, P26, P27, P28, P29 or NER 643 as appropriate. a. Use 0.15 lb/cu ft (2.4 kg/m<sup>3</sup>) of ACQ® in accordance with U1 or NER 643 as appropriate.
  2. Treatment: EcoLife II as manufactured by Viance. a. Use 0.019 lb/cu ft (0.3 kg/m<sup>3</sup>) of EL2 (+ 0.2 lb/cu ft MCS) in accordance with AWPA U1 or use 0.0187 lb/cu ft (0.3kg/m<sup>3</sup>) Ecolife II in accordance with ESR 1851 as appropriate.
3. Treat wood in the following locations:
- a. In contact with roofing, flashing, or waterproofing.
  - b. In contact with masonry or concrete.
  - c. Within 18 inches (450 mm) of grade.
  - d. Exposed to weather.
  - e. Other locations indicated.

END OF SECTION

## SECTION 06 15 13 Wood Decking

### **PART 1 GENERAL**

#### 1.1 SUMMARY

- A. Wood Decking for:
  - 1. Exterior Metal Ramps and Decks
  - 2. Interior decking at kitchen, bath and areas indicated

#### 1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification

Sections that relate directly to work of this Section include, but are not limited to:

- 1. Section 06 11 00, Wood Framing
- 2. Section 09 00 00, Finishes
- 3. Section 05 00 00, Metal Fabrications

#### 1.3 SUBMITTALS

- A. Product Data: Submit product data, installation instructions, and recommendations for each product specified.
- B. Material Samples: 6 quantity 3 foot flat samples showing diverse range of the product.

#### 1.4 QUALITY ASSURANCE

- 1. Installer: SCI-Arc / Caltech: Solar Decathlon Team 2011

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with project management's recommendations and industry standards. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

B. Perform work of this section in coordination with other sections to provide the highest quality work which best fulfills the intent requirements of this work.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

A. 5/4" reclaimed "deodar cedar"

Cedar shall be sanded smooth and cut to dimensional widths as indicated on the drawings. Excessive "knotty" pieces shall be cut and salvaged as applicable.

C. Accessories: Provide all stainless steel fasteners, similar items necessary to properly complete the work. Provide accessories used and which are of sufficient size and gage to perform as intended.

### **2.2 FABRICATION**

A. Isolate dissimilar materials with isolation coating recommended by the manufacturer or other permanent separation acceptable to the Architect.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

A. Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### **3.2 INSTALLATION**

A. Strictly comply with manufacturer's and fabricator's instructions and recommendations and approved details.

B. Securely anchor work and allow for thermal movement and building movement. Use concealed fasteners to the greatest extent possible.

### **3.3 ADJUSTING, CLEANING, PROTECTION**

A. Adjust work to conform to appear uniform and in proper relationship with adjacent work.

B. Repair minor damage to eliminate all evidence of repair. Remove and replace work, which cannot be satisfactorily repaired.

C. Clean exposed surfaces using mild detergent and water.

## **END OF SECTION**

## SECTION 06 16 00 – Sheathing

### PART 1 – GENERAL

#### 1.1 Summary

- A. Submittals: ICC-ES evaluations reports for wood-preservative treated wood, fire-retardant treated

### Part 2 - Products

#### 2.1 Wood Panel Products, General

- A. Plywood: DOC PS 1
- B. For supplier, see: <http://www.stockbuildingsupply.com>

#### 2.2 Treated Plywood

- A. Preservative-treated Plywood AWPA C9
  - 1. Use treatment containing no arsenic or chromium
  - 2. Kiln-dry plywood after treatment to maximum moisture content of 15 percent

#### 2.3 Wall Sheathing

- A. Plywood Wall Sheathing:
  - 1. Thickness 15/32 inch
  - 2. For supplier, see: <http://www.stockbuildingsupply.com>

#### 2.4 Roof Sheathing

- A. Plywood Roof Sheathing:
  - 1. Thickness 19/32 inch
  - 2. For supplier, see: <http://www.stockbuildingsupply.com>

#### 2.5 Subflooring and Underlayment

- A. Subfloor weather-resistant plywood sheathing panel
  - 1. Thickness 19/32 inch
  - 2. For supplier, see: <http://www.stockbuildingsupply.com>

### Part 3 - Execution

#### 3.1 Installation

- A. Securely attach to substrates, complying with the following:
  - 1. CABO NER-272 for power-driven fasteners.
- B. Fastening Methods:
  - 1. Combination Subfloor-underlayment:
    - a. Glue and nail to wood framing
  - 2. Wall and Roof Sheathing:
    - a. Nail to wood framing

## SECTION 06 18 00 – GLUED-LAMINATED CONSTRUCTION

### PART 1 – GENERAL

#### 1.1 Summary

- A. Submittals: Product Data
- B. Standards: Comply with ANSI/AITC A 190.1, “Structural Glued Laminated Timber”
- C. Comply with AITC 111, “Recommended Practice for Protection of Structural Glued Laminated Timber during Transit, Storage, and Erection”

### Part 2 - Products

#### 2.1 Structural Glued-Laminated Units

- A. Structural Performance: Provide structural glulam timber capable of withstanding design loads indicated according to AITC 117 or as determined according to ASTM D 3737
- B. Species: Use any Species U.O.N.
- C. Balanced lay-ups are for cantilevered and continuous span applications but can be used for simple spans; unbalanced lay-ups are for simple spans
- D. Appearance: Industrial grade
- E. Adhesive: Wet-use adhesive complying with AITC A190.1
- F. End-cut Sealing: After end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces
- G. Seal Coat: After fabricating and sanding each unit, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit
- H. Wiped Stain Finish: Manufacturer’s standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.
- I. Manufacturer’s standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus
- J. For Supplier see <http://www.stockbuildingsupply.com>

#### 2.2 Parallel Strand Lumber

- A. Manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456
- B. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12 in nominal depth members
- C. Modulus of Elasticity, Edgewise: 2,000,000 psi

#### 2.3 Connectors

- A. General: Fabricate from structural steel complying with ASTM A 36/A 36M; steel bars complying with ASTM A 575, Grade M 1020; and steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33. Finish with rust-inhibitive primer.
- B. Use 16d nail connection to double top plates
- C. Use Simpson A35 clips for connection to rim joists, see SECTION 060523 Wood and Plastic Fastening

### Part 3 - Execution

#### 3.1 Installation

- A. Install structural glued-laminated timber for a close fit and neat appearance of joints. Carefully trim ends to fit connectors, mark and drill for bolts, and seal cuts with end sealer
- B. Handle and temporarily support members to prevent visible surface damage. When hoisting members into place, use padded slings, and protect corners with wood blocking.
- C. Brace members as they are placed to maintain safe condition until full stability is provided.

**END OF SECTION**

**SECTION 06 20 00 – FINISHED CARPENTRY**

**PART 1 – GENERAL**

1.1 Summary

- A. Submittals: Product Data

**Part 2 - Products**

2.1 Materials, General Manufactured by Arauco

- A. 1/2" Douglas Fir ACX Plywood
- B. 1/2" Douglas Fir ACX Plywood flooring

2.2 Minimum Material Standards

- A. ASTM D 1037, ASTM D 1037, Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
- B. ASTM D 3043, Standard Test Methods for Flexural Structural Panels in Flexure
- C. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials
- D. ASTM D 4442, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials
- E. ASTM D 3500, Standard Test Method for Structural Panels in Tension
- F. ASTM E 1333, Standard Test Method for Determining Formaldehyde Concentrations in Air Emission Rates from Wood Using a Large Chamber

2.3 Interior Paneling

- A. 1/2" plywood

**Part 3 - Execution**

3.1 Installation

- A. Condition finish carpentry in installation 24 hours before installing
- B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seat cuts.
- C. Select and arrange paneling for best match to adjacent units. Install with uniform tight joints.

**END OF SECTION**

## SECTION 06 80 00 - COMPOSITE FABRICATIONS

### PART 1 – General

#### 1.01 SUMMARY

Low Density Poly Ethylene "bull-nose" reinforcement at north and south insulation apertures edges. This bull-nose is aesthetic in nature and smoothes condition.

#### 1.02 REFERENCES

##### ASTM Testing Standards

1. D-123
2. D-1505
3. D-638
4. D-882
5. D-256
6. D-2240
7. D-668
8. D-570

#### 1.03 SUBMITTALS

A. Product Data: Manufacturer's literature including independently tested data listing performance criteria and Owner's Manual with installation instructions.

#### 1.04 SITE CONDITIONS, DELIVERY, STORAGE AND HANDLING

A. In addition to general delivery, storage and handling requirements specified in Section 01600, comply with the following:

1. Deliver materials to job site in sealed, unopened cartons or crates. Protect units from damage. Store material under cover, protected from weather and construction activities.
- B. Store flat in dry, well ventilated area out of direct sunlight.

### PART 2 – PRODUCTS

#### 2.01 SUPPLIER

- A. McMaster Carr  
9630 Norwalk Blvd.  
Santa Fe Springs, CA 90670-2932  
www.mcmaster.com

#### 2.02 MATERIALS

##### A. Low Density Polyethylene

1. 1/8" Thickness
2. 48" x 96" Cut to Size  
3 1/16" (78mm) / 2 5/8" (66mm)
3. ASTM STANDARDS
  1. D-123 Melt index: 1.0 to 2.5 g/10 min
  2. D-1505 Density: .910 to .925 g/cm cubed
  3. D-638 Tensile Strength Yield: 1800-2200 psi
  4. D-882 Tensile Elongation: 600 %

5. D-256 IZOD Impact Notched @ 73 Degrees F: No Break
6. D-2240 Hardness Shore D: 41-50
7. D-668 Heat Deflection Temp @ 264 psi: 90-105 F  
@ 66 psi: 100-121 F
8. D-570 Water Absorption: < 0.01 %

#### 2.04 ACCESSORIES

##### A. Fasteners:

#10 1/2" or greater sheet metal type Lath zinc coated steel screws or approved equal

### **PART 3 – EXECUTION**

#### 3.02 INSTALLATION

A. Cut 1/8" LDPE to proper widths for radius of curve(s) with metal shears or knife

B. Fasten LDPE with fasteners at 12" or less increments and no more than 3" and no less than 1" from any corner edge of the material.

**END OF SECTION**

## Division 07 – Thermal and Moisture Protection

### 07 21 16 - Batt Insulation

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Natural Cotton Fiber Insulation

##### **1.2 RELATED SECTIONS**

- A. Division 7 Sections that apply to thermal protection.
- B. Division 6 Sections that apply to wood framing.

##### **1.3 REFERENCES**

- A. ASTM E 84 - Surface Burning Characteristics of Building Materials.
- B. ASTM C 518 – Test Method for Steady-State Thermal Transmissions properties by means of Heat Flow Meter Apparatus.
- C. ASTM C 423-90A – Standard Test Methods for Sound Absorption and Sound Absorption Coefficient by the Reverberation Method.
- D. ASTM E795-93 – Standard Practices for Mounting Test Specimens during Sound Absorption Tests.
- E. ASTM E90-97 – Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- F. ASTM E 413-87 – Classification for Sound Insulation Rating.
- G. ASTM E 1332-90 – Classification for Determination of Outdoor-Indoor Transmission Class.
- H. ASTM C 739-9.0 – Corrosiveness of Cellulosic Fiber Insulation.
- I. ASTM C 739-11.0 – Fungi Resistance of Cellulosic Fiber Insulation.
- J. ASTM C 739-13.00 – Odor Emission of Cellulosic Fiber Insulation.
- K. ASTM C 739-12 - Moisture Absorption of Cellulosic Fiber Insulation.

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's printed product data and specifications.
- B. Samples: Submit manufacturer's sample, minimum 6 inches square.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying material name and manufacturer.
- B. Storage: Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Handling: Protect materials during handling and installation to prevent damage.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURER**

- A. Bonded Logic, Inc., 24053 S Arizona Ave, Chandler, AZ, 85248. Phone (480) 812-9114. Fax (480) 812-9633. Web Site [www.BondedLogic.com](http://www.BondedLogic.com). E-Mail [Sales@BondedLogic.com](mailto:Sales@BondedLogic.com).

### **2.2 MATERIALS**

- A. UltraTouch Natural Cotton Fiber Insulation: - Unfaced batts made from post-industrial natural cotton fibers that have been thermally bonded.
- B. R-value: 3.5 Inch=R13, 5.5 Inch=R19, 5.5 Inch=R21, 8 Inch=R30
- C. Fire Rating: Flame Spread – 5 (Class A), Smoke Developed – 35 (Class-A)
- D. Mold/Mildew/Fungi Resistance: Pass-No Growth (ASTM C 739)
- E. Corrosion Resistance: Pass (ASTM C 739)
- F. Odor Emission: Pass (ASTM C 739)
- G. Moisture Absorption: Pass – Less than 15% (ASTM C 739)
- H. Retardant used also acts as excellent pest inhibitor.
- I. Environmentally safe, sustainable, non-allergenic, non-hazardous, non-formaldehyde, non-itich insulation product.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify on site conditions.
- B. Verify insulation layout and dimensions.
- C. Ensure areas are ready for insulation and accurately match accepted project drawings.

### **3.2 PREPARATION**

- A. Remove batts from packaging and shake to activate binding fibers. Batts should be given up to 72hrs to complete rebound activity.

### **3.2 INSTALLATION**

- A. Install insulation in accordance with manufacturer's instructions at locations indicated on the drawings.
- B. Cut or tear insulation to fit snugly around electrical wall outlets and other cutouts.
- E. Replace damaged material as directed by Architect.

### **3.3 PROTECTION**

- A. Protect insulation from damage during construction.

**END OF SECTION**

## SECTION 07 21 35 - INSULATING SPRAY FOAM SYSTEM FOR WALLS

### **PART 1 GENERAL**

#### 1.01 SECTION INCLUDES

- A Insulating spray foam system for voids and openings in walls.

#### 1.02 RELATED SECTIONS

- A Section 06 10 00 - Rough Carpentry.
- B Section 07 92 00 - Joint Sealants.
- C Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.03 SUBMITTALS

- A Submit Product data as specified in Section 01340 Shop Drawings, Product Data and Samples for each product.
- B Foam Sealant Air System Schedule: Indicate locations of each through-foam sealant air system, along with the following information:
  - 1 Types of penetrating items.
  - 2 Types of construction penetrated, including thicknesses of construction penetrated.

#### 1.04 QUALITY ASSURANCE

- A Regulatory Approvals: Provide products with the following approvals.
  - 1 BOCAI-ES, Report 96-32.01, Spray Polyurethane Foams.
  - 2 ICBO Evaluation Service, Inc, Report ER-3974, ES Report Filling Category: Insulation, Spray-Applied Polyurethane Foams.
  - 3 National Research Council Canada, Report CCMCa 13074-R, Institute for Research in Construction, Product Evaluation Report.
  - 4 SBCCI-ES, Report 9571B, Evaluation of Product for Compliance with the Standard Building Code and Submission to Building Officials or Other Authorities Having Jurisdiction for Product Usage.
  - 5 Underwriters Laboratories, Report R7813, Product Evaluation.

- 6 Underwriters Laboratories, Report R13655, Product Evaluation.

B Installer: Qualified installer with minimum 1 year experience in application of spray applied foams.

#### 1.05 DELIVERY, STORAGE AND HANDLING

A Deliver and store products undamaged in original containers with manufacturer's labels and seals intact.

B Do not store at temperatures above 120 degrees F. Avoid prolonged storage in direct sunlight or near heat sources.

C Protect Foam Sealant Air System materials from physical damage and from deterioration due to moisture, soiling and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing and protecting during installation.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A Manufacturers of insulating spray foam system for walls having products considered acceptable for use:

- 1 The Dow Chemical Company.
- 2 Or approved equal.

B Substitution Procedures: refer to Section 00100 Instruction to Bidders

#### 2.02 MATERIALS

A Polyurethane Foam: Two-component chemically-cured spray-applied polyurethane foam with the following characteristics:

- 1 Manufacturer: The Dow Chemical Company.
- 2 Product **STYROFOAM SPF RS 2045** 2.5 pounds per cubic foot.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A Inspect existing conditions to ensure they are suitable for product application. Do not proceed until unacceptable conditions are corrected.

### 3.02 INSTALLATION

- A Install materials in strict compliance with manufacturer's written installation instructions, when ambient temperature is between 60 and 80 degrees F, with lower application temperature (above freezing) acceptable if kit contents are at least 75 degrees F.
- B Protect adjacent Work from damage. Clean adjacent surfaces of excess product and overspray.
- C Foam Sealant Air System: Apply Foam Sealant Air System according to manufacturer's written instructions. Do not apply Foam Sealant Air System until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive Foam Sealant Air System are masked. After Foam Sealant Air System is applied, make flush with finished surface by using method recommended by Foam Sealant Air System manufacturer.
- D Miscellaneous Voids: Install Foam Sealant Air System in miscellaneous voids and cavity spaces where indicated on Drawings and where required to prevent air infiltration.

### 3.03 PROTECTION

- A Protect installed Foam Sealant Air System from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where Foam Sealant Air System is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B For exterior uses, provide a coating or painting for protection from ultraviolet radiation.

END OF SECTION

## SECTION 07 27 00 - AIR BARRIER BUILDING WRAP

### PART 1 – General

#### 1.03 SUMMARY

The Air Barrier "Building Wrap" is to wrap and enclose the building prior to final exterior finish. It is a non-woven, non-perforated polyolefin-based wrap. Designed for enhanced job-site durability and long-term product performance

#### 1.02 SUBMITTALS

A. Product Data: Manufacturer's literature including independently tested data listing performance criteria and Owner's Manual with installation instructions.

#### 1.04 SITE CONDITIONS, DELIVERY, STORAGE AND HANDLING

A. In addition to general delivery, storage and handling requirements specified in Section 01600, comply with the following:

1. Deliver materials to job site in sealed, unopened cartons or crates. Protect units from damage. Store material under cover, protected from weather and construction activities.
- B. Store flat in dry, well ventilated area out of direct sunlight.

### PART 2 – PRODUCTS

#### 2.1 MATERIALS

1. Building Wrap: non-woven, non-perforated polyolefin-based membrane, 2744 mm or 2896 mm wide rolls; and having the following properties when tested to the following guides/standards.

1. Air Leakage (CCMC Technical Guide 07273): [0.02 L/s-m<sup>2</sup> minimum] @ 75 Pa.
2. Water Vapor Permeance (ASTM E96): 286 ng/Pas m<sup>2</sup> [5 perms] minimum.
3. Tensile Strength (ASTM D882): 4.5N/25mm minimum.
4. Manufacturer and Product Name: WEATHERMATE Plus Housewrap.
2. Sheathing Tape: CCMC evaluated sheathing tape; eg. Tuck 20502 by Canadian Technical Tape, Ltd. or 1585 cw-p2/48001 Sheathing Tape by Venture Tape Corp.
3. Fasteners: [plastic cap nails] [OR] [rust-resistant screws with washer heads.]

## **Part 3 - Execution**

### **3.1 INSTALLATION**

1. Position joints or laps of sheets over studs or other film bearing in order to achieve an effective and permanent seal.
2. Install building wrap horizontally with print side facing out.
3. Position bottom edge of building wrap to overlap foundation 25 mm minimum.
4. Position top edge of building wrap to cover edges of top plates.
5. Overlap vertical seams minimum 150 mm and seal with sheathing tape. Ensure weathertight bond.
6. Overlap horizontal seams minimum 150 mm shingle fashion and seal with sheathing tape. Ensure weather tight bond.
7. Secure building wrap to framing members with plastic cap nails spaced at 150 mm OC. Ensure fasteners penetrate sheathing at least 13 mm. 2002 01 01 Dow Chemical Canada ULC Short Form Guide Specification - Air Barrier Building Wrap WEATHERMATE Plus Housewrap
8. Cut building wrap at wall opening in accordance with manufacturer's printed installation instructions. Pull flaps to inside of opening and fasten to inside face of framing with fasteners spaced at 150 mm OC. Trim excess membrane.
9. Seal penetrations with sheathing tape to shed water and prevent air infiltration.

### **3.2 PROTECTION**

1. If building wrap is to remain exposed for 60 days or more, protect it from direct sunlight.

## **END OF SECTION**

## 07 27 29 - FOAMED-IN-PLACE AIR BARRIERS

### PART 1 - GENERAL

#### 1.1 REFERENCES

.1 CAN/ULC-S710.1-[05]: Standard for Thermal Insulation - Bead Applied One-Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

.2 CAN/ULC-S710.2-[05]: Standard for Thermal Insulation - Bead Applied One-Component Polyurethane Air Sealant Foam, Part 2: Application.

#### 1.2 DELIVERY, STORAGE AND HANDLING

.1 Refer to Solar Decathlon 2001 Rules

.2 Store Products in a dry and adequately ventilated area, with an ambient temperature maintained between [0 degrees C and 32 degrees C] [32 degrees F and 90 degrees F].

.3 Keep containers tightly closed when not in use.

.4 Protect containers from damage.

.5 Keep Products away from direct sunlight.

.6 Do not incinerate aerosol canisters.

#### 1.3 ENVIRONMENTAL REQUIREMENTS

.1 Apply foamed-in-place air barriers when ambient air temperature is greater than [-3 degrees C] [25 degrees F] and less than [44 degrees C] [120 degrees F].

### PART 2 - PRODUCTS

#### 2.1 ACCESSORIES

.1 Foamed-in-Place Sealant - General Purpose Type: semi-rigid single-component polyurethane sealant, to CAN/ULC-S710.1; and having the following properties:

SPEC NOTE: Gun-applied and Straw-applied products differ in thermal resistance values. Refer to Dow product literature to determine applicable application technique and edit the following accordingly.

.1 Thermal Resistance (ASTM C518): [RSI [0.73][0.67] per 25 mm thickness][R-[4.2][3.8] per inch thickness].

.2 Core Density (ASTM D1622): [[16.02][24.03] kg/m<sup>3</sup>] [[1.0][1.5] pcf].

.3 Fire Resistance (ASTM E84): Flame spread = 15, Smoke Developed = 20.

.4 Color: Light Tan.

.5 Cure Time: approximately 1 hour.

.6 Tack-free Time: 6-7 minutes.

.7 Applicator: [Gun] [Straw] applied.

.8 Manufacturer's and Product Name: GREAT STUFF PRO™ Gaps and Cracks

Insulating Foam Sealant by Dow Chemical Canada ULC

.2 Foamed-in-Place Sealant - Low Pressure Type: semi-flexible soft, single-component polyurethane sealant, to CAN/ULC-S710.1; and having the following properties:

.1 Core Density (ASTM D1622): [27.24 kg/m<sup>3</sup>] [1.7 pcf].

.2 Fire Resistance (ASTM E84): Flame spread = 10, Smoke Developed = 20.

.4 Color: Yellow.

.5 Cure Time: approximately 12 hours.

.6 Tack-free Time: 6-9 minutes.

.7 Applicator: [Gun] [Straw] applied.

.8 Manufacturer's and Product Name: GREAT STUFF PRO™ Window & Door

Insulating Foam Sealant by Dow Chemical Canada ULC

.3 Tool Cleaner: formulated to dissolve and remove uncured polyurethane foam from dispenser tools; eg. GREAT STUFF PRO™ Tool Cleaner by Dow Chemical Canada ULC

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

.1 Apply foamed-in-place air barrier sealants in strict accordance with manufacturer's installation guidelines.

.3 Avoid overfilling restricted spaces.

.4 Apply general purpose foamed-in-place sealant in gaps and cracks up to [75 mm] [3 inches] in size.

.5 Apply low pressure foamed-in-place sealant in gaps and cracks adjacent to door and window frames, up to a maximum gap width of [75 mm] [3 inches].

### 3.2 CLEANING

.1 Clean overspray from adjacent surfaces and ensure a suitable substrate for subsequent work.

**END OF SECTION**

## 07 60 30 STAINLESS STEEL SHEET METAL

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Provide copper-clad stainless steel for the following applications:
1. Sheet metal roofing including standing seam, flat seam and batten seam types.
  2. Sheet metal fascia and wall panels.
  3. Rain drainage including gutters, downspouts, scuppers and conductors.
  4. Flashing including base, counter, cap, eave, valley, drip and step flashings.
  5. Fabricated assemblies, including dormers, cupolas, finials, and spires.

#### 1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification

Sections that relate directly to work of this Section include, but are not limited to:

1. Section 05 50 00, Metal Fabrications.
2. Section 09 00 00, Finishes

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, and recommendations for each product specified.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide large scale plans, elevations, and details of profiles, joints, seams, anchorages, connections and accessory items. Indicate galvanic isolation from adjacent aluminum or carbon steel if applicable.
- C. Material Samples: Submit two 6 by 6 inch flat stainless steel.
- D. Fabricated Samples: Submit full size sample of typical seam, corner and termination as acceptable to the Architect, for approval of fabrication details and workmanship.
- D. Warranty: 5 year warranty.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator: Minimum 5 years experience with projects of similar complexity.
- B. Installer: Minimum 3 years experience with projects of similar complexity. At Architect's request, submit names and locations of recent projects.
- C. Industry Standards for Materials and Fabrication Details: Comply with recommendations of the Sheet

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions  
  
and recommendations and industry standards. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Perform work of this section in coordination with other sections to provide the highest quality work which best fulfills the intent requirements of this work.

### **PART 2 PRODUCTS**

#### 2.1 MATERIALS

- A. Acceptable Manufacturing:
  - 1. Cross Section: stainless steel
  - 2. Standard Thicknesses: As recommended by manufacturer from the following standard thicknesses  
  
and weights:
    - a. 0.012 inches thick, 0.4959 pounds per square foot.
    - b. 0.016 inches thick, 0.6612 pounds per square foot.
    - c. 0.0216 inches thick, 0.8927 pounds per square foot.
    - d. 0.027 inches thick, 1.1159 pounds per square foot.
  - 3. Mechanically Fastened Joints: stainless steel fasteners.
  - 4. Soldered Joints: Soft soldered using 50-50 or higher tin content solder, mild fluxes.
  - 5. Shapes: Coils, rolls or sheets up to 48 inches wide, as applicable.

- C. Accessories: Provide all clips, cleats, straps, anchors, similar items necessary to properly complete the work. Provide accessories that are compatible with sheet metal materials used and which are of sufficient size and gage to perform as intended.

## 2.2 FABRICATION

- A. Shop fabricates work to the greatest extent possible. Fabricate work to match approved shop drawings and to provide the best possible watertight, weatherproof performance with expansion provisions in running work. Minimize oil-canning, buckling, tool marks and other defects.
- B. Fabricate work with uniform, watertight joints. Make seams as inconspicuous as possible.
- C. Isolate dissimilar materials with isolation coating recommended by the manufacturer or other permanent separation acceptable to the Architect.

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 INSTALLATION

- A. Strictly comply with manufacturer's and fabricator's instructions and recommendations and approved details.
- B. Securely anchor work and allow for thermal movement and building movement. Use concealed fasteners to the greatest extent possible. Install work to be permanently weatherproof and watertight.

### 3.3 ADJUSTING, CLEANING, PROTECTION

- A. Adjust work to conform to appear uniform and in proper relationship with adjacent work.
- B. Repair minor damage to eliminate all evidence of repair. Remove and replace work, which cannot be satisfactorily repaired.
- C. Clean exposed surfaces using detergent and water. If solder flux residues are evident, remove using mild abrasive cleanser.

## END OF SECTION

## SECTION 07 92 00 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. Section includes joint sealants for the following applications:

1. Exterior joints

#### 1.02 PERFORMANCE REQUIREMENTS

A. Provide joint protection for exterior applications that establish and maintain weatherproofing and reduce unconditioned air exchange through continuous joint protection without staining or deteriorating joint substrates.

#### 1.02 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Shop Drawings

C. Compatibility and adhesion test reports.

D. Manufacturer's Instructions

1. The product manufacturer shall provide a written installation guide.

#### 1.03 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field Testing

1. Preconstruction Field-Adhesion Testing: Before installing joint protection, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

1. All material shall arrive in the manufacturer's original sealed, labeled containers.

B. Storage and Handling Requirements

1. Store materials in a dry, protected, well-vented area. The contractor shall report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.

#### 1.05 FIELD OR SITE CONDITIONS

A. Observe all appropriate OSHA safety guidelines for this work.

#### 1.06 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which installer agrees to repair or replace joint protection that do not comply with performance and other requirements specified in this section within specified warranty period.

1. Warranty Period: Two years from date of substantial completion.

## **PART 2 - PRODUCTS**

### **2.01 PRODUCT TYPE**

- A. Polyurethane Joint Sealant (Caulk)
- B. Silicone Joint Sealant (Caulk)

### **2.02 MANUFACTURERS**

- A. DAP (Polyurethane)
- D. Dow (Silicone)
- E. GE (Silicone)

### **2.03 PERFORMANCE / DESIGN CRITERIA**

- A. Capacities / Characteristics
  - 1. Polyurethane: to seal joints between two porous surfaces (i.e. :wood, concrete, etc) & where sealant is to be painted.
  - 2. Silicone: to seal joints between non porous surfaces (i.e. glass, metal, etc)
  - 3. Effective in hot and cold conditions, even to 70° F below zero.

### **2.04 MATERIALS**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of exposed joint sealants: As indicted

## **PART 3 - EXECUTION**

### **3.01 INSTALLERS**

- A. Team California Solar Decathlon Team

### **3.02 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint protection.
    - a. Clean by brushing, grinding, blast cleaning, mechanical abrading or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint protection. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
- B. Joint Priming: Prime joint where recommended in writing by manufacturer based on preconstruction joint-substrate tests or prior experience. Apply primer to comply with manufacturers written instructions. Confine primers to areas of joint-protection-bond; do not allow spillage or migration onto adjoining surfaces.

**C. Masking Tape:** Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint protection.

**3.03 INSTALLATION**

**A. Sealant Installation Standard:** Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

**B. Manufacturer's Installation:** Follow the manufacturer's written installation guide as necessary.

**END OF SECTION**

## Division 08 – Openings

### SECTION 08 14 76 - Bi-folding Exterior and/or Glazed Wood Doors and Windows

#### PART 1 – General

##### 1.04 SUMMARY

A. Section Includes: Engineered sliding/folding wood and glass door system, including wood/aluminum frame, threshold, wood panels, sliding/folding and locking hardware, splines, weather stripping, glass and glazing; designed to provide an opening glass wall, with sizes and configurations as shown on drawings and specified herein, with NanaWall® WD66, the Standard Wood Framed Folding System as supplied by NANA WALL SYSTEMS, INC.

##### 1.05 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
  - 1. AAMA 1303.5, Voluntary Specifications for Forced Entry Resistant Aluminum Sliding Glass Doors.
- B. American National Standards Institute (ANSI)
  - 1. ANSI Z97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM E 283, Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  - 2. ASTM E 330, Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  - 3. ASTM E 547, Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
- D. Consumer Product Safety Commission (CPSC):
  - 1. CPSC 16CFR-1201, Safety Standard for Architectural Glazing Materials.
- E. National Fenestration Rating Council (NFRC):
  - 1. NFRC 100, Procedure for Determining Fenestration Product Thermal Materials.
  - 2. NFRC 200, Procedure for Determining Solar Heat Gain Coefficient.

##### 1.03 SUBMITTALS

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

##### 1.04 QUALITY ASSURANCE

- A. Manufacturer: Provide complete, precision built, engineered, pre-fitted unit by a single source manufacturer with at least 20 years experience in providing folding/sliding door systems for large openings in the North American market.
  - 1. The manufacturer must have a quality management system registration to the ISO 9001: 2008 standard.
  - 2. The manufacturer must have an environmental management system registration to the ISO 14001: 2004 standard.

B. Performance Requirements: Provide from manufacturer that has independently tested typical units. Testing results to include air infiltration in accordance with ASTM E 283, water penetration in accordance with ASTM E547, structural loading in accordance with ASTM E 330, and forced entry in accordance with AAMA 1303.5 and CAWM 300-96.

C. Thermal Performance U value: Unit to be rated, certified and labeled in accordance with NFRC 100, shown in manufacturer's latest published data for the glazing, sill and direction of opening specified.

D. Solar Heat Gain Coefficient: Unit to rated, certified and labeled in accordance with NFRC 200, shown in manufacturer's latest published data for the glazing, sill, and direction of opening specified.

E. Installer Qualifications: Installer experienced in the installation of manufacturer's products or the other similar products for large openings. Installer to provide reference list of at least 3 projects of similar scale and complexity successfully completed in the last 3 years.

#### 1.05 WARRANTY

A. Provide manufacture's standard warranty against defects in materials and workmanship.

B. Warrant Period: Ten years for rollers and for seal failure of insulated glass supplied. For all other components, one year (two years if unit is installed by manufacturer's certified trained installer) from date of delivery by manufacturer.

#### 1.06 SITE CONDITIONS, DELIVERY, STORAGE AND HANDLING

A. In addition to general delivery, storage and handling requirements specified in Section 01600, comply with the following:

1. Deliver materials to job site in sealed, unopened cartons or crates. Protect units from damage. Store material under cover, protected from weather and construction activities.
- B. Condition wood components to average prevailing relative humidity before installation.
- C. Do not subject wood components to extreme nor rapid changes in heat or humidity.
- D. Do not use forced heat to dry out building.
- E. Store flat in dry, well ventilated area out of direct sunlight.

## PART 2 – PRODUCTS

### 2.01 SUPPLIER

A. NANA WALL SYSTEMS, INC.  
707 Redwood Highway, Mill Valley, CA 94941  
Toll Free: (800) 873-5673  
Telephone: (415) 383-3148  
Fax: (415) 383-0312  
Website: [www.nanawall.com](http://www.nanawall.com)  
Email: [info@nanawall.com](mailto:info@nanawall.com)

### 2.02 MATERIALS

A. Frame and Panels: From manufacturer's standard profiles, provide head track, side jambs, panels, and glazing stops with dimensions shown on drawings.

1. Provide panels with:  
Standard one lite
2. Provide stile and rail width/depth of  
3 1/16" (78mm) / 2 5/8" (66mm)

3. Provide standard bottom rail
4. Type of Wood: Solid, three layer, vertical-grained, kiln dried Douglas Fir – PEFC Certified (Programme for the Endorsement of Forest Certification, included SFI and CSA)
5. Construction of wood panels to include close tolerance mortise and tenon, glued and pinned corners.
6. Wood Finish: Finishes to be water based, opened pored Clear sanding sealer for stain.  
SPECIFIER'S NOTE: Before installation, the unit must be field finished with at least two coats for a final protected finish.
7. Aluminum Extrusion: Extrusions with nominal thickness of .078" (2.0 mm). Alloy specified as AlMgSi0.5 with strength rated as 6063-T5 or F-22 (European standard). Anodized conforming to AAMA 611.98.

B. Glass:

1. Provide manufacturer's standard glass and dry glazing with EPDM gaskets and glass stops fixed with hidden nails. Glass to comply with safety glazing requirements of ANSI Z97.1 and CPSC 16CFR 1201.  
15/16" (24 mm) Double IG Low E 272/SB60 (Tempered Argon filled and enhanced spacer)

C. Locking Hardware and Handles:

1. Multi Point Locking with Latch, Deadbolt and Lever Handles on Both Sides on Primary Swing Panel Only

D. Sliding/Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top, bottom tracks and threshold. All running carriages to be with sealed, self-lubrication, ball bearing multi-rollers.

Surface mounted hinges and running carriages will not be allowed.

1. For each pair of folding panels:  
For top hung system WD66/o, provide cardanic, independently suspended, four wheeled coated with fiber glass reinforced polyamide upper running carriage and lower guide carriage.
2. Threshold: Provide  
Clear anodized, thermally broken with polyamide flush sill  
Cover plate over the sill will not be allowed  
SPECIFIER'S NOTE: Note that this option is not available with the floor mounted WD66/u.
3. Provide manufacturer's standard clear anodized aluminum hinges and spine on edge of panel. For structural strength, hinges to be connected to spine and not directly into wood.  
Provide stainless steel security hinge pins with set screws.
4. Adjustment: Provide folding/sliding hardware capable of specified amount of compensation and adjustments without needing to remove panels from tracks, in width, 1/8" (3 mm) per hinge and in height, 1/4" up and down.
5. Weather stripping: Provide manufacturer's standard double layer EPDM or brush seals with a two layer polyamide fin at both the inner and outer edge of door panels or on frame for sealing between panels and between panel and frame. Single layer weather stripping will not be allowed.

## 2.03 FABRICATION

A. Use solid, three layer, cross grained frame and panel profiles, hinges and spines, sliding and folding hardware, locking hardware and handles, threshold and track, glass and glazing and weather stripping as specified herein to make a folding glass wall. Factory pre-assemble as is standard for manufacturer and ship with all components and installation instructions.

B. Sizes and Configurations: See drawings for selected custom dimensions within maximum frame sizes possible as indicated in manufacturer's literature. See drawings for selected number of panels and configuration.

Swing/stacking direction: Outward opening unit. On configuration with a pair of swing panels, looking from inside, primary swing panel on the left (1L3R).

## 2.04 ACCESSORIES (Edit for project requirements)

A. Provide the NanaScreen™, a series of vertical, collapsible, pleated screen panels. Provide pleated screen material with floor tracking chain with 1/4" (5 mm) floor track. See drawings for selected number of panels and configuration.

Provide aluminum top track, side jambs, and vertical struts:

Clear anodized

B. Provide other slide lites, transoms, or single or double doors as per drawings provided.

## PART 3 – EXECUTION

### 3.01 ERECTION

A. Because of the large dimensions involved and the weight and movement of the panels, verify the structural integrity of the header such that the maximum deflection with the live and dead loads is limited to be the lesser of L/720 of the span and 1/4". (The approximate weight of a panel with double-glazing is 5.5 lbs/ft<sup>2</sup>). Structural support for lateral loads (both wind load and eccentric load when the panels are stacked open) must be provided. It is recommended that all building dead loads be applied to the header prior to installing the NanaWall. If so and if a reasonable amount of time has been allowed for the effect of this dead load on the header, then only the building's live load can be used to meet the above requirements of L/720 or 1/4". If not, both the dead and live loads need to be considered.

B. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square, with no unevenness, bowing, or bumps on the floor.

C. Installation of units constitutes acceptance of existing conditions.

D. Check all parts carefully before assembly. Depending on the model, some of these parts may already be pre-installed on the panels. Check that the sizes of the frame components and panels match with what was ordered. In the cardboard box attached to the frame components that contains hinge pins and various hardware, inspect the elevation drawing, indicating size, configuration, and labeling of the unit ordered. Confirm whether the unit ordered is WD66/o, top hung or WD66/u, floor mounted. For orders with multiple units, do not mix and match panels and frames, even if two units are exactly the same.

E. The WD66 system is shipped with all necessary components. However, not included are screws, bolts, shims, etc. to anchor the unit to the rough opening. The frame is shipped knocked down and needs to be assembled. Panels are pre-assembled with or without glass, ready to be attached to the installed frame. In most cases, all hinges, weather stripping, multiple locking, and flat handles are pre-attached to the panels and frame components.

### 3.02 INSTALLATION

A. Install frame in accordance with manufacturer's recommendations and installation instructions. Properly flash and waterproof around the perimeter of the opening.

B. Installer to provide appropriate anchorage devices and to securely and rigidly fit frame in place, absolutely level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work.

- C. If necessary, provide drain connections from lower track.
- D. Install panels, handles and lock set in accordance with manufacturer's recommendations and installation instructions.
- E. If necessary, adjust hardware for proper operation.
- F. Finishing: Field finish under Section 09900 – Painting; seal and finish promptly after installation and prior to exposure to weather in accordance with manufacturer's recommendations.
- G. Accessories: Screens; install in accordance with screen manufacturer's recommendations and installation instructions.

END OF SECTION

## Section 08 52 00 Wood Framed Dual Action Tilt Turn

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Inswing casement, tilt turn in frame and sash, tilt turn hardware, handles, weather stripping, glass and glazing; designed to provide a dual action tilt turn window/door, with sizes and configurations as shown on drawings and specified herein, with NanaWall® WD68, the Wood Framed Dual Action Tilt Turn Window/Door as supplied by NANA WALL SYSTEMS, INC.

#### 1.02 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
  1. AAMA/WDMA/CSA 101/I.S.2/A440-05, Standard Specification for Windows, Doors, and Unit Skylights.
- B. American National Standards Institute (ANSI):
  1. ANSI Z97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used In Buildings.
- C. American Society for Testing and Materials (ASTM):
  1. ASTM E 283, Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  2. ASTM E 330, Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  3. ASTM E 331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
  4. ASTM E 547, Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
  5. ASTM F 588, Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies.
- D. Consumer Product Safety Commission (CPSC):
  1. CPSC 16CFR-1201, Safety Standard for Architectural Glazing Materials.

#### 1.03 SUBMITTALS

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

#### 1.04 QUALITY ASSURANCE

- A. Manufacturer: Provide complete, precision built, engineered, pre-fitted unit by a single source manufacturer with at least 20 years experience in providing fenestration systems in the North American market.
  - 1. The manufacturer must have a quality management system registration to the ISO 9001: 2008 standard.
  - 2. The manufacturer must have an environmental management system registration to the ISO 14001: 2005 standard.
- B. Performance Requirements: Provide from manufacturer that has independently tested typical units per AAMA/WDMA/CSA 101/I.S.2/A440-05. Testing results to include air infiltration in accordance with ASTM E 283, water penetration in accordance with ASTM E 331 and ASTM E 547, structural loading in accordance with ASTM E 330 and forced entry in accordance with ASTM F 588.
- C. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar fenestration products. Installer to provide reference list of at least 3 projects of similar scale and complexity successfully completed in the last 3 years. Provide project names, locations, completion dates, names and telephone numbers of General Contractor and Owner's contact person.

#### 1.05 WARRANTY

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

#### 1.06 SITE CONDITIONS, DELIVERY, STORAGE AND HANDLING

- A. In addition to general delivery, storage and handling requirements specified in Section 01600, comply with the following:
  - 1. Deliver materials to job site in sealed, unopened cartons or crates. Protect units from damage. Store material under cover, protected from weather and construction activities.
  - B. Condition wood components to average prevailing relative humidity before installation.
  - C. Do not subject wood components to extreme nor rapid changes in heat or humidity.
  - D. Do not use forced heat to dry out building.
  - E. Store flat in dry, well ventilated area out of direct sunlight.

### PART 2 – PRODUCTS

#### 2.01 SUPPLIER

NANA WALL SYSTEMS, INC.  
707 Redwood Highway, Mill Valley, CA 94941  
Toll Free: (800) 873-5673  
Telephone: (415) 383-3148  
Fax: (415) 383-0312  
Website: [www.nanawall.com](http://www.nanawall.com)  
Email: [info@nanawall.com](mailto:info@nanawall.com)

## 2.02 MATERIALS

A. Frame and Sash: From manufacturer's standard profiles, provide frame, sash and glazing stops with dimensions shown on drawings.

1. Provide Sash with: Standard one lite

[OR with horizontal mullion(s) at specified height(s) from the bottom of the panel]

[OR with simulated divided lites in pattern as shown on drawings].

2. Type of Wood: Solid, three layer, cross-grained, kiln dried with matching solid wood glazing stops.

Douglas fir - PEFC

3. Wood Finish: Finishes to be water based, opened pored

Clear sanding sealer for stain

SPECIFIER'S NOTE: Before installation, the unit must be field finished with at least two coats for a final protected finish.

B. Glass:

1. Provide manufacturer's standard glass and dry glazing with EPDM gaskets and glass stops fixed with hidden nails. Glass to comply with safety glazing requirements of ANSI Z97.1 and CPSC 16CFR 1201.

15/16" (24 mm) insulating clear safety

[OR 15/16" (24 mm) insulating argon filled Low-E safety]

[OR 1/4" tempered]

[OR other glass available from manufacturer].

2. For insulated units, provide manufacturer's standard glass spacers. Provide without capillary tubes [OR with capillary tubes].

C. Tilt Turn Hardware

1. Provide manufacturer's standard cam type multipoint locking mechanism.

a. The concealed multipoint locking mechanism shall be driven by a single locking handle.

2. Provide manufacturer's standard hinges, pins, strikes, and limit stays.

3. Handles:

Stainless steel window handles in a titanium black finish

[OR stainless steel window handles in a brushed satin finish]

D. Provide handle height centered [OR at 41 3/8" from bottom of panel] [OR as specified from bottom of panel].

E. Rain Channel: Provide clear anodized rain channel

[OR dark bronze anodized rain channel]

1. Aluminum Extrusion: Extrusions with nominal thickness of .078" (2.0 mm). Alloy specified as AlMgSi0.5 with strength rated as 6063-T5 or F-22 (European standard). Anodized conforming to AAMA 611.98.

F. Weather stripping: Provide manufacturer's standard double layer EPDM

### 2.03 FABRICATION

- A. Use solid, three layer, cross grained frame and sash profiles, tilt turn hardware and handles, rain channel, glass and glazing and weather stripping as specified herein to make a Dual Action Tilt Turn window/door. Construction of wood panels to include close tolerance mortise and tenon, glued and pinned corners. Factory pre-assemble as is standard for manufacturer and ship with all components and installation instructions.
- B. Sizes and Configurations: See drawings for dimensions, swing and number of single tilt turns, double sash tilt turns and double tilt turns with mullion. On double sash tilt turn, looking from inside, tilt turn panel on the left [OR right]

### 2.04 ACCESSORIES (Edit for project requirements.)

- A. Provide insect screen. Mesh in gray [Or black]

Provide screen frame in aluminum:

White powder coated

[OR clear anodized]

[OR dark bronze anodized]

[OR powder coated select from range of RAL powder coated finishes available from manufacturer].

- B. Provide other side lites, transoms as per drawings provided.

## PART 3 – EXECUTION

### 3.01 ERECTION

- A. Because of the large dimensions involved and the weight and movement of the sash, verify the structural integrity of the header such that the maximum deflection with live and dead loads is limited to be the  $L/720$  of the span.
- B. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square, with no unevenness, bowing, or bumps on the floor.
- C. Installation of units constitutes acceptance of existing conditions.

### 3.02 INSTALLATION

- A. Install frame in accordance with manufacturer's recommendations and installation instructions. Properly flash and waterproof around the perimeter of the opening.
- B. Installer to provide appropriate anchorage devices and to securely and rigidly fit frame in place, absolutely level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work.
- C. Install sash and handles in accordance with manufacturer's recommendations and installation instructions.
- D. If necessary, adjust hardware for proper operation.
- E. Finishing: Field finish under Section 09900 -Painting; seal and finish promptly after installation and prior to exposure to weather in accordance with manufacturer recommendations.

- F. Accessories: Screens; install in accordance with screen manufacturer's recommendations and installation instructions.

**END OF SECTION**

## SECTION 08 60 00 – ROOF WINDOWS AND SKYLIGHTS

### PART 1 – General

#### 1.01 SUMMARY

This section is for all glazing between the interior and roof of the bathroom

#### 1.02 REFFERANCES

##### United States

1. ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
2. ASTM C162 - Standard Terminology of Glass and Glass Products.
3. ASTM C1036 - Standard Specification for Flat Glass.
4. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass -- Kind HS, Kind FT Coated and Uncoated Glass.
5. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
6. ASTM E1300 - Standard Practice for Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load.
7. ASTM E2188 - Standard Test Method for Insulating Glass Unit Performance.
8. ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
9. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
10. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
11. Insulating Glass Manufacturers Alliance (IGMA)- Glazing Guidelines.

##### United States & Canada

1. GANA Glazing Manual; Glass Association of North America.
2. GANA Sealant Manual; Glass Association of North America.
3. Oldcastle Glass® - Glazing Instructions.

#### 1.03 Definitions

Sealed Insulating Glass Unit Surfaces & Coating Orientation:

1. Surface 1 – Exterior surface of outer pane  
(surface facing outdoors of outboard lite).
2. Surface 2 – Interior surface of outer pane  
(surface facing indoors of outboard lite).
3. Surface 3 – Exterior surface of inner pane  
(surface facing outdoors of inboard lite).
4. Surface 4 – Room side surface of inner pane (surfacing facing indoors of inboard lite).

#### 1.04 Performance Characteristics

1. Center-of-Glass – Performance values that take only the center portion of a glass make-up into account and not the framing members. Customarily found in Sweets catalogs and Oldcastle Glass® GlasSelect® and used in 08 81 00 architectural specifications.
2. Glass thermal and optical performance properties shall be based on data and calculations from the current LBNL WINDOW 5.2 computer program.
3. Fenestration Performance – Performance values that take into account the total fenestration (center-of-glass and framing members). Normally identified with building energy codes such as ASHRAE-IESNA 90.1 and the IECC. These values can also be tested and certified by the National Fenestration Rating Council (NFRC).

#### 1.05 Design Requirements

1. Provide glazing systems capable of withstanding normal thermal movements, windloads and impact loads, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.
2. Provide glass products in the thicknesses and strengths (annealed or heat-treated) required to meet or exceed the following criteria based on project loads and in-service conditions per ASTM E1300.
  - Minimum thickness of annealed or heat-treated glass products is selected, so the worst-case probability of failure does not exceed the following:
    1. 8 breaks per 1000 for glass installed vertically or not over 15 degrees from the vertical plane and under wind action.
    2. 1 break per 1000 for glass installed 15 degrees or more from the vertical plane and under action of wind and/or snow.

#### 1.06 Submittals

1. Submit 12-inch (305mm) square samples of each type of glass indicated (except clear monolithic glass products), and 12-inch (305mm) long samples of each color required (except black) for each type of sealant or gasket exposed to view.

2. Submit manufacturer's product data sheet and glazing instructions.
3. Glazing contractor shall obtain compatibility and adhesion test reports from sealant manufacturer, indicating that glazing materials were tested for compatibility and adhesion with glazing sealant, as well as other glazing materials including insulating units.
4. Glazing Contractor shall provide test reports showing that the glass meets the requirements of any security test reports specified on drawings.

#### 1.07 Quality Assurance

1. Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or referenced standards.

- GANA Publications
- AAMA Publications
- IGMA/IGMAC Publications

2. Safety glass products in the US are to comply with CPSC 16 CFR Part 1201 for Category II materials.

3. Safety glass products in Canada are to comply with the testing requirements of CAN/CGSB-12.1-M, Type 1 for Laminated Glass and Type 2 for Tempered Glass.

4. Provide safety glass permanently marked with the company name or logo and CAN/CGSB-12.1-M if the product meets categories 1 and 2, or mark as CAN/CGSB 12.1-M-1 if the product meets the requirements of Category 1 only.

5. Insulating Glass products are to be permanently marked either on spacers or at least one insulating unit component with appropriate certification label of inspecting and testing agency indicated below:

6. US - Insulating Glass Certification Council (IGCC)

- Canada - Insulating Glass Manufacturers Alliance (IGMA) or Insulating Glass Manufacturers Association of Canada (IGMAC)

7. Single-source fabrication responsibility: All glass fabricated for each type shall be processed and supplied by a single fabricator.

#### 1.08 Delivery, Storage and Handling

1. Comply with manufacturer's instruction for receiving, handling, storing and protecting glass & glazing materials.

2. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

3. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
4. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coating on glass.
5. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations of venting and sealing.

#### 1.09 Project/site Conditions

1. Environmental Requirements: Installation of glass products at ambient air temperature below 40 degrees F (4.4 degrees C) is prohibited.
2. Field Measurements: When construction schedule permits, verify field measurements with drawing dimensions prior to fabrication of glass products.

#### 1.10 Warranty

1. Provide a written 10-year limited warranty from date of manufacture for insulating glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to glass manufacturer's published instructions.
2. Provide a written 10-year limited warranty from date of manufacture for coated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to glass manufacturer's published instructions.

## Part 2. Products

#### 2.01 Manufacturers

Manufacturer is used in this section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced standards.

1. Oldcastle Glass®
2. Guardian Industries
3. Pilkington
4. PPG Industries
5. ACH Float Glass

## 2.02 Materials

### SunGlass™ Sealed Insulating Glass (IG) Units

#### 1. Insulating Glass Unit Make-up

- Outboard Lite

1. Glass Type: Low-E Coated
2. Glass Tint: SunGlass™
3. Nominal Thickness: ¼"
4. Glass Strength: (Heat-Strengthened

or Tempered)

5. Coating Orientation: Surface #2

- Spacer

1. Nominal Thickness: ½"
2. Gas Fill: Air

- Inboard Lite

1. Glass Type: Uncoated
2. Glass Tint: Clear
3. Nominal Thickness: ¼"
4. Glass Strength: (Annealed,

Heat-Strengthened or Tempered)

5. Coating Orientation: NA

#### 1. Performance Characteristics (Center of Glass)

(Note: Verify that the glass type and thickness specified matches the Performance Characteristics listed below.)

- Visible Transmittance: 50%
- Visible Reflectance: 8%
- Winter U-Factor (U-Value): 0.29
- Shading Coefficient (SC): 0.29
- Solar Heat Gain Coefficient (SHGC): 0.25

2. Provide hermetically sealed IG units with dehydrated airspace, dual sealed with a primary seal of polyisobutylene (PIB), or thermo plastic spacer (TPS) and a secondary seal of silicone or an organic sealant depending on the application.

3. US Requirements:

- Insulating glass units are certified through the Insulating Glass Certification Council (IGCC) to ASTM E2190.

- Annealed float glass shall comply with ASTM C1036, Type I, Class 1 (clear), Class 2 (tinted), Quality-Q3.

- Heat-Strengthened float glass shall comply with ASTM C1048, Type I, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind HS.

- Tempered float glass shall comply with ASTM C1048, Type I, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind FT.

4. Canadian Requirements:

- The Insulating Glass Manufacturers Alliance (IGMA) sponsors two certification programs in Canada. Insulating glass units are certified either through the Insulating Glass Manufacturers Association of Canada (IGMAC) to CAN/CGSB-12.8, or through the IGMA Certification Program to ASTM E2190.

- Annealed float glass shall comply with CAN/CGSB-12.3-M, Quality, Glazing.

- Tinted annealed float glass shall comply with CAN/CGSB-12.4-M.

- Heat-Strengthened float glass shall comply with CAN/CGSB-12.9-M, Type 2-Heat-Strengthened, Class A-Float Glass.

- Tempered float glass shall comply with CAN/CGSB-12.1-M, Type 2, Tempered Glass, Class B-Float Glass.

5. Glass shall be annealed, heat-strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.

6. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.

#### Glazing Products

1. Select appropriate glazing sealants, tapes,

gaskets and other glazing materials of proven compatibility with other materials that they contact. These include glass products, insulating glass unit seals and glazing channel substrates under installation and service conditions, as demonstrated by testing and field experience.

## Part 3. Execution

### 3.01 Examination

#### Site Verification and Conditions

1. Verify that site conditions are acceptable for installation of the glass.
2. Verify openings for glazing are correctly sized and within tolerance.
3. Verify that a functioning weep system is present.
4. Verify that the minimum required face and edge clearances are being followed.
5. Do not proceed with glazing until unsatisfactory conditions have been corrected.

### 3.02 Preparation

#### Protection

1. Handle and store product according to manufacturers' recommendations.

### 3.03 Surface Preparation

1. Clean and prepare glazing channels and other framing members to receive glass.
2. Remove coatings and other harmful materials that will prevent glass and glazing installation required to comply with performance criteria specified.

### 3.04 Installation

1. Install products using the recommendations of manufacturers of glass, sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those in the "GANA Glazing Manual".
2. Verify that Insulating Glass (IG) Unit secondary seal is compatible with glazing sealants.
3. Install glass in prepared glazing channels and other framing members.
4. Install setting blocks in rabbets as recommended by referenced glazing standards in GANA Glazing Manual and IGMA Glazing Guidelines.
5. Provide bite on glass, minimum edge and face clearances and glazing material tolerances recommended by GANA Glazing Manual.

6. Provide weep system as recommended by GANA Glazing Manual.
7. Set glass lites in each series with uniform pattern, draw, bow and similar characteristics.
8. Distribute the weight of the glass unit along the edge rather than at the corner.
9. Comply with manufacturer's and referenced industry recommendations on expansion joints and anchors, accommodating thermal movement, glass openings, use of setting blocks, edge, face and bite clearances, use of glass spacers, edge blocks and installation of weep systems.
10. Protect glass from edge damage during handling and installation.
11. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing or plaster.
12. Remove and replace glass that is broken, chipped, cracked or damaged in any way.

### 3.05 Cleaning

1. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.
2. Glass to be cleaned according to:
  - GANA Glass Informational Bulletin GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.
  - GANA Glass Information Bulletin GANA TD-02-0402 – Heat-Treated Glass Surfaces Are Different.
3. Do not use scrapers or other metal tools to clean glass.

END OF SELECTION

## Division 09 – Finishes

### SECTION 09 50 00 - Ceiling Finishing

#### Part 1 – General

##### 1.1 Section Requirements

- A. Submittals: Product Data

#### Part 2 – Products

##### 2.1 Polyurethane

- A. Products
  - 1. Defthane Polyurethane Satin FinishSee Manufacturers Specifications  
[http://www.deftfinishes.com/trade/sites/default/files/8-2010\\_msdms\\_number\\_23x39\\_aerosol\\_defthane\\_satin.htm](http://www.deftfinishes.com/trade/sites/default/files/8-2010_msdms_number_23x39_aerosol_defthane_satin.htm)

#### Part 3 – Execution

##### 3.1 Preparation

- A. Comply with manufacturers specifications
- B. All surfaces must be cured, clean, dry, and free from dirt, dust, rust, stains, grease, oil, mildew, wax, efflorescence, and other contaminants. Remove all loose, peeling, or cracked coatings. Repair all cracks, holes, and other surface imperfections with a suitable patching material. Repaired surfaces should then be sanded, and cleaned. Glossy surfaces should be dulled to provide a roughened surface for good adhesion.

##### 3.2 Application

- A. Follow manufacturers instructions
  - 1. Sand wood and wipe off dust.
  - 2. Apply first coat with long, smooth strokes. Let dry for 4-6 hours (450 VOC) or 6-8 hours (275 VOC).
  - 3. Sand smooth, remove dust.
  - 4. Apply 2 more thin coats. Where exposure or wear is severe, apply additional coats. Let dry 4-6 hours between coats (450 VOC) or 6-8 hours between coats (275 VOC).
  - 5. Use paint thinner (mineral spirits) for clean up.
  - 6. Sand and repeat when first signs of deterioration appear.

END OF SECTION

## SECTION 09 61 00 FLOOR TREATMENT

### PART- 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Finish systems for hardwood sports floors.  
Specifier Note: Revise paragraph below to suit project requirements. Add section numbers and titles per CSI MasterFormat and specifier's practice.
- B. Related Sections:
  - 1. Division 9 Sections: Wood Flooring.

#### 1.02 REFERENCES

- A. Maple Flooring Manufacturers Association (MFMA) approved.

#### 1.03 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit manufacturer's product data and application instructions.
- C. Closeout Submittals: Submit the following: FLOOR TREATMENT 09610BonaKemi USA Inc.
  - 1. Warranty documents specified herein.

#### 1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Utilize a professional contractor trained in application of the manufacturer's sport floor products.
- B. Regulatory Requirements and Approvals: [Comply with clean air requirements.] [Specify applicable requirements of regulatory agencies.].

#### 1.05 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirement Section.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

#### 1.06 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.
- C. Warranty Period: BonaKemi stands behind its products; however, many variables can and do occur at the site of application. A successful installation is dependent on application technique and proper environmental conditions; therefore, installation is not warranted. For additional information on warranty conditions, duration and remedies, contact BonaKemi USA Inc.

## PART 2 PRODUCTS

### 2.01 FLOOR FINISHING SYSTEM

#### A. Manufacturer: Bona

1. Contact: 2550 S. Parker Road, Suite 600, Aurora, CO 80014; Telephone: (800) 872-5515, (303) 371-1411; Fax: (303) 371-6958; E-mail: bill.price@bona.com; website: www.bona.com.

#### B. Proprietary Products/Systems. Sport floor systems, including the following: FLOOR TREATMENT 09610

##### 1. Bona Traffic HD

Ingredients – Water, Polymer(s), and amorphous silica

Color – Milky white (wet)

pH – 7.9

Solids – 34% (with hardener)

Density – 8.70 lbs./gallon (1.04 S.G.)

US Regulatory VOC Compliant – 125 g/L (with hardener)

Coefficient of Friction - = 0.5

Gloss Level – (60°) – 7-10 for Commercial Extra Matte, 15-20 for Commercial Satin,

40-45 for Commercial Semi-Gloss

Odor – Very slight non-offensive odor

Stability – 1 year shelf life in unopened container

## PART 3 EXECUTION

### 3.01 MANUFACTURER'S INSTRUCTIONS

- A. Comply with the instructions and recommendations of the sport floor finish system manufacturer.
- B. For new installation of sport floors, use only in structures with humidity and temperature controls. Do not use over channel and clip floor systems in environments not controlled for temperature and humidity.

### 3.02 PREPARATION

- A. Protection: Protect adjacent finish surface to prevent damage during sanding and sport floor system application.
- B. Surface Preparation:
  1. Sand and prepare floor using MFMA accepted methods.
  2. For Sport Poly 350 oil modified system, make final sanding cut to 100 - 120 grit paper. Screen with 100 - 120 grit screen.
  3. For Sportive waterborne system, make final cut with 100 - 120 grit sandpaper and screen to 120 - 150 grit.
  4. Vacuum thoroughly.
  5. For Sport Poly 350, tack with mineral spirits.
  6. For Sportive, tack with slightly water dampened Bona Mop or cloth.

### 3.03 APPLICATION

- A. Specific application methods vary with product. Consult manufacturer and comply fully with manufacturer's application recommendations.
  1. Before using these products, read and understand all directions and the Material Safety Data Sheets (MSDS).
  2. Shake well before using.
  3. Do not thin these products.
  4. Keep from freezing.

3.04 PROTECTION

- A. After application, protect sport floor finish from damage during subsequent work.
- B. Do not allow foot traffic until floor is sufficiently dried and cured.

END OF SECTION

## SECTION 09 64 19 – Flooring Material

### PART 1 – GENERAL

#### 1.1

- A. Section Includes:
  - 1. Plywood used as: [Decorative wainscoting,] [ceiling panels,] [furniture,] [counters,] [kitchen systems,] [wall coverings,] [other.]
- B. Related Sections:
  - 1. Division 01: Administrative, procedural, and temporary work requirements.

#### 1.2 REFERENCES

- A. Abbreviations and Acronyms:
  - 1. ANSI: American National Standards Institute.
  - 2. ASTM: American Society for Testing and Materials.
  - 3. HPVA: Hardwood Plywood & Veneer Association.
  - 4. LEED®: Leadership in Energy and Environmental Design.
- B. Reference Standards: Current edition at date of Bid.
  - 1. American Society for Testing and Materials:
    - a. ASTM D 1037: Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
    - b. ASTM D 3043: Standard Test Methods for Structural Panels in Flexure.
    - c. ASTM D 3500: Standard Test Methods for Structural Panels in Tension.
    - d. ASTM D 4442: Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
    - e. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
    - f. ASTM E 1333: Method for Determining Formaldehyde Concentrations in Air Emission Rates from Wood Using a Large Chamber.
  - 2. American National Standards Institute/Hardwood Plywood and Veneer Association:
    - a. ANSI/HPVA HP-1: Standard for Hardwood and Decorative Plywood.
    - 3. US Green Building Council: LEED Green Building Rating System™.

#### 1.3 SUBMITTALS

- A. Reference Section 01 33 00?Submittal Procedures; submit following items:
  - 1. Product Data: For each type of product[, including finishing materials and processes].
  - 2. LEED® Submittals:
    - a. Credit MR 4.1 – Recycled Content: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
    - b. Credit MR 6 - Rapidly Renewable Materials: Product data for products made from plants that are typically harvested within a 10-year or shorter cycle.
    - c. Credit MR 7 – FSC-Certified Wood: Chain-of-custody certificates for products containing certified wood.
    - d. Credit IEQ 4.1 – Low-Emitting Materials, Adhesives and Sealants: Product data for adhesives and sealants, indicating VOC content of each product used. Indicate VOC content in g/L calculated.
    - e. Credit IEQ 4.4 - Low-Emitting Materials, Composite Wood & Agrifiber Products: Product data for products containing composite wood or agrifiber

products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer:

- a. Minimum five years of experience in producing bamboo plywood panels.
- b. Maintain documentable quality control program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Reference the General Conditions for Product Storage and Handling Requirements.

B. Packaging:

INCLUDE THE LEED STATEMENT BELOW FOLLOWING VERIFICATION THAT THE MATERIALS TO THIS PROJECT CAN PROVIDE THE RECYCLABLE WRAPPING AND PALLET MATERIALS AS INDICATED IN THE SUBMITTALS ARTICLE ABOVE.

1. Package panels in weatherproof bulk pallets. Weatherproof wrapping and pallet material shall be recyclable.

2. Include following information on pallets:

- a. Thickness and color.
- b. Warranty information.
- c. Manufacturer's contact information.

C. Delivery of panels in original packaging not less than 10 days prior to start of installation.

D. Store materials minimum [6] [ ] inches above ground on framework or blocking and protect unused material with weatherproof covering, providing for adequate air circulation.

E. Do not store seasoned or treated materials in damp location.

F. Protect edges and corners of sheet materials from damage.

G. Maintain an ambient temperature between 50 and 82 deg F and 40-70% relative

1.6 WARRANTY

A. Provide manufacturer's [6]year warranty against delamination.

PART 2 –PRODUCTS

2.1 Manufacturers:

1. Higuera Hardwoods LLC, [www.higuerahardwoods.com](http://www.higuerahardwoods.com), 360-779-4050. or approved equal

A. Panel Characteristics:

1. Species: Douglas Fir

3-PLY PANELS ARE AVAILABLE ONLY IN CROSS LAMINATED CORES.

2. Plies: [4] [3] [2] [Single]-ply.

3. Core: [Cross] [Straight] laminated.

STRAND IS AVAILABLE ONLY IN 3-PLY CROSS LAMINATED CORES.

4. Grain: [Horizontal]

5. Color: [Natural]

6. Size: [4 feet x 8 feet] [Custom].

7. Thickness: [3/4] [1/2] [1/4] inch [Custom].

8. Edge Configuration: [Square] [Custom].

9. Moisture Content: Average of [13 to 14] percent.

10. Panel Grade: A-A (both sides) Architectural.

B. Properties:

1. Delamination, Type II Testing, Interior; ANSI/HPVA HP-1-2004: Pass.\  
TEST DATA below IS FOR 3/4 INCH PANELS.

2. Mechanical and Physical Properties; ASTM D 1037.

- a. 3/4 inch thick 1-ply vertical Grain:
  - 1) Face: 263 pounds.
  - 2) Back: 229 pounds.
  - 3) Edge 1: 511 pounds.
  - 4) Edge 2: 636 pounds.
  - 5) Linear Expansion: Parallel -0.04 percent; Perpendicular -0.10%
  - 6) Thickness Swell: 0.12 percent
- b. 3/4 inch thick 3-ply cross laminated vertical and horizontal grain:
  - 1) Face: 1,019 pounds.
  - 2) Back: 668 pounds.
  - 3) Edge 1: 359 pounds.
  - 4) Edge 2: 652 pounds.
  - 5) Linear Expansion: Parallel -0.09 percent;
  - 6) Perpendicular: -0.07 percent
  - 7) Thickness Swell: -0.39 percent

TEST DATA below in paragraphs 3, 4 & 5 are FOR 3/4 INCH PANELS only.

3. Flexural Properties of Structural Panels; ASTM D 3043.
  - a. 3/4" inch thick 1-ply vertical grain: 179 MOE/11,371 MOR.
  - b. 3/4" inch thick 3-ply cross laminated core: 148 MOE/9,109 MOR.
4. Tensile Properties of Structural Panels; ASTM D 3500.
  - a. 3/4 inch thick 1-ply vertical grain: Load 642 pounds, Strength 428 psi.
  - b. 3/4 inch thick 3-ply cross laminated core: Load 1,536 pounds, Strength 1024 psi.
5. Direct Moisture Content Measurement; ASTM D 4442.
  - a. 3/4 inch thick 1-ply Straight Grain: 4.6 percent.
  - b. 3/4 inch thick 3-ply Cross Core: 5.4 percent.
6. Surface Flame Spread and Smoke Density Measurements; ASTM E 84.
  - a. Flame-Spread Index: [25] [Insert requirement] or less.
  - b. Smoke-Developed Index: [450] [Insert requirement] or less.
7. Rapidly renewable product manufactured using low-emitting, urea formaldehyde-free binders; ASTM E 1333.
  - a. 1/4" inch thick [1-ply] [3-ply] vertical grain: 0.07 ppm.
  - b. 1/2" inch thick [1-ply] [3-ply] vertical grain: 0.02 ppm.
  - c. 1/3" inch thick 3-ply cross laminated core: 0.10 ppm
  - d. 1/3" inch thick 1-ply vertical grain: 0.10 ppm.
8. Certified to FSC STD-04-004.

**END OF SECTION**

## SECTION 09 90 00 PAINTING

### PARTS 1 - GENERAL

#### 1.01 SUMMARY:

- A. Section Includes: Painting and finishing of all interior and exterior items and surfaces, unless otherwise indicated or listed under exclusions below:

1. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated

- B. Work Included:

1. The intent and requirements of this Section is that all work, items and surfaces which are normally painted and finished in a building of this type and quality, shall be so included in this contract, whether or not said work, item or surface is specifically called out and included in the schedules and notes on the drawings, or is, or is not, specifically mentioned in these specifications.

- C. The following general categories of work and items that are included under other sections shall not be a part of this section:

1. Shop prime painting of structural and miscellaneous iron or steel.  
2. Shop prime painting of hollow metal work.  
3. Shop finished items.

D. The Room Finish Schedules indicated on the drawings indicates the location of interior room surfaces to be painted or finished. The schedule indications are general and do not necessarily define the detail requirements. Include all detailed refinements and further instructions as may be given for the required complete finishing of all spaces and rooms.

- E. Related Sections:

Section 05 70 00 – Ornamental Metal  
Section 07 17 50 - Water Repellent Coatings  
Section 09 96 00 – High Performance Coatings

#### 1.02 SUBMITTALS:

- A. Product Data: Submit complete manufacturer's descriptive literature and specifications in accordance with the provisions of Section 01 30 00.

1. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item when applicable. When required, provide a list of paint and coating materials proposed for use, which equates such materials with the design-basis products specified.

B. Samples: In accordance with provisions of Section 01300, submit, on 8-1/2 inch by 11 inch hardboard, samples of each color, gloss, texture and material selected by the Architect from standard colors available for the coatings required.

1. For natural and stained finishes, provide sample on each type and quality of wood used on the project.

C. Manufacturer's Instructions: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, application rates, and composition analysis.

#### 1.03 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.

- a. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
- b. Comply with South Coast Air Quality Management District (SCAQMD) Rule 1113. A copy of this regulation can be obtained from <http://www.aqmd.gov/rules/reg/reg11/r1113.pdf>.

B. Field Sample: When and as directed by the Architect, apply one complete coating system for each color, gloss and texture required. When approved, the sample panel areas will be deemed incorporated into the Work and will serve as the standards by which the subsequent Work of this Section will be judged.

#### 1.04 DELIVERY, STORAGE, AND HANDLING:

A. Storage and Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.

B. Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name and trade name. Store where directed in accordance with manufacturer's instructions.

C.

#### 1.05 PROJECT CONDITIONS:

- A. Do not apply exterior materials during fog, rain or mist, or when inclement weather is expected within the dry time specified by the manufacturer. No exterior or interior painting shall be done until the surfaces are thoroughly dry and cured. Do not apply paint when temperature is below 50° F. Avoid painting surfaces when exposed to direct sunlight.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS:

- A. Manufacturer's catalog names and number of paint types in this Section herein are based on products manufactured or distributed by the Dunn-Edwards Corporation [www.dunnedwards.com](http://www.dunnedwards.com) and are the basis of design against which the Architect will judge equivalency. The quantity of titanium dioxide, the use of clays, aluminum silicate, talc and the purity of acrylic materials are a few of the criteria which will be used by the Architect in determining equivalency of materials.
- B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 Product Requirements. When submitting request for substitution, provide complete product data specified of competition above under Submittals, for each substitute product.
- C. Acceptable Manufacturers
  - 1. Carboline [www.carboline.com](http://www.carboline.com)
  - 2. Deft [www.deftfinishes.com](http://www.deftfinishes.com)
  - 3. Dumond Chemicals [www.dumondchemicals.com](http://www.dumondchemicals.com)
  - 4. Okon [www.okoninc.com](http://www.okoninc.com)
  - 5. Rustoleum [www.rustoleumibg.com](http://www.rustoleumibg.com)
  - 6. Valspar [www.valsparwood.com](http://www.valsparwood.com)

## 2.02 MATERIALS:

- A. Paints: Provide ready-mixed, except field catalyzed coatings. Pigments shall be fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixture. Paints shall have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.
- B. Accessory Materials: Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes shall be of high quality and approved by manufacturer.
- C. Colors shall be selected from color chip samples provided by manufacturer of paint system approved for use. Match approved samples for color, texture and coverage.
- D. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- E. Restricted Components: Paints and coatings shall not contain any of the following.
  - 1. Acrolein.
  - 2. Acrylonitrile.
  - 3. Antimony.
  - 4. Benzene.
  - 5. Butyl benzyl phthalate.
  - 6. Cadmium.
  - 7. Di (2-ethylhexyl) phthalate.
  - 8. Di-n-butyl phthalate.
  - 9. Di-n-octyl phthalate.
  - 10. 1,2-dichlorobenzene.
  - 11. Diethyl phthalate.

12. Dimethyl phthalate.
13. Ethylbenzene.
14. Ethylene Glycol.
15. Formaldehyde.
16. Hexavalent chromium.
17. Isophorone.
18. Lead.
19. Mercury.
20. Methyl ethyl ketone.
21. Methyl isobutyl ketone.
22. Methylene chloride.
23. Naphthalene.
24. Toluene (methylbenzene).
25. 1,1,1-trichloroethane.
26. Vinyl chloride.

2.04 MIXES:

- A. Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

PART 3-EXECUTION

3.01 EXAMINATION:

- A. Examine surfaces to be painted before beginning painting work. Work of other trades that has been left or installed in a condition not suitable to receive paint, stain other specified finish shall be repaired or corrected by the applicable trade before painting. Painting of defective or unsuitable surface implies acceptance of the surfaces.
- B. Beware of a condition known as critical lighting. This condition causes shadows that accentuate even the slightest surface variations. A pigmented sealer will provide tooth for succeeding decorative coating, but "does not" equalize smoothness or surface texture. Any corrective action to drywall must be done by the drywall contractor prior to decorating.

3.02 PROTECTION:

- A. Protect previously installed work and materials, which may be affected by Work of this Section.
  1. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.
  2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or splatter from fouling surfaces not being painted.
  3. Protect surfaces, equipment, and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking, and staging.
- B. Provide wet paint signs, barricades, and other devices required to protect newly finished surfaces. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.03 PREPARATION:

- A. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.
- B. Concrete and Masonry: Surfaces shall be dry, clean, and free of dirt, efflorescence, encrustation, and other foreign matter. Glazed surfaces on concrete shall be roughened or etched to uniform texture.
- C. Ferrous Metal: Clean oil, grease, and foreign matter with solvent. Surface shall be primed within 3 hours after preparation.
- D. Sand and scrape metal to remove loose primer and rust.
- E. Non-Ferrous Metal: Chemically or solvent clean and then treat with an etching-type solution if recommended by the finish manufacturer. Cleaned and retreated Non-Ferrous Metal shall be primed the same day that cleaning has been performed.
- F. Wood Surfaces: Remove dust, grit and foreign matter. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs when fully cured.
- G. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
- H. Existing surfaces to be recoated shall be thoroughly cleaned and deglossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as specified for new work.
- I. Thoroughly backpaint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, cabinetwork, etc., which will be concealed after installation. Backpaint items to be painted or enameled with the priming coat. Use a clear sealer for backpriming where transparent finish is required.

3.03 PREPARATION:

- J. Bare and covered pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work shall be cleaned prior to priming.
- K. Preparation of other surfaces shall be performed following specific recommendations of the coatings manufacturer.
- L. Bond breakers and curing agents shall be removed and the surface cleaned before primers, sealers or finish paints can be applied.

- M. All drywall surfaces shall be completely dry and dust free before painting. Skim coated drywall shall be sealed with a sealer recommended by the paint manufacturer for this surface. Use the appropriate light or medium tack masking tape.

#### 3.04 APPLICATION:

- A. Apply painting and finishing materials in accordance with the manufacturer's recommendations.
  - 1. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
- B. Apply each material at not less than the manufacturer's recommended spreading rate:
- C. Apply prime coat to surface which is required to be painted or finished.
- D. Finish exterior doors on tops, bottoms, and edges same as exterior faces, after fitting.
- E. Sand lightly and dust clean between succeeding coats.

#### 3.05 CLEANING, TOUCH-UP AND REFINISHING:

- A. Carefully remove all spattering, spots and blemishes caused by work under this section from surfaces throughout the project.
- B. Upon completion of painting work remove all rubbish, paint cans, and accumulated materials resulting from work in each space or room. All areas shall be left in a clean, orderly condition.
- C. Runs, sags, misses, holidays, stains and other defects in the painted surfaces, including inadequate coverage and mil thickness shall be satisfactorily touched up, or refinished, or repainted as necessary.

#### 3.06 FINISH SCHEDULE

- A. Apply the following finishes to the surfaces specified on the finish schedule or on the drawings.  
Apply all materials in accordance with manufacturer's instructions on properly prepared surfaces and foundation coats. All intermediate undercoats must be tinted to approximate the final color.

1. Architect will issue a color schedule prior to start of painting to designate the various colors and

B. Exterior Systems:

1.. Ferrous Metal

a. Semi-Gloss – Alkyd

First Coat GALV-ALUM Premium, Non Ferrous Metal Primer (GAPR00)

Second Coat SYN-LUSTRO 9V Series

Third Coat SYN-LUSTRO 9V Series

2. Non-Ferrous Metal

a. Semi-Gloss – Alkyd

Pretreatment SUPREME CHEMICAL, METAL CLEAN AND ETCH (ME 01)

First Coat GALV-ALUM Premium, Non Ferrous Metal Primer (GAPR00)

Second Coat SYN-LUSTRO 9V Series

Third Coat SYN-LUSTRO 9V Series

C. Interior Systems:

1. Ferrous Metal

a. Semi-Gloss – Alkyd

First Coat GALV-ALUM Premium, Non Ferrous Metal Primer (GAPR00)

Second Coat SYN-LUSTRO 9V Series

Third Coat SYN-LUSTRO 9V Series

2. Non-Ferrous Metal

a. Semi-Gloss – Alkyd

Pretreatment SUPREME CHEMICAL, METAL CLEAN AND ETCH (ME 01)

First Coat GALV-ALUM Premium, Non Ferrous Metal  
Primer (GAPR00)

Second Coat SYN-LUSTRO 9V Series

Third Coat SYN-LUSTRO 9V Series

END OF SECTION

## SECTION 09 93 00 STAINS AND TRANSPARENT FINISHES

PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Deck Coatings:

1. Translucent finish deck coatings.
2. Semi-transparent finish deck coatings.
3. Solid hide finish deck coatings.

B. Exterior Coatings: 1. Clear finish exterior coatings.

2. Translucent finish exterior coatings.
3. Semi-transparent finish exterior coatings.
4. Solid hide finish exterior coatings.

C. Coatings for Interior Wood Surfaces: 1. Clear finish coatings for interior wood surfaces.

1. Translucent finish coatings for interior wood surfaces.

### 1.2 RELATED SECTIONS

A. Section 06200 - Finish Carpentry.

B. Section 07460 - Wood Siding.

C. Section 09640 - Wood Flooring.

### 1.3 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.
4. Cleaning and maintenance instructions.

C. Selection Samples: Submit two sets of samples showing available colors, textures, and finishes.

D. Verification Samples: For each product specified, two samples, representing colors, textures, and finishes to be installed.

#### 1.4 QUALITY ASSURANCE

A. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

#### 1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards. Store materials within absolute limits for temperature and humidity recommended by the manufacturer. Protect from damage.

B. Store products in manufacturer's labeled packaging until ready for installation.

#### 1.6 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.

#### 1.7 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranty for materials and workmanship.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

A. Acceptable Manufacturer: Sikkens; Wood Finishes , which is located at:  
15885 W. Sprague Rd. ; Strongsville, OH 44136; Toll Free Tel: 866-745-5367;  
Email: [request info \(sikkensnam@akzonobel.com\)](mailto:request_info@sikkensnam.akzonobel.com); Web: [www.nam.sikkens.com](http://www.nam.sikkens.com)

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

## 2.2 COATING TYPES

## 2.3 COATING APPLICATION AND SCHEDULE

A. Application: Deck coating systems.

1. Level of Transparency: Translucent coatings.

a. System: Sikkens Cetol SRD 250. 1) Number of Coats:   3  .

## PART 3 EXECUTION

### 3.1 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

B. Do not proceed with installation until substrates have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

### 3.2 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations, including the following: 1. Test moisture content of wood substrates to confirm it is within manufacturer's recommended limits for the coating type required.

2. Remove hardware and similar items to allow continuous coverage to the greatest extent practical.

3. Clean substrate of dirt, dust and other debris. Remove temporary markings and labels.

4. Countersink nails if raised above the surface to be coated, fill holes.

5. Apply to achieve uniform appearance, free of lap marks, bush marks, and other imperfections.

### 3.3 PROTECTION

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

END OF SECTION

## SECTION 09 91 00 PAINTING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

A. The Work in this Section requires the surface preparation and field application of primers, paints, stains and coatings to surfaces scheduled in the Schedule.

#### 1.2 RELATED SECTIONS

- A. Section 06 20 00 - Finish Carpentry: Preparation of wood surfaces to receive finishes.
- B. Section 09 00 00 - Plaster and Gypsum Board: Preparation of interior wall sheathing to receive finishes.
- C. Section 10200 - Louvers and Vents.

#### 1.3 REFERENCES

- A. Green Seal Standard GS-11; May 20, 1993.
- B. US Green Building Council, (USGBC) - Green Seal standards for LEED paint credits.
- C. Occupational Safety and Health Act (OSHA) - Safety Standards.
- D. American National Standards Institute (ANSI) - Performance Standards.
- E. Paint Decorating Contractors of America (PDCA) - Application Standard.
- F. National Paint and Coatings Association (NPCA) - Gloss Standard.
- G. American Society for Testing Materials (ASTM) - Testing Methods.
- H. Master Paint Institute (MPI) - Established paint categories and standards.
- I. Ozone Transmission Commission (OTC) - Established levels of Volatile Organic Compounds.
- J. SCAQMD 1168 - South Coast Air Quality Management District Rule #1168; October 3, 2003.
- K. SSPC (PM1) - Steel Structures Painting Manual, Vol. 1, Good Painting Practice; Society for Protective Coatings; 1993, Third Edition.
- L. SSPC (PM2) - Steel Structures Painting Manual, Vol. 2, Systems and Specifications; Society for Protective Coatings; 1995, Seventh Edition.
- M. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

#### 1.4 DEFINITIONS

- A. Commercial as used in this Section refers to a product well suited for a commercial application.
- B. DFT as used in this Section refers to the Dry Film Thickness of the coating.

C. Enamel refers to any acrylic or alkyd (oil) base paint which dries leaving an eggshell, pearl, satin, semi-gloss or high gloss enamel finish.

D. DTM as used in this Section refers to paint that is applied Direct To Metal.

E. LEED as used in this Section refers to Leadership in Energy and Environmental Design. Products listed meet LEED criteria for environmentally safe interior primers, paints and coatings.

F. OTC as used in this Section refers to the Ozone Transmission Commission. OTC has established the following VOC levels for the Northeastern United States. Products shall meet the following OTC limits for VOC's.

1. Interior flat paints: 100 grams per liter or less, per gallon.
2. Interior enamels: 150 grams per liter or less, per gallon.
3. Interior stains: 250 grams per liter or less, per gallon.
4. Interior primers: 200 grams per liter or less, per gallon.
5. Rust preventive coatings: 400 grams per liter or less, per gallon.
6. Dry fog coatings: 400 grams per liter or less, per gallon.
7. Floor coatings: 250 grams per liter or less, per gallon.

G. Premium as used in this Section refers to the best quality product "top of the line".

H. VOC as used in this Section refers to Volatile Organic Compounds found in primers, paints, sealers and stains. The level of VOCs appears after each product listed in the Schedule in grams per liter (g/L).

I. Paints are available in a wide range of sheens or glosses, as measured by a gloss meter from a 60 degree angle from vertical, as a percentage of the amount of light that is reflected. The following terms are used to describe the gloss of our products.

1. Flat - Less than 5 Percent.
2. Eggshell - 5 - 20 Percent.
3. Satin - 20 - 35 Percent.
4. Semi-Gloss - 30 - 65 Percent.
5. Gloss - Over 65 Percent.

## 1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Coordinate with Section 01305 - Submittals, for submittal procedures and LEED Submittal Forms MRc3, MRc4, MRc5.

C. LEED Certification Product Data:

1. See Section 01115 - Green Building Requirements, for LEED certification submittal forms and certification templates.

2. Submittals Required: a. MRc3 Resource Reuse (LEED Form).

b. MRc4 Recycled Content (LEED Form).

c. MRc5 Local and Regional Materials (LEED Form).

d. EQc4.1 Low Emitting Materials - Adhesives and Solvents (VOC Certification Letter).

e. EQc4.2 Low Emitting Materials - Paint (VOC Certification Letter).

f. Green Seal Standard GS-11 Certified Product certificates.



D. Product Data: Provide a complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category.
2. Cross-reference to specified paint system(s) that the product is to be used in; include description of each system.

E. Samples: Submit three paper samples, 5 inches by 7 inches (127mm x 178mm) in size, illustrating selected colors for each color and system selected with specified coats cascaded.

F. Manufacturer's Instructions: Indicate special surface preparation procedures.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

## 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten (10) years experience.

B. Installer Qualifications: All products listed in this section are to be applied by a Painting Contractor with a minimum of five years demonstrated experience in surface preparation and field application of the same type and scope as specified.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Mock-up areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Approved mock-up areas will serve as the standard for remaining Work.
4. Refinish mock-up area as required to produce acceptable Work.

## 1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Disposal:

1. Never pour leftover coating down any sink or drain. Use up material on the job or seal can and store safely for future use.
2. Do not incinerate closed containers.
3. For specific disposal or recycle guidelines, contact the local waste management agency or district. Recycle whenever possible.

## 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. Inspection of all surfaces to be coated must be done by the manufacturer's representative to insure proper preparation prior to application. All thinners, fillers, primers and finish coatings shall be from the same manufacturer to support a product warranty. Products other than those submitted shall be accompanied by a letter stating its fitness for use and compatibility.
- B. At project closeout, provide to the Owner or owner's representative an executed copy of the Manufacturer's standard form outlining the terms and conditions of and any exclusions to their Limited Warranty against Manufacturing Defect.

### 1.10 EXTRA MATERIALS

- A. At project closeout, supply the Owner or owner's representative one gallon of each product for touch-up purposes. Cans shall be clearly marked with color name, number and type of paint.
- B. At project closeout, provide the color mixture name and code to the Owner or owner's representative for accurate future color matching.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Benjamin Moore & Co., which is located at: 101 Paragon Dr Montvale, NJ 07645; Toll Free Tel: 866-708-9181; Tel: 201-573-9600; Email: [info@benjaminmoore.com](mailto:info@benjaminmoore.com); Web: [www.benjaminmoore.com](http://www.benjaminmoore.com)
- B. Substitutions: Coronado Paint Company.

### 2.2 LEED CRITERIA

- A. All paints and coatings used must meet the VOC limits of Green Seal Standard GS-11:
1. Interior: 50 g/l VOC or less for Flats and 150 g/l VOC for Non Flats.
  2. Exterior: 100 g/l VOC for Flats and 200 g/l VOC or Less for Non Flats.
- B. EQ CR4.2 Low Emitting Materials: 1 Credit - Paint.

### 2.3 MATERIALS - GENERAL

- A. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D-National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Compatibility: Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

#### 2.4 MIXING AND TINTING

A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted. Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.

B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.

C. Where paint is to be sprayed, thin according to manufacturer's current guidelines.

#### 2.5 INTERIOR PAINT SCHEDULE

A. Wood: Doors and Trim (Painted):

1. Premium Waterbase System: (one prime coat and two finish coats).

a. Eggshell Finish: Natura Waterborne 513 Acrylic Latex Eggshell Enamel,

### PART 3 EXECUTION

#### 3.1 EXAMINATION

A. The Contractor shall review the product manufacturer's special instructions for surface preparation, application, temperature, re-coat times, and product limitations.

B. The Contractor shall review product health and safety precautions listed by the manufacturer.

C. The Contractor shall be responsible for enforcing on site health and safety requirements associated with the Work.

D. Do not begin installation until substrates have been properly prepared.

E. Ensure that surfaces to receive paint are dry immediately prior to application.

F. Ensure that moisture-retaining substrates to receive paint have moisture content within tolerances allowed by coating manufacturer. Where exceeding the following values, promptly notify Architect and obtain direction before beginning work.

1. Concrete and Masonry: 13 percent. Allow new concrete to cure a minimum of 28 days.

2. Exterior Wood: 17 percent.

3. Interior Wood: 15 percent.

4. Interior Finish Detail Woodwork, Including Trim, and Casework: 10 percent.

5. Plaster and Gypsum: 15 percent.

6. Concrete Slab-On-Grade: Perform calcium chloride test over 24 hour period or other acceptable test to manufacturer. Verify acceptable moisture transmission and pH levels.

G. Examine surfaces to receive coatings for surface imperfections and contaminants that could impair performance or appearance of coatings, including but not limited to, loose primer, rust, scale, oil, grease, mildew, algae, or fungus, stains or marks, cracks, indentations, or abrasions.

H. Correct conditions that could impair performance or appearance of coatings in accordance with specified surface preparation procedures before proceeding with coating application.

### 3.2 PREPARATION - GENERAL

A. Clean surfaces thoroughly prior to coating application.

B. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.

C. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; cover stains and marks which cannot be completely removed with isolating primer or sealer recommended by coating manufacturer to prevent bleed-through.

D. Remove Mildew, Algae, and Fungus using materials and methods recommended by coating manufacturer.

E. Remove dust and loose particulate matter from surfaces to receive coatings immediately prior to coating application.

F. Remove or protect adjacent hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, and other items not indicated to receive coatings.

G. Move or protect equipment and fixtures adjacent to surfaces indicated to receive coatings to allow application of coatings.

H. Protect adjacent surfaces not indicated to receive coatings.

I. Prepare surfaces in accordance with manufacturer's instructions for specified coatings and indicated materials, using only methods and materials recommended by coating manufacturer.

### 3.3 SURFACE PREPARATION

A. Concrete and Concrete Masonry: Clean surfaces free of loose particles, sand, efflorescence, laitance, form oil, curing compounds, and other substances which could impair coating performance or appearance.

B. Concrete Floors: Remove contaminants which could impair coating performance or appearance. Verify moisture transmission and alkaline-acid balance recommended by coating manufacturer; mechanically abrade surface to achieve 80-100 grit medium-sandpaper texture.

C. Existing Coatings:

1. Remove surface irregularities by scraping or sanding to produce uniform substrate for coating application; apply one coat primer of type recommended by coating manufacturer for maximum coating adhesion.

2. If presence of lead in existing coatings is suspected, cease surface preparation and notify Architect immediately.

D. Gypsum Board: Repair cracks, holes and other surface defects with joint compound to produce surface flush with adjacent surfaces.

E. Masonry Surfaces - Restored: Remove loose particles, sand, efflorescence, laitance, cleaning compounds and other substances that could impair coating performance or appearance.

F. Metals - Aluminum, Mill-Finish: Clean and etch surfaces with a phosphoric acid-water solution or water based industrial cleaner. Flush with clean water and allow to dry, before applying primer coat.

G. Metals - Copper: Clean surfaces with pressurized steam, pressurized water, or solvent washing.

H. Metals - Ferrous, Unprimed: Remove rust or scale, if present, by wire brush cleaning, power tool cleaning, or sandblast cleaning; remove grease, oil, and other contaminants which could impair coating performance or appearance by solvent cleaning, with phosphoric-acid solution cleaning of welds, bolts and nuts; spot-prime repaired welds with specified primer.

I. Metals - Ferrous, Shop-Primed: Remove loose primer and rust, if present, by scraping and sanding, feathering edges of cleaned areas to produce uniform flat surface; solvent-clean surfaces and spot-prime bare metal with specified primer, feathering edges to produce uniform flat surface.

J. Metals - Galvanized Steel (not passivated): Clean with a water-based industrial strength cleaner, apply an adhesion promoter followed by a clean water rinse. Alternately, wipe down surfaces using clean, lint-free cloths saturated with xylene or lacquer thinner; followed by wiping the surface dry using clean, lint-free cloths.

K. Metals - Galvanized Steel, Passivated: Clean with water-based industrial strength cleaner. After the surface has been prepared, apply recommended primer to a small area. Allow primer to cure for 7 days, and test adhesion using the "cross-hatch adhesion tape test" method in accordance with ASTM D 3359. If the adhesion of the primer is positive, proceed with a recommended coating system for galvanized metal.

L. Metals - Stainless Steel: Clean surfaces with pressurized steam, pressurized water, or water-based industrial cleaner.

M. Plaster: Repair cracks, holes and other surface defects as required to maintain proper surface adhesion. Apply patching plaster or Joint compound and sand to produce surface flush with adjacent undamaged surface. Allow a full cure prior to coating application as recommended by the patching compound manufacturer's recommendations.

N. Polyvinyl Chloride (PVC) Pipe: remove contaminants and markings with denatured alcohol scuff sand and wipe with solvent for maximum adhesion. Test adhesion before starting the job.

O. Fiberglass Doors - remove contaminants with cleaning solvent (alcohol) scuff sand and wipe. Test adhesion of primer before starting job.

P. Textiles - Insulated Coverings, Canvas or Cotton: Clean using high-pressure air and solvent of type recommended for material.

Q. Wood:

1. Seal knots, pitch streaks, and sap areas with sealer recommended by coating manufacturer; fill nail recesses and cracks with filler recommended by coating manufacturer; sand surfaces smooth.
2. Remove mill marks and ink stamped grade marks.
3. Apply primer coat to back of wood trim and paneling.

R. Wood Doors: Seal door tops and bottoms prior to finishing.

S. Wood Doors - Field-Glazed Frames and Sash: Prime or seal glazing channels prior to glazing.

3.4 APPLICATION - GENERAL

A. Application of primers, paints, stains or coatings, by the Contractor, will serve as acceptance that surfaces were properly prepared in accordance with the manufacturer's recommendation.

B. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.

C. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.

D. Inspect each coat before applying next coat; touch-up surface imperfections with coating material, feathering, and sanding if required; touch-up areas to achieve flat, uniform surface without surface defects visible from 5 feet (1.5 m).

E. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

F. Where paint application abuts other materials or other coating color, terminate coating with a clean sharp termination line without coating overlap.

G. Where color changes occur between adjoining spaces, through framed openings that are of same color as adjoining surfaces, change color at outside stop corner nearest to face of closed door.

H. Re-prepare and re-coat unsatisfactory finishes; refinish entire area to corners or other natural terminations.

3.5 CLEANING

A. Clean excess coating materials, and coating materials deposited on surfaces not indicated to receive coatings, as construction activities of this section progress; do not allow to dry.

B. Re-install hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, and other items that have been removed to protect from contact with coatings.

C. Reconnect equipment adjacent to surfaces indicated to receive coatings.

D. Relocate to original position equipment and fixtures that have been moved to allow application of coatings.

E. Remove protective materials.

### 3.6 PROTECTION AND REPAIR

A. Protect completed coating applications from damage by subsequent construction activities.

B. Repair to Architect's acceptance coatings damaged by subsequent construction activities. Where repairs cannot be made to Architect's acceptance, re-apply finish coating to nearest adjacent change of surface plane, in both horizontal and vertical directions.

END OF SECTION

## SECTION 09 93 23.13 STAINS AND TRANSPARENT FINISHES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Interior Stains and Clear Finishes.
- B. Surface Preparation.

#### 1.2 RELATED SECTIONS

- A. Section 06200 - Finish Carpentry: Preparation of wood surfaces to receive finishes.

#### 1.3 REFERENCES

- A. Green Seal Standard GS-11; May 20, 1993.
- B. SCAQMD 1168 - South Coast Air Quality Management District Rule #1168; October 3, 2003.
- C. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

#### 1.4 DEFINITIONS

A. Stains are available in a wide range of opacities from transparent stain that allow all the grain and texture to show to solid colors which mastic all the grain but allow the texture to show. The following terms are used to describe the different opacities.

- 1. Transparent.
- 2. Semi Transparent.
- 3. Semi Solid.
- 4. Solid Color.

B. Varnishes and clear coats are available in a wide range of sheens or glosses, as measured by a gloss meter from a 60 degree angle from vertical, as a percentage of the amount of light that is reflected. The following terms are used to describe the gloss of our products.

- 1. Flat: 10 - 20 Percent.
- 2. Satin / Low Lustre: 20 - 35 Percent.
- 3. Semi Gloss: 35 - 70 Percent.
- 4. Gloss: Over 70 Percent.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Coordinate with Section 01305 - Submittals, for submittal procedures and LEED Submittal Forms MRc3, MRc4, MRc5.
- C. LEED Certification Product Data:
  - 1. See Section 01115 - Green Building Requirements, for LEED certification submittal forms and certification templates.
  - 2. Submittals Required:
    - a. MRc3 Resource Reuse (LEED Form).

b. MRc4 Recycled Content (LEED Form).

- c. MRc5 Local and Regional Materials (LEED Form).
- d. EQc4.1 Low Emitting Materials - Adhesives and Solvents (VOC Certification Letter).
- e. EQc4.2 Low Emitting Materials - Paint (VOC Certification Letter).
- f. Green Seal Standard GS-11 Certified Product certificates.

D. Product Data: Provide a complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category.
2. Cross-reference to specified paint system(s) that the product is to be used in; include description of each system.

E. Samples: Submit three paper samples, 5 inches by 7 inches (127mm x 178mm) in size, illustrating selected colors for each color and system selected with specified coats cascaded.

F. Manufacturer's Instructions: Indicate special surface preparation procedures.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

#### 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten (10) years experience.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Disposal:

1. Never pour leftover coating down any sink or drain. Use up material on the job or seal can and store safely for future use.
2. Do not incinerate closed containers.
3. For specific disposal or recycle guidelines, contact the local waste management agency or district. Recycle whenever possible.

#### 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. At project closeout, provide to the Owner or owner's representative an executed copy of the Manufacturer's standard form outlining the terms and conditions of and any exclusions to their Limited Warranty against Manufacturing Defect.

### 1.10 EXTRA MATERIALS

A. At project closeout, supply the Owner or owner's representative one                      gallon of each product for touch-up purposes.

B. At project closeout, provide the color mixture name and code to the Owner or owner's representative for accurate future color matching.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Acceptable Manufacturer: Benjamin Moore & Co., which is located at: 101 Paragon Dr ; Montvale, NJ 07645; Toll Free Tel: 866-708-9181; Tel: 201-573-9600; Email: [info@benjaminmoore.com](mailto:info@benjaminmoore.com); Web: [www.benjaminmoore.com](http://www.benjaminmoore.com)

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

### 2.2 LEED CRITERIA

A. All paints and coatings used must meet the VOC limits of Green Seal Standard GS-11:

1. Interior: 50 g/l VOC or less for Flats and 150 g/l VOC for Non Flats.
2. Exterior: 100 g/l VOC for Flats and 200 g/l VOC or Less for Non Flats.

B. EQ CR4.2 Low Emitting Materials: 1 Credit - Paint.

### 2.3 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:

- a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
- b. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Compatibility: Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

### 2.4 MIXING AND TINTING

A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted. Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.

B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.

C. Where paint is to be sprayed, thin according to manufacturer's current guidelines.

1. Waterproof: One (1) coat - Benjamin Moore Waterproof 320.

## 2.5 INTERIOR WOOD.

A. Wood - Interior wood flooring, ceilings and walls

1. Finish Material: Benwood Stays Clear Acrylic Polyurethane Low Lustre 423..
2. Finish Coats: Three (3) coats.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Ensure that surfaces to receive paint are dry immediately prior to application.

C. Ensure that moisture-retaining substrates to receive finishes have moisture content within tolerances allowed by coating manufacturer. Where exceeding the following values, promptly notify Architect and obtain direction before beginning work.

1. Exterior Wood: 17 percent.
2. Interior Wood: 15 percent.
3. Interior Finish Detail Woodwork, Including Trim, and Casework: 10 percent.

D. Examine surfaces to receive coatings for surface imperfections and contaminants that could impair performance or appearance of coatings, including but not limited to, loose primer, oil, grease, mildew, algae, or fungus, stains or marks, cracks, indentations, or abrasions.

E. Correct conditions that could impair performance or appearance of coatings in accordance with specified surface preparation procedures before proceeding with coating application.

### 3.2 PREPARATION - GENERAL

A. Clean surfaces thoroughly prior to coating application.

B. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.

C. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; cover stains and marks which cannot be completely removed with isolating primer or sealer recommended by coating manufacturer to prevent bleed-through.

D. Remove Mildew, Algae, and Fungus using materials and methods recommended by coating manufacturer.

E. Remove dust and loose particulate matter from surfaces to receive coatings immediately prior to coating application.

F. Remove or protect adjacent hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, and other items not indicated to receive coatings.

G. Move or protect equipment and fixtures adjacent to surfaces indicated to receive coatings to allow application of coatings.

H. Protect adjacent surfaces not indicated to receive coatings.

I. Prepare surfaces in accordance with manufacturer's instructions for specified coatings and indicated materials, using only methods and materials recommended by coating manufacturer.

### 3.3 SURFACE PREPARATION

A. Seal knots, pitch streaks, and sap areas with sealer recommended by coating manufacturer; fill nail recesses and cracks with filler recommended by coating manufacturer; sand surfaces smooth.

### 3.4 APPLICATION - GENERAL

A. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.

B. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.

C. Inspect each coat before applying next coat; touch-up surface imperfections with coating material, feathering, and sanding if required; touch-up areas to achieve flat, uniform surface without surface defects visible from 5 feet (1.5 m).

D. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

E. Where application abuts other materials or other coating color, terminate coating with a clean sharp termination line without coating overlap.

F. Where color changes occur between adjoining spaces, through framed openings that are of same color as adjoining surfaces, change color at outside stop corner nearest to face of closed door.

G. Re-prepare and re-coat unsatisfactory finishes; refinish entire area to corners or other natural terminations.

### 3.5 CLEANING

A. Clean excess coating materials, and coating materials deposited on surfaces not indicated to receive coatings, as construction activities of this section progress; do not allow to dry.

B. Re-install hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, and other items that have been removed to protect from contact with coatings.

C. Reconnect equipment adjacent to surfaces indicated to receive coatings.

D. Relocate to original position equipment and fixtures that have been moved to allow application of coatings.

E. Remove protective materials.

### 3.6 PROTECTION

A. Protect completed coating applications from damage by subsequent construction activities.

B. Repair to Architect's acceptance coatings damaged by subsequent construction activities. Where repairs cannot be made to Architect's acceptance, re-apply finish coating to nearest adjacent change of surface plane, in both horizontal and vertical directions.

**END OF SECTION**

## SECTION 09 93 23.53 - Interior Finishing

### Part 1 – General

- 1.1 Section Requirements
  - A. Submittals: Product Data

### Part 2 – Products

- 2.1 Polyurethane
  - A. Products
    - 1. Defthane Polyurethane Satin Finish
      - See Manufacturers Specifications
      - [http://www.deftfinishes.com/trade/sites/default/files/82010\\_msd\\_number\\_23x39\\_aerosol\\_defthane\\_satin.htm](http://www.deftfinishes.com/trade/sites/default/files/82010_msd_number_23x39_aerosol_defthane_satin.htm)

### Part 3 – Execution

- 3.1 Preparation
  - A. Comply with manufacturers specifications
  - B. All surfaces must be cured, clean, dry, and free from dirt, dust, rust, stains, grease, oil, mildew, wax, efflorescence, and other contaminants. Remove all loose, peeling, or cracked coatings. Repair all cracks, holes, and other surface imperfections with a suitable patching material. Repaired surfaces should then be sanded, and cleaned. Glossy surfaces should be dulled to provide a roughened surface for good adhesion.
- 3.2 Application
  - A. Follow manufacturers instructions
    - 1. Sand wood and wipe off dust.
    - 2. Apply first coat with long, smooth strokes. Let dry for 4-6 hours (450 VOC) or 6-8 hours (275 VOC).
    - 3. Sand smooth, remove dust.
    - 4. Apply 2 more thin coats. Where exposure or wear is severe, apply additional coats. Let dry 4-6 hours between coats (450 VOC) or 6-8 hours between coats (275 VOC).
    - 5. Use paint thinner (mineral spirits) for clean up.
    - 6. Sand and repeat when first signs of deterioration appear.

END OF SECTION

## Division 10 - Specialties

### SECTION 10 28 16 BATH ACCESSORIES

#### **PART 5 - GENERAL**

##### 5.01 SUMMARY

- A. Section Includes
  - 1. Commercial and hospitality bathroom accessories.

##### 5.02 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI A 117.1 - Accessible and Usable Buildings and Facilities.
- B. ASTM International (ASTM):
  - 1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  - 3. ASTM A 1008/A 1008M- Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
  - 4. ASTM B 456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - 5. ASTM C 1503 - Standard Specification for Silvered Flat Glass Mirror.
  - 6. ASTM F 446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

##### 5.03 ACTION SUBMITTALS

- A. Product Data: For each product:
  - 1. Manufacturer's product data sheets indicating operating characteristics, materials and finishes. Mark each sheet with product designation.
  - 2. Mounting requirements and rough-in dimensions.
- B. LEED Submittals:
  - 1. Product data for Credit MR 4: Indicate percentages by weight of postconsumer and preconsumer recycled content, and product cost.
  - 2. Laboratory Test Reports for Credit IEQ 4: For accessory components made from composite materials: Indicate compliance with testing and product requirements of the

California Department of Health Services ""Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.""

5.04 INFORMATION SUBMITTALS

- A. Sample warranty.
- B. Operation, care and cleaning instructions.

5.05 MAINTENANCE SUBMITTALS

- A. Furnish indicated spare parts that are packaged with identifying labels listing associated products.
- B. Operation and Maintenance data.

5.06 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum [5] years experience in the manufacture of product types. Manufacturers seeking approval must submit the following:
  - 1. Product data, including test data from qualified independent testing agency indicating compliance with requirements.
  - 2. Samples of each component of product specified.
  - 3. List of successful installations of similar products available for evaluation by Architect.
  - 4. Submit substitution request not less than 15 days prior to bid date.
- C. Accessibility Requirements: Comply with requirements of ADA/ABA and with requirements of authorities having jurisdiction.

5.07 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.

**PART 6 - PRODUCTS**

6.01 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide bath accessories manufactured by Bradley Corporation, Menomonee Falls, WI 53051, (800) 272-3539, fax: (262) 251-5817; Email [info@BradleyCorp.com](mailto:info@BradleyCorp.com); Website: [www.bradleycorp.com](http://www.bradleycorp.com).
  - 1. Submit comparable products of one of the following for approval by Architect:

a. ASI

2. Submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.
3. Provide specified product; Owner will not consider substitution requests.

6.02 MATERIALS

- A. Stainless Steel: ASTM A 666 Type 304 (18-8); satin finish exposed surfaces unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS, manufacturer's standard thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating, manufacturer's standard thickness.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners:
  1. Exposed: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant.
  2. Concealed: Galvanized steel.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2, moderate service.
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

6.03 COMMERCIAL HOSPITALITY BATHROOM ACCESSORIES

- A. Toilet Tissue Roll Dispenser, Surface Mount **TTDS**:
  1. Basis of Design: **Bradley Corp., Model [ 5054\_\_ ]**.
  2. Application: [At each water closet, unless otherwise indicated.] [Where indicated] [insert location description].
  3. Capacity: [Single roll] [dispenser].
  4. Finish and Base Material: [Chrome-plated stainless steel]
  5. Delivery: [Non-controlled.]
  6. Mounting: [Surface-mounted.]
- B. Towel Bar **TB**:
  1. Basis of Design: **Bradley Corp., Model [ \_1055\_\_ ]**.
  2. Configuration: Surface mounted, 24 inch (610 mm)
  3. Towel Bar Shape: 3/4 inch (19 mm) [diameter round] Material: [Stainless steel], with [stainless steel] escutcheons [and zinc plated steel wall plate] Finish: [Chrome plated] exposed surfaces.
  4. Application: [Where indicated]

## 6.04 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 7 - EXECUTION

### 7.01 INSTALLATION

- A. Assemble fixtures and associated fittings and trim in accordance with manufacturer's instructions.
- B. Install supports attached to building structure for equipment requiring supports.
- C. Grab Bars: Install grab bars to withstand downward force of not less than 250 lbf (1112 N) per ASTM F 446.
- D. Install equipment level, plumb, and firmly in place in accordance with manufacturer's rough-in drawings.

### 7.02 CLEANING AND PROTECTION

- A. Repair or replace defective work, including damaged equipment and components.
- B. Clean unit surfaces, and leave in ready-to-use condition.
- C. Turn over keys, tools, maintenance instructions, and maintenance stock to Owner.

### 7.03 TESTING AND ADJUSTING

- A. Test each piece of equipment provided with moving parts to assure proper operation, freedom of movement, and alignment.
- B. Repair or replace malfunctioning equipment, or equipment with parts that bind or are misaligned.

END OF SECTION

SECTION 11 06 30 – RESIDENTIAL EQUIPMENT

MARK	DESCRIPTION	MFR	MODEL	MANUAL SECTION
	REFRIGERATOR			
EK-1	FREEZER	GE	GTH18ISXSS	11 31 13
EK-2	RANGE HOOD	GE	JV930SCBR	11 31 13
EK-3	COOKTOP	GE	PP912SMSS	11 31 13
EK-4	CONVECTION OVEN	GE	JTP70DPWW	11 31 13
EK-5	DISHWASHER	BOSCH	SHV43P13UC	11 31 13
GD-1	GARBAGE DISPOSAL	KITCHENAID	KCDB250G	11 31 13
EL-1	CLOTHES WASHER	LG	WM2140CW	11 31 23
EL-2	CLOTHES DRYER	LG	DLE2140W	11 31 23

SECTION 11 31 13 – RESIDENTIAL KITCHEN APPLIANCES

**PART 1 – GENERAL**

**1.1 Section Requirements**

- A. Allowances: See Division 01 Section “Price and Payment Procedures” for appliance allowances.
- B. Submittals: Product Data.
- C. Regulatory Requirements: Comply with provisions of the following product certifications
  - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
  - 3. NAECA: Provide residential appliances that comply with NAECA standards.
- D. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board’s ADA-ABA Accessibility Guidelines.
- E. Energy Ratings: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

**PART 2 – PRODUCTS**

**2.1 Residential Kitchen Appliances**

**A. Refrigerator/Freezer**

- 1. GE; GTH18ISXSS

**PART 8 - Product Requirements**

**SCHEDULE 0 - Freestanding**

## **PART 9 - Product Specifications**

### **2. Capacity**

- i. Total Capacity: 18.0 cu ft
- ii. Fresh Food Capacity: 12.93 cu ft
- iii. Freezer Capacity: 5.09 cu ft
- iv. Shelf Area: 21.9 sq ft

### **3. Features**

- i. Defrost Type: Frost Free
- ii. Control type: Upfront Temperature Controls
- iii. Icemaker: Optional (IM4A Ready)
- iv. Fresh Food Cabinet Shelves: 3 Total
  - i. Glass
  - ii. 3 Adjustable
  - iii. 2 Split
  - iv. 1 Full-Width
- v. Fresh Food door Bins: 2 Total
  - i. 2 Full-Width
  - ii. 1 with Gallon Storage
- vi. Fresh Food Door Shelves: 1 Total
  - i. ½ Shelf with Gallon Storage
- vii. Fresh Food Cabinet Drawers: 3 Total
  - i. 2 Clear
  - ii. 1 Snack Drawer
- viii. Fresh Food Door Features: Dairy Compartment
- ix. Fresh Food Features: Interior Lighting - Dual Level
- x. Freezer Cabinet Shelves: 1 Total
  - i. Wire
  - ii. 1 Step Shelf
- xi. Freezer Door Bins: 2 Total
  - i. 2 Fixed Full-Width
- xii. Freezer Features
  - i. 1 Ice N' Easy Tray
  - ii. Spill Proof Freezer Floor
- xiii. Leveling System: Leveling Legs
- xiv. Performance Features
  - i. Easily removable door gaskets
  - ii. NeverClean Condenser
  - iii. Deluxe Quiet Design

### **4. Certifications**

- i. Energy Star Qualified
- ii. Freezer: CEE tier: I
- iii. ADA Compliant

### **5. Appearance**

- i. Color Appearance: Stainless Steel
- ii. Door Stops: Yes
- iii. Door Swing: Reversible Hinges
- iv. Exterior Design: Rounded Doors
- v. Handle
  - i. Stainless Steel
  - ii. Customer Installed Handles
- vi. Textured Steel Class: Black
- vii. Coil-Free Back: Yes

6. Weights & Dimensions
    - i. Approximate Shipping Weight: 239 lb
    - ii. Net Weight: 215 lb
    - iii. Overall depth 32 ½ in
    - iv. Case Depth Without Door 27 ½ in
    - v. Depth With Door Open 90 Degrees: 58 ½ in
    - vi. Depth Without Handle: 20 ¼ in
    - vii. Overall Height: 66 ¾ in
    - viii. Height to Mid-Freezer: 53 15/16 in
    - ix. Height to Top of Case: 66 ¼ in
    - x. Overall Width: 29 ½ in
    - xi. Width w/Door Open 90 Degrees incl. Handle 32 in
    - xii. Width w/Door Open 90 Degrees less handle: 30 in
    - xiii. Back Air Clearances: 1 in
    - xiv. Side Air Clearances: ½ in
    - xv. Top Air Clearances: 1 in
  7. Power / Ratings
    - i. Volts/Hertz/Amps: 120V/60Hz/15A
  8. Price: \$1049
- PART 10 - Manufacturer Information and Product Link**
2. Manufacturer: GE
  3. <http://products.geappliances.com/AppProducts/Dispatcher?REQUEST=SpecPage&Sku=GTH18ISXSS>

**B. Electric Ceramic Cooktop**

1. GE; PP912SMSS

**Part 1 - Product Requirements**

SCHEDULE 0 - 30in.

SCHEDULE 1 - Built-in cooktop with four burner elements

**PART 2 - Product Specifications**

1. Features
  - i. Cooktop Surface
    - i.Black Patterned Glass Ceramic With Stainless Steel Trim
  - ii. Cooktop Burner Type
    - i.Smoothtop
    - ii.4 Ribbon
  - iii. Style: Smoothtop
  - iv. 6" Heating Element: 2 Ribbon (1200 W)
  - v. 8" Heating Element: 1 Ribbon (PowerBoil)
  - vi. 9/12" Dual Heating Element: 1 Ribbon (2000/2700W)
  - vii. Control type: Infinite Heat rotary
  - viii. Cooktop Control Features: Child Lock
  - ix. Control Location: Right Side
  - x. Dishwasher Safe Knobs: Yes
  - xi. Indicator Lights
    - i.4 Hot Surface
    - ii.Surface Element "ON"
2. Appearance
  - i. Color Appearance: Stainless Steel
  - ii. Control Knobs: Professional die-cast
3. Weights & Dimensions

- i. Approximate Shipping Weight: 38lb
  - ii. Cabinet Width: 30in
  - iii. Cooktop Size: 30in
  - iv. Cutout Dimensions (Width x Depth): 28 ½ in x 19 ⅝ in
  - v. Net Weight: 33 lb
  - vi. Overall Depth: 21 ½ in
  - vii. Overall Height: 3 ¼ in
  - viii. Overall Width: 29 ⅞ in
4. Power/Ratings
    - i. Amp Rating at 208V: 30 Amp
    - ii. Amp Rating at 240V: 40 Amp
    - iii. KW Rating at 208V: 5.7 Amp
    - iv. KW Rating at 240V: 7.6
  5. Price: \$999

**PART 3 - Manufacturer Information and Product Link**

4. Manufacturer: GE
5. <http://products.geappliances.com/AplProducts/Dispatcher?REQUEST=SpecPage&Sku=PP912SMSS>

**C. Electric Wall Convection Oven**

1. GE; JTP70DPWW

b. Product Specifications

- ii. Dimensions and Weight
  - a. Width: 29 ¾ in
  - b. Depth: 23 1/2 in
  - c. Height: 28 ¼ in
  - d. Interior Dimensions: (W x H x D) (in.) 24 x 17-1/2 x 18-1/4
  - e. Approximate Shipping Weight: 122 lb
  - f. Weight: 105 lb
- iii. Configuration: Single Oven
- iv. Cooking Technology Convection Cooking System Precise Air™ Convection System Flat Back
- v. Convection Oven Cleaning Type: Self-Clean
- vi. Style: Built-In
- vii. Temperature Management System TrueTemp™ System
- viii. Cleaning Time Variable with Delay Clean Option
- ix. Control Type: QuickSet VI
- x. Oven Cooking Modes Convection Bake Multi/Single Rack Convection Roast
- xi. Self-Clean Oven Door Lock Automatic
- xii. Oven Interior: Hidden
- xiii. Bake Oven Rack Features 3 Oven Racks  
7 Embossed Rack Positions
- xiv. Interior Oven Light 1, Auto, Incandescent
- xv. Features
  - a. [PreciseAir™ convection system](#)
  - b. [Glass Touch Oven Controls](#)
  - c. Convection Bake (Multi-Mode)
  - d. [Convection Roast](#)
  - e. [Flat back convection](#)



- iv. Efficiency
  - a. Energy Star: 259 kwh/yr
  - b. CEE tier II
  - c. EcoSense™ Reduces Energy Usage by up to 20%
  - d. Half Load Option for Small Loads
  - e. Flow-Through Water Heater™
  - f. Triple Filtration System
- v. Safety
  - a. Bosch exclusive 24/7 Overflow Leak Protection
  - b. NSF Certified - Eliminates 99.9% of Bacteria
  - c. Concealed Heating Element - No Melting of Plastics
  - d. SaniDry™ Hygienic Condensation Drying
- vi. Capacity
  - a. 300 Series Racks with Flexible Silverware Basket
  - b. Manual Height Adjustment Upper Rack
- vii. Convenience
  - a. AquaStop® Leak Protection
  - b. NSF Certified - Eliminates 99.9% of Bacteria
  - c. SaniDry™ Hygienic Condensation Drying
  - d. Quick Wash - In 30 Minutes or Less
  - e. End of Cycle Sound
- viii. Price: \$ 999
- d. Manufacturer Information and Product Link
  - ii. Manufacturer: Bosch
  - iii. <http://www.bosch-home.com/us/SHV43P13UC.html>

#### E. Range Hood

- 1. GE, JV930SCBR
  - b. Product Requirements
    - i. Standard range hood
  - c. Product Specifications
    - ii. Features
      - a. Cooktop Lighting
      - b. Damper Included
      - c. Fan Speed Control: Variable
      - d. Filter Size: 147 sq in
      - e. Ventilation System Control: Auto Heat Sensor
      - f. CFM/Sones Rating
        - i. 320/4.5 (High Speed)
        - ii. 100/0.3 (Working Speed)
    - iii. Economical /Quiet
    - iv. Venting Type: Externally Vented
    - v. Appearance
      - a. Color Appearance: Brushed Aluminum/Glass
    - vi. Weights & Dimensions
      - a. Approximate Shipping Weight: 37 lb
      - b. Cabinet Width: 30 in



## **PART 3 – EXECUTION**

### **3.1 Installation**

- A.** Built-in Appliances: Securely anchor to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- B.** Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C.** Test each item of residential appliances to verify proper operation. Make necessary adjustments.

**END OF SECTION**

## Section 11 31 23 - RESIDENTIAL LAUNDRY APPLIANCES

### PART 1 – GENERAL

#### 1.1 Section Requirements

- A. Allowances: See Division 01 Section “Price and Payment Procedures” for appliance allowances.
- B. Submittals: Product Data.
- C. Regulatory Requirements: Comply with provisions of the following product certifications
  - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
  - 3. NAECA: Provide residential appliances that comply with NAECA standards.
- D. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board’s ADA-ABA Accessibility Guidelines.
- E. Energy Ratings: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

### PART 2 – PRODUCTS

#### 2.1 Residential Laundry Appliances

- A. Clothes Washer
  - 1. LG, WM2140CW
    - b. Product Requirements
      - ii. Freestanding
      - iii. Front loading
      - iv. Automatic clothes washer with 4 cubic feet of capacity
      - v. A stainless steel interior
      - vi. 7 wash cycles including the ability to adjust temperature levels and spin speeds
  - C. Product Specifications
    - ii. Total Capacity: 3.5 cu ft
    - iii. Features
      - a. Washer Options:
        - i. Prewash
        - ii. Quick Cycle
        - iii. Extra Rinse
        - iv. Rinse + Spin
        - v. Stain Cycle
        - vi. Tub Clean
        - vii. Water Plus
        - viii. SpinSense™
      - b. Dispenser
        - i. Prewash
        - ii. Main Wash (with liquid detergent cup)
        - iii. Bleach
        - iv. Softener

- C. Control Type
  - i. Electronic
  - ii. Pushbutton
  - iii. LED
- d. Wash/Rinse Temperatures
  - i. Hot/Cold
  - ii. Warm/Warm
  - iii. Warm/Cold
  - iv. Cold/Cold
  - v. Tap Cold/Cold
- e. Wash/Spin Speed Combinations:
  - i. Extra High (1100 max)
  - ii. High
  - iii. Medium
  - iv. Low
  - v. No Spin
- f. Washer Control Features
  - i. LED Cycle Status Lights TrueBalance™ Anti-Vibration System
  - ii. SmartDiagnosis™
  - iii. Load Sense
  - iv. Status Indicator
  - v. End of Cycle Signal
  - vi. Child Lock
  - vii. Auto Suds Removal
  - viii. Forced Drain System
  - ix. Auto Balancing
  - x. Delay Start - Up to 19 hours
- g. Water Levels: Auto-adjusts to load size
- h. Cycles: 7
  - i. Bulky/Large
  - ii. Perm Press
  - iii. Cotton/Normal
  - iv. Delicates
  - v. Hand Wash/Wool
  - vi. Speed Wash
  - vii. Drain & Spin
- i. Style: Front-Loading
- j. Wash Basket Type: Stainless Steel
- k. Soil Levels
  - i. 5
- l. Additional Washer Features
  - i. 6Motion™ Technology
  - ii. TrueBalance™ Anti Vibration System
  - iii. Direct Drive Motor, 10 Year Warranty
  - iv. SpeedWash™ Cycle
  - v. SenseClean™ System



- d. Capacity: 7.1 cu. ft.
- e. Stackable: Yes
- f. Designer Color: White
- g. Number of Drying Programs: 7
  - viii. Sensor Dry: Normal, Perm Press, Cotton/Towels, Delicates
  - ix. Manual Dry: Speed Dry, Freshen Up, Air Dry
- h. Number of Temp Levels: 5
  - i. High, Medium High, Medium, Low, Ultra Lows
- i. Number of Options: 7
  - iii. More Time, Less Time, Signal, Custom Program, Damp Dry Signal, Wrinkle Care
- j. Features:
  - i. Dial-A-Cycle™ Sensor Dry System
  - ii. SmartDiagnosis™
  - iii. Wrinkle Care Option
  - iv. Remaining Time Display/Status Indicator(s)
  - v. End of Cycle Beeper
  - vi. Drum Light
  - vii. Reversible Door
  - viii. Leveling Legs: 4 Adjustable Legs
  - ix. Venting Option: 4 Way Venting

## **PART 3 – EXECUTION**

### **3.1 Installation**

- A.** Built-in Appliances: Securely anchor to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- B.** Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C.** Test each item of residential appliances to verify proper operation. Make necessary adjustments.
- D.** Verify that accessories required have been furnished and installed.

## **END OF SECTION**

## Division 12 – Furnishings

### SECTION 12 21 13 – Window Treatments (.13 for metal, .23 for wood, .33 for plastic)

#### Part 1 - GENERAL

##### 1.1 Summary

###### A. Section Includes:

1. Horizontal Light Louvers for both of the windows

##### 1.2 Related Sections

- ###### A. Section 08 50 00 – windows with integral louver blinds

##### 1.3 Section Requirements

###### A. Submittals

1. Product Data sheet – Installation is according to Manufacturer’s instructions:  
<http://lightlouver.com/index.php?/design-information/construction-specifications/>
2. See Section 01300 - Administrative Requirements, for submittal procedures
3. Product Data: Provide data indicating physical and dimensional characteristics and operating features, photometric properties of the reflective slats, and other data substantiating that the Performance Requirements of Section 1.04 have been met.
4. Shop Drawings: Indicate opening sizes, tolerances required, methods of assembly and attachment, clearances, and operation.
5. Manufacturer's Installation Instructions: Indicate any special procedures.  
<http://lightlouver.com/index.php?/design-information/installation-and-maintenance/installation-information/>
6. Manufacturer’s Maintenance Instructions.  
<http://lightlouver.com/index.php?/design-information/installation-and-maintenance/maintenance-information/>

##### 1.4 Allowances

##### 1.5 Quality Assurance

- ###### A. The supplier of the optical side-daylighting system shall prepare shop drawings and specifications to substantiate that the Performance Requirements specified in Section 1.04 have been met, and inform the general contractor and / or the installing subcontractor of the required installation procedures.

##### 1.6 Accessibility

##### 1.7 Delivery, Storage and Handling

- ###### A. Deliver optical side-daylighting units packaged in a manner to prevent damage to components or marring of surfaces.
- ###### B. Store in a clean, dry area. Store in a manner recommended by the manufacturer to avoid damage.

#### Part 2 - PRODUCTS

##### 2.1 Products

A. Light Louvers

1. LightLouver LLC

a. Product Requirements

b. Performance Requirements

i. The reflecting slats of the optical side-daylighting system shall have, at a minimum, the following optical properties:

1. Reflective Surfaces:

1. Total Reflectance (Nominal) -- 85%

2. Direct Image Reflectance, Specularity (Nominal) -- 84%

2. Non-Reflective Surfaces:

1. Total Reflectance (Nominal) -- Less than 40%

2. Direct Image Reflectance, Specularity (Nominal) -- Less than 5%

ii. Optical design / geometry of the reflective slat shall be such that all direct sunlight above a 5-degree solar altitude angle striking the slat shall be redirected in an upward direction.

iii. The reflective slat film shall be durable and ultra-violet light stable, and shall not peel or discolor.

iv. The reflecting slats of an optical side-daylighting unit shall not have an offset from level of more than 0.125 inch over the length (span) of the slat.

v. The optical side-daylighting unit shall securely attach to the window frame so that seismic or other forces will not dislodge the unit, causing it to fall.

vi. The optical side-daylighting unit shall pivot into the room, without the potential to become dislodged, so that the window glass behind the daylighting unit can be cleaned.

vii. The optical side-daylighting unit shall be removable with minimum potential for damage.

viii. It shall be possible to replace the optical reflective slats. This may require the removal of the unit from "daylight" window, and disassembling of the optical side-daylighting unit.

c. Product Components

i. Reflective Slats: Horizontal reflective slats, with the optical and physical properties specified in Section 1.04, and formed into an optical geometric shape designed to achieve the daylighting and solar control functions specified in Section 1.04.

ii. Reflective Surfaces: Reflective surfaces of the optical slats shall consist of a heat applied reflective film with an appropriate pressure sensitive adhesive which meets the optical and physical performance properties specified in Section 1.04.

iii. Unit Support: Integrated support system shall include a horizontal unit support bar at the top of the unit that connects to vertical support rods which support the reflective slats and that engages specially designed support brackets that are fastened to the window frame.

iv. Accessory Hardware: All accessory hardware, such as light-blocking elements and unit glazing stand-offs, shall be provided with the optical side-daylighting units, with no substitutions allowed.

d. Product Specifications

i. **Fenestration Specifications**

Most commercial buildings in various climates benefit from windows with a low U-value ( low heat conduction ) and a low Solar Heat Gain Coefficient (reduced solar heat gain).

This essentially translates to an insulated glazing unit (IGU) with a low-emissivity coating. When using LightLouver units, these windows must also have a high visible light transmittance and a low exterior reflectance to maximize daylight collection. The ideal glazing performance specification for this common scenario / design condition is:

1. **Visible Light Transmission**

( VLT, Tvis ) > 65%

Light to Solar Heat ( LSG ) Gain Ratio > 1.8

U-Value < .31

NOTE: Scenarios/design conditions in cold climates may benefit by a lower LSG.

2. **Ceiling Reflectance Specifications**

Reflectance > 80%

Specular Reflectance < 2%

Surface Finish - A smooth, matte finish with no heavy patterns, texture or protrusions that would act as a "light dam," blocking daylight distribution across the ceiling surface

3. **Wall / Partition Reflective Specifications**

Diffuse Reflectance > 50% below 7' 0" or > 70% above 7' 0"

4. **Fenestration Shading Specifications**

Effectively shades the "view" window during the spring, summer and fall months without shading any portion of the "daylight" window.

5. **Interior Shading Specifications**

Effectively blocks the direct sunlight entering the "view" window and does not allow more than 3 % of this direct sunlight to strike critical work surfaces.

6. **Electric Lighting Fixture**

Source Efficacy > 60 lumens / Watt

Luminaire Efficiency > 80%

Indirect Component 10 - 30 %

Electronic Programmed Start Ballasts

Zoning / Circuiting Ability to control lighting in response to daylight signal rows parallel to the windows

7. **Daylight Responsive Controls**

Any photosensor control based system

Known spatial sensitivity with a broad symmetrical sensitivity curve

Known spectral response with minimal sensitivity in the Infra-Red (IR) and Ultra-Violet (UV) wavelengths

8. Open Loop

1. Sensitive from 50 – 8,000 footcandles

2. Durable, UV stable and resistant to yellowing and cracking, etc...

3. Programmable control algorithm

9. Closed Loop

1. Sensitive from 0.5 – 500 footcandles

2. Sensor shielded from seeing any LightLouver units

3. Programmable sliding setpoint control algorithm

## Part 3 - EXECUTION

### 3.1 Installation

- A. Install the optical side-daylighting units in accordance with manufacturer's instructions and procedures.
- B. Install proper optical side-daylighting unit type in the "daylight" window.
- C. Field apply the light-blocking seals as required in accordance with the manufacturer's instructions and procedures.
- D. As required, clean reflective surfaces of the slats to remove any dust, smudges or fingerprints following the manufacturer's instructions for cleaning and handling.
- E. Leave work area clean and free of debris.

### 3.2 Installation Tolerances:

- A. Maximum Variation of Gap at Window Opening Perimeter: side edge -- 3/8 (0.375) inch. Top / bottom edge -- varies based on "daylight" window sizing. Variation in the "daylight" window finished

opening dimensions may result in larger tolerances to minimize the number of different unit types fabricated.

- B. Maximum Offset From Level: 0.0625 inch.

### **3.3 Testing/ Inspection**

- A. Verify that “daylight” window openings are ready to receive the optical side-day lighting units.

### **3.4 Maintenance**

- A. Manufacturer’s Maintenance Instructions.  
<http://lightlouver.com/index.php?/design-information/installation-and-maintenance/maintenance-information/>

### **3.5 Fabrication**

- A. Fabricate optical side-daylighting units to fit within “daylight” window openings with uniform side edge clearance of 3/8 inch +/- 1/8 inch. Top and bottom edge clearance may vary due to size of window specified by the architect. Variation in the “daylight” window finished opening dimensions may result in larger tolerances to minimize the number of different unit types fabricated.
- B. Fabricate optical side-daylighting units to easily install into the “daylight” window openings without damaging the daylighting unit or the surrounding window frame. Variation in the “daylight” window finished opening dimensions may result in larger tolerances to minimize the number of different unit types fabricated.

### **3.6 Cleaning**

- A. As required, clean optical side-daylighting unit slat reflective surfaces just prior to occupancy, following the manufacturer’s instructions for cleaning and handling.

**END OF SECTION**

## SECTION 12 25 00 RESIDENTIAL FURNITURE

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Foam furniture
  - 1. Foam
  - 2. faux vinyl leather

#### 1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification

Sections that relate directly to work of this Section include, but are not limited to:

- 1. Section 09 00 00, Finishes

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, and recommendations for each product specified.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide large scale plans, elevations, and details of profiles, joints, seams, anchorages, connections and accessory items. Indicate galvanic isolation from adjacent aluminum or carbon steel if applicable.
- C. Material Samples: Submit two 6 by 6 inch flat samples.
- D. Warranty: Submit manufacturer's standard 10 year warranty.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator: Minimum 5 years experience with projects of similar complexity.
- B. Installer: Minimum 3 years experience with projects of similar complexity. At Architect's request, submit names and locations of recent projects.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions

and recommendations and industry standards. Protect from damage.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.6 SEQUENCING AND SCHEDULING

A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

B. Perform work of this section in coordination with other sections to provide the highest quality work which best fulfills the intent requirements of this work.

### **PART 2 PRODUCTS**

#### 2.1 MATERIALS

A. Acceptable Manufacturers:

1. Foam: TBD

In accordance:

State of California Department of Consumer Affairs Bureau of Home  
Furnishings and Thermal insulation

2. Faux Vinyl Leather:

Faux Sure 2880 by Design Tex a Steelcase Company

800.221.1540

[www.designtex.com](http://www.designtex.com)

B. Accessories: Provide all clips, cleats, straps, anchors, similar items necessary to properly complete the work. Provide accessories that are compatible with sheet metal materials used and which are of sufficient size and gage to perform as intended.

#### 2.2 FABRICATION

A. Isolate dissimilar materials with isolation coating recommended by the manufacturer or other permanent separation acceptable to the Architect.

### **PART 3 EXECUTION**

#### 3.1 INSPECTION

A. Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 INSTALLATION

A. Strictly comply with manufacturer's and fabricator's instructions and recommendations and approved details.

### 3.3 ADJUSTING, CLEANING, PROTECTION

A. Adjust work to conform to appear uniform and in proper relationship with adjacent work.

B. Repair minor damage to eliminate all evidence of repair. Remove and replace work, which cannot be satisfactorily repaired.

C. Clean exposed surfaces using detergent and water

**END OF SECTION**

## Section 12 36 00 Wood Laminate Casework & Cabinetry

### **PART 1 GENERAL**

#### 1.1 SUMMARY

- A. Wood Laminate case work for the following
  - 1. Kitchen base & Wall Cabinets
  - 2. Hanging box shelf/ Cabinet shelves

#### 1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification

Sections that relate directly to work of this Section include, but are not limited to:

- 1. Section 06 11 00, Wood Framing
- 2. Section 09 00 00, Finishes

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, and recommendations for each product specified.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide large scale plans, elevations, and details of profiles, joints, seams, anchorages, connections and accessory items. Indicate galvanic isolation from adjacent aluminum or carbon steel if applicable.
- C. Material Samples: Submit two 6 by 6 inch flat samples.
- D. Warranty: Submit manufacturer's standard 10 year warranty.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator: Minimum 5 years experience with projects of similar complexity.
- B. Installer: Minimum 3 years experience with projects of similar complexity. At Architect's request, submit names and locations of recent projects.

### 1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions

and recommendations and industry standards. Protect from damage.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

### 1.6 SEQUENCING AND SCHEDULING

A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

B. Perform work of this section in coordination with other sections to provide the highest quality work which best fulfills the intent requirements of this work.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Acceptable Manufacturer:

Cab Parts, Inc  
716 Arrowest Road  
Grand Junction, CO 81505  
Phone: 970.241.7682  
Fax: 970.241.7689  
www.cabparts.com

**B. 3/4" Maple Laminate Plywood Construction**

**C. 32mm Boring Patterns**

All components, including sides, tops, bottoms and drawer parts are bored on 32mm centers. This assures you of the greatest flexibility in adding hardware, such as hinge blocks, drawer guides and studs for KD shelves. Since the holes are already bored, these hardware items can be assembled to the case component while still "in-the-flat" prior to assembling the case.. Drawers fit, doors hang true and shelf spacing is widely adjustable.

C. Accessories: Provide all clips, cleats, straps, anchors, similar items necessary to properly complete the work. Provide accessories that are compatible with sheet metal materials used and which are of sufficient size and gage to perform as intended.

### 2.2 FABRICATION

A. Isolate dissimilar materials with isolation coating recommended by the manufacturer or other permanent separation acceptable to the Architect.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

A. Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### **3.2 INSTALLATION**

A. Strictly comply with manufacturer's and fabricator's instructions and recommendations and approved details.

B. Securely anchor work and allow for thermal movement and building movement. Use concealed fasteners to the greatest extent possible.

### **3.3 ADJUSTING, CLEANING, PROTECTION**

A. Adjust work to conform to appear uniform and in proper relationship with adjacent work.

B. Repair minor damage to eliminate all evidence of repair. Remove and replace work, which cannot be satisfactorily repaired.

C. Clean exposed surfaces using detergent and water

## **END OF SECTION**

## Division 13 – Special Construction

### SECTION 13 31 33–CONTINUOUS VINYL COATED POLYESTER MEMBRANE

#### **PART 1 – GENERAL**

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

This Section includes:

Exterior fabric for application to exterior of structure.

##### 1.3 DEFINITIONS

- A. Exterior unstructured Vinyl siding: An architectural vinyl siding that provides weather protection, and is wholly supported by the building to which it is attached.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide exterior fabric capable of withstanding the effects of gravity loads and the following loads and stresses within and under conditions indicated: Wind Loads: Uniform pressure of 18.6 lbf/sq. ft., acting upward or downward.

##### 1.5 SUBMITTALS

- A. Product Data: Include exterior fabric description, fabrication and construction details, dimensions and profiles, features, and finishes.

Samples for Initial Selection: For each application, color and finish of exterior fabric.

Samples for Verification: For each exterior fabric selected or required.

Exterior Fabric Schedule: Use designations indicated on Drawings.

Product Certifications: Manufacturer's certification that each type of exterior fabric complies with requirements.

Maintenance and Cleaning Instructions: Manufacturer's recommendations, including:

Maintenance of exterior fabrics.

Cleaning information and precautions for exterior fabrics.

Warranty: Manufacturer's standard warranty.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employ workers skilled in production of fabricated vinyl products similar to those required for this project, with a record of successful performance.

#### 1.7 PROJECT CONDITIONS

- A. Weather Limitations; Do not proceed with installation unless existing and forecast weather conditions permit installation of exterior fabrics in compliance with manufacturers' written instructions and warranty requirements.

#### 1.8 WARRANTY

- A. Fabric Manufacturer's Warranty: Manufacturer's standard warranty in which manufacturer and fabricator agree to repair or replace exterior fabric material or workmanship that fails within specified warranty period.

Failures include, but are not limited to, the following:

Deterioration of fabric including seam failure.

- 2. Exterior Fabric Warranty Period: Five years from date of Substantial Completion

- B. Siding Manufacturer's Warranty: Manufacturer's standard warranty in which manufacturer and fabricator agree to repair or replace defective assembly material or workmanship that fails within specified warranty period.

Failures include, but are not limited to, the following:

Deterioration of assembly components.

Warranty Period: Ten years from date of substantial completion.

#### 1.9 REFERENCED SECTIONS

- A. Section 05 15 19 Woven Galvanized Steel Cable

## PART 2 - MATERIALS

### 2.1 MANUFACTURER

- A. Manufacturer: Subject to compliance with requirements, provide exterior fabrics products by Naizil Inc., 12667 Coleraine Drive, Bolton, Ontario, Canada, L7E  
Tel: 1-800-387-2764; Fax: 905-857-4772. Website: [www.naizilcanada.com](http://www.naizilcanada.com)

### 2.2 EXTERIOR FABRICS

Product: Naizil Vinyl PS Cover.

1. Generic Classification: PVC Coated Polyester.
2. Description: High tenacity 1100 Dtex polyester PVC coated fabric, total weight 680 g/m<sup>2</sup>. Self-extinguishing, ROTOFLUO W fluoridised mixed acrylic/resin lacquering.

Weight: 24 ounce/yd<sup>2</sup>.

Width: 98.5 inches.

Color Fade Resistance: UV resistant. Most colors tested up to 1500 hrs in SAE 1960j fadeometer with minimal or no change. Fade resistant to most chemicals.

Durability/Average Lifespan: Five to Ten years, depending upon climate and proper application of fabric.

Mildew Resistance: Fabric will not support growth of mildew. Mildew growing on Foreign matter attached to fabric is easily removed.

Chemical Resistance: Highly resistant to acids, alkalis, and solvents.

9. Water Repellency: Excellent

10. Oil Repellency: AATCC 118-1997 Grade 5.

11. Sewability: Excellent.

12. Heat Sealing: Can be heat sealed using heat source such as radio frequency Bar type welder.

13. Warranty: Ten year limited warranty.
14. Grab Tensile (Warp): 450 lb/in
15. Grab Tensile (Weft): 420 lb/in
16. Strip Tensile (Warp): 260 lb/in
17. Strip Tensile (Weft): 250 lb/in
18. Tongue Tear (Warp): 50lb/in
19. Tongue Tear (Weft): 40lb/in
20. Trapezoid Tear (Warp): 32lb/in
21. Trapezoid Tear (Weft): 30lb/in
22. Cold Resistance: -22F
23. Heat Resistance: 158F
24. CL 2, DIN 4102/B1, M2, SIS 65 00 82, BS 5867  
Part 2: 1980, NFPA 701 1989-Large Scale,  
California Fire Marshall  
Allowance on values: +/- 5%

### 2.3 Fastening Products

1. 5/16"1/2" ID 1-1/2" OD Fender Washers)
2. ID 1 1/2" OD Fender Washers
3. 1/4-IP Thread Steel Nipples
4. 1/4-IP Hex Nuts
5. #4 x 1/2" Pan Head Phillips

## Part 3 - Execution

### 3.1 Preparation

6. Fabric to be delivered by manufacturer fully assembled
7. Manufacturing process to include cutting, heat sealing, and packing for transport to build site
8. Customer's design team to deliver shop drawings to manufacturer

### 3.2 Installers

- i. Sciarc/Caltech Solar Decathlon Team

### 3.3 Special Techniques

- xxi. Taking measurements: provide shop drawings and construction documents to manufacturer for order specification.
- xxii. Aligning fabric cover over photovoltaic mounting pipes
- xxiii. Attaching and securing lower mounting rails to foundation
- xxiv. Fitting exterior vents, window frames and pattern tufts.
- xxv. Attaching and securing window frame mounts to fabric edge seam
- xxvi. Attaching and securing cable net to tufting pattern. See section 05 15 19 for instructions and specifications

**End of section**

Division 21 – Fire Suppression

SECTION 21 06 10 – Schedules for Water Based Fire Suppression

Mark	Description	MFR	Model	Notes	Manual Section
SW-1	Pipe for sprinkler system	Uponor	F1040750	¾"	21 13 13
SW-1	Pipe for sprinkler system	Uponor	F1041000	1"	21 13 13
S-1	Sprinkler head	Uponor	Q74900WH	Kitchen Sprinkler	21 13 13
S-2	Sprinkler head	Uponor	Q74900WH	Bed Room	21 13 13
S-3	Sprinkler head	Uponor	Q74900WH	Laundry Room	21 13 13
S-4	Sprinkler head	Uponor	Q74400WH	Office Space	21 13 13
S-5	Sprinkler head	Uponor	Q74400WH	Living Area	21 13 13
S-6	Sprinkler head	Uponor	Q74400WH	Living Area	21 13 13
S-7	Sprinkler head	Uponor	Q74400WH	Living Area	21 13 13
SF-1	Sprinkler fittings	Uponor	LF7707575		21 13 13
SF-2	Sprinkler fittings	Uponor	LF7701010		21 13 13
MB-1	Mounting bracket	Uponor	A7750700		21 13 13

## SECTION 21 13 13 – Wet Pipe Sprinkler Systems

### Part 1 – GENERAL

#### 1.1 Summary

- A. Section includes:
1. Sprinkler heads
  2. Pipe for sprinkler system
  3. Sprinkler Fittings

#### 1.2 Section Requirements

- A. Submittals
1. Product Data

### Part 2 – PRODUCTS

#### A. Sprinkler

##### 1. Horizontal Sidewall Sprinkler

- a. Product Requirements
  - i. NSF and UL Approved for combined plumbing and fire sprinkler systems
- b. Product Specifications
  - i. Item Number: Q74900WH
  - ii. F1/Res 44 (155°F)
- c. Manufacturer Information and Product Link
  - i. Manufacturer: Uponor
  - ii. Link:  
[http://www.uponor.ca/~media/Files/Technical%20Documents/2009%20Catalog/CA\\_UponorCatalog\\_4%206%2009\\_FS.aspx?sc\\_lang=en-CA](http://www.uponor.ca/~media/Files/Technical%20Documents/2009%20Catalog/CA_UponorCatalog_4%206%2009_FS.aspx?sc_lang=en-CA)
  - iii. Price: \$30.00

##### 2. Pendent Sprinkler

- a. Product Requirements
  - i. NSF and UL Approved for combined plumbing and fire sprinkler systems
- b. Product Specifications
  - i. Item Number: Q74400WH
  - ii. F1/Res 44 (155°F)
- c. Manufacturer Information and Product Link
  - i. Manufacturer: Uponor
  - ii. Link:  
[http://www.uponor.ca/~media/Files/Technical%20Documents/2009%20Catalog/CA\\_UponorCatalog\\_4%206%2009\\_FS.aspx?sc\\_lang=en-CA](http://www.uponor.ca/~media/Files/Technical%20Documents/2009%20Catalog/CA_UponorCatalog_4%206%2009_FS.aspx?sc_lang=en-CA)
  - iii. Price: \$30.00

#### B. Pipe for sprinkler system

##### 1. AQUAPEX White

- a. Product Requirements
  - i. Follows IPC, UPC, NSP, IMC, UMC, and NSPC codes
  - ii. Standards met: DIN4726, ASTM F877, NSF
- b. Product Specifications
  - i. Item Number F1040750
  - ii. PEX Size 3/4"
  - iii. Length 100'

- iv. Maximum Pressure 160 psi
        - v. Temperature 200°F
        - vi. Price \$112.20
      - 1. Quote: Uponor
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Uponor
      - ii. Link:  
[http://www.uponor.ca/~media/Files/Technical%20Documents/2009%20Catalog/CA\\_UponorCatalog\\_4%206%2009.aspx?sc\\_lang=en-CA](http://www.uponor.ca/~media/Files/Technical%20Documents/2009%20Catalog/CA_UponorCatalog_4%206%2009.aspx?sc_lang=en-CA)
  - 1. AQUAPEX White
    - a. Product Requirements
      - i. Follows IPC, UPC, NSP, IMC, UMC, and NSPC codes
      - ii. Standards met: DIN4726, ASTM F877, NSF
    - b. Product Specifications
      - i. Item Number F1041000
      - ii. PEX Size 1"
      - iii. Length 100'
      - iv. Maximum Pressure 160 psi
      - v. Temperature 200°F
      - vi. Price \$196.30
    - 1. Quote: Uponor
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Uponor
      - ii. Link:  
[http://www.uponor.ca/~media/Files/Technical%20Documents/2009%20Catalog/CA\\_UponorCatalog\\_4%206%2009.aspx?sc\\_lang=en-CA](http://www.uponor.ca/~media/Files/Technical%20Documents/2009%20Catalog/CA_UponorCatalog_4%206%2009.aspx?sc_lang=en-CA)
- C. Fittings for sprinkler system
  - 1. PROPEX Ring
    - a. Product Specifications
      - i. Item Number Q4681000
      - ii. Ring Size 1", 3/4"
      - iii. Price \$0.36, \$0.63
    - 1. Quote: Uponor
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Uponor
      - ii. Link:  
[http://www.uponor-usa.com/~media/Files/Technical%20Documents/2009%20Catalog/US\\_UponorCatalog\\_4%206%2009\\_FS.aspx?sc\\_lang=en](http://www.uponor-usa.com/~media/Files/Technical%20Documents/2009%20Catalog/US_UponorCatalog_4%206%2009_FS.aspx?sc_lang=en)
  - 2. PROPEX Fire Sprinkler Adapter Tee
    - a. Product Requirements
      - i. NSF and UL Approved for combined plumbing and fire sprinkler systems
    - b. Product Specifications
      - i. Item Number LF7701010
      - ii. Size 1" PEX x 1" PEX x 1/2" FNPT
      - iii. Price \$39
    - 1. Quote: Uponor
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Uponor
      - ii. Link:

[http://www.uponor.ca/~media/Files/Technical Documents/Specifications and Submittals/Plumbing/propex fittings/LF7701010\\_LF7707575\\_ProPEX LF SP Adapter Tee\\_11.20.09.aspx?sc\\_lang=en-CA](http://www.uponor.ca/~media/Files/Technical Documents/Specifications and Submittals/Plumbing/propex fittings/LF7701010_LF7707575_ProPEX LF SP Adapter Tee_11.20.09.aspx?sc_lang=en-CA)

3. PROPEX Fire Sprinkler Adapter Tee

a. Product Requirements

- i. NSF and UL Approved for combined plumbing and fire sprinkler systems

b. Product Specifications

- i. Item Number LF7707575  
ii. Size 3/4" PEX x 3/4" PEX x 1/2" FNPT  
iii. Price \$36

1. Quote: Uponor

b. Manufacturer Information and Product Link

- i. Manufacturer: Uponor  
ii. Link:

[http://www.uponor.ca/~media/Files/Technical Documents/Specifications and Submittals/Plumbing/propex fittings/LF7701010\\_LF7707575\\_ProPEX LF SP Adapter Tee\\_11.20.09.aspx?sc\\_lang=en-CA](http://www.uponor.ca/~media/Files/Technical Documents/Specifications and Submittals/Plumbing/propex fittings/LF7701010_LF7707575_ProPEX LF SP Adapter Tee_11.20.09.aspx?sc_lang=en-CA)

4. PROPEX Fire Sprinkler Mounting Bracket

a. Product Specifications

- i. Item Number A7750700  
ii. Size 3/4" and 1"  
iii. Price \$8

1. Quote: Uponor

b. Manufacturer Information and Product Link

- i. Manufacturer: Uponor  
ii. Link:

[http://www.uponor.ca/~media/Files/Technical Documents/Specifications and Submittals/Plumbing/propex fittings/LF7701010\\_LF7707575\\_ProPEX LF SP Adapter Tee\\_11.20.09.aspx?sc\\_lang=en-CA](http://www.uponor.ca/~media/Files/Technical Documents/Specifications and Submittals/Plumbing/propex fittings/LF7701010_LF7707575_ProPEX LF SP Adapter Tee_11.20.09.aspx?sc_lang=en-CA)

**PART 3 – EXECUTION**

**3.1 Installation of Sprinkler System**

- A. Do not store where ambient temperature increases 100°F  
B. Assembly requires recessed sprinkler wrench

**3.2 Installation of Pipes and Fittings**

- A. Follow manufacturer's installation instructions

**END OF SECTION**

Division 22 – Plumbing

SECTION 22 06 10 – Schedules for Plumbing Piping and Pumps

Mark	Description	MFR	Model	Notes	Manual Section
PI-1	Piping Insulation	K-Flex USA	6RXL048058	fits 5/8" OD pipe	22 07 19
PI-2	Piping Insulation	K-Flex USA	6RXL048078	fits 7/8" OD pipe	22 07 19
PX-1	1/2" white PEX	Uponor	F1040500		22 11 16
PX-2	3/4" white PEX	Uponor	F1040750		22 11 16
PX-3	1/2" red PEX	Uponor	F2040500		22 11 16
PX-4	3/4" white PEX	Uponor	F2040750		22 11 16
P-1	Centrifugal Pump	Grundfos	MQ3-45	Water Supply	22 11 23
P-2	Circulator Pump	Grundfos	59896832		22 11 23
SMP-1	Sump Pump/Tank	Little Giant	505055		22 14 29

SECTION 22 06 12 – Schedules for Facility Potable Water Storage

Mark	Description	MFR	Model	Notes	Manual Section
PT-1	Water Supply tank	Ace	A-VT0625-64		22 12 23
PT-2	Wastewater tank	Ace	A-VT0625-64		22 13 53

SECTION 22 06 30 – Schedules for Plumbing Equipment

Mark	Description	MFR	Model	Notes	Manual Section
PE-1	Heat Pump Retrofit	AirGenerate	A7		22 33 30
E-2	Domestic Water Heater	Rheem	RHES PRO 40-2		22 33 30

SECTION 22 06 40 – Schedules for Plumbing Fixtures

Mark	Description	MFR	Model	Notes	Manual Section
PF-1	Toilet	Caroma	609151AW/ABI		22 41 13
PF-3	Lavatory basin	Kohler	K-2388		22 41 16
PF-4	Lavatory faucet	Chicago	293-XKRCF		22 41 39
PF-5	Kitchen sink faucet	Chicago	445-DJ13E1CP		22 41 39
PF-6	Kitchen sink basin	Custom			22 41 16
PF-7	Shower head	Chicago	151-CP		22 41 39
PF-8	Scalding prevention valve	Kohler	K-304-UX		22 41 39
PF-10	Bath drain	Oatey	42150		22 13 19
PF-11	Bath Tub	Custom			22 41 19
PF-12	Tub Spout	Chicago	293-XKRCF		22 41 39
PF-13	Shower Spout	Chicago	629-LESSSPTCP		22 41 39
PF-14	Kitchen Drain	Sioux Chief	821-2APK		22 13 19
PF-15	Bath Overflow Drain	Westbrass	WB79220CP		22 13 19
AAV-1	Air admittance valve	Studor	MINI-VENT		22 13 19

**END OF SECTION**

## Section 22 07 19 – Plumbing Piping Installation

### Part 1 – GENERAL

- A. Comply with NSF 14 for plastic, potable domestic water piping and components.
- B. Comply with NSF 61 for potable domestic water piping and components.

### Part 2- PRODUCTS

#### A. 5/8" Pipe (O.D.) x 1/2" Wall Insul-Lock Pipe Insulation, 6'

##### 1. Product Requirements

- |                                   |                |
|-----------------------------------|----------------|
| a. Chemical/ Solvent Resistance   | Good           |
| b. Mildew Resistance/ Air Erosion | Pass           |
| c. Ozone Resistance               | Pass           |
| d. Water Absorption               | <20% by volume |

##### 2. Product Specifications

- |                          |               |
|--------------------------|---------------|
| a. Pipe Size             | 5/8"          |
| b. Wall Thickness        | 1/2"          |
| c. R-Value               | 3.2           |
| d. Color                 | black         |
| e. Operation Temperature | -70 F - 200 F |

##### 3. Manufacturer Information

- a. Manufacturer: K-Flex USA
- b. Price: \$6.47

[http://www.pexsupply.com/K-Flex-6RXL048058-5-8-Pipe-OD-x-1-2-Wall-Insul-Lock-Pipe-](http://www.pexsupply.com/K-Flex-6RXL048058-5-8-Pipe-OD-x-1-2-Wall-Insul-Lock-Pipe-Insulation-6)

#### Insulation-6

- c. SKU: 6RXL048058

#### B. 7/8" Pipe (O.D.) x 1/2" Wall Insul-Lock Pipe Insulation, 6'

##### 1. Product Requirements

- |                                   |                |
|-----------------------------------|----------------|
| a. Chemical/ Solvent Resistance   | Good           |
| b. Mildew Resistance/ Air Erosion | Pass           |
| c. Ozone Resistance               | Pass           |
| d. Water Absorption               | <20% by volume |

##### 2. Product Specifications

- |                          |               |
|--------------------------|---------------|
| a. Pipe Size             | 7/8"          |
| b. Wall Thickness        | 1/2"          |
| c. R-Value               | 3.1           |
| d. Color                 | black         |
| e. Operation Temperature | -70 F - 200 F |

##### 3. Manufacturer Information

- a. Manufacturer: K-Flex USA
- b. Price: \$6.99

[http://www.pexsupply.com/K-Flex-6RXL048078-7-8-Pipe-OD-x-1-2-Wall-](http://www.pexsupply.com/K-Flex-6RXL048078-7-8-Pipe-OD-x-1-2-Wall-Insul-Lock-Pipe-Insulation-6)

#### Insul-Lock-Pipe-Insulation-6

- c. SKU: 6RXL048078

### Part 3 – EXECUTION

#### 3.1. Installation

- A. Install pipe insulation in accordance with manufacturer's directions

## SECTION 22 11 16 – DOMESTIC WATER PIPING

### Part 1 – General

#### 1.1 Summary

##### A. Section Includes

1. Domestic Water Piping

#### 1.2 Related Sections

- A. Section 22 11 13 - Domestic Water Packaged Booster Pumps
- B. Section 22 33 30 - Residential Small-Capacity Electric Domestic Water Heaters
- C. Section 22 40 00 - Plumbing Fixtures

#### 1.3 Section Requirements

##### A. Submittals

1. Product Data
2. Manufacturer Data

### Part 2 – Products

#### 2.1 Hydronic Piping

##### A. Crosslinked PE Tubing

1. 1/2" AQUAPEX Red - (100 ft. coil)

##### a. Product Requirements

##### i. Meets Standards:

1. DIN4726
2. ASTM F877
3. NSF

##### 1. Product Specifications

##### a. Dimensions

1. Outside diameter 0.625 in.
2. Inside diameter 0.475 in.
3. PEX Size ½ in.

##### b. Mechanical Data

1. Max. pressure 160 psi
2. Max. temp. 200°F

##### c. Fitting System

1. Crimp/Clamp HydroPEX
2. Expander ProPEX
3. PEX Compression Press Viega
4. Push Fit Sharkbite

##### d. Misc. Data

1. Material PEX
2. Grade PEX-a
3. Color red
4. Tubing Type Non-Oxygen Barrier

##### 3. Manufacturer Information

- Manufacturer: Uponor (Wirsbo)

- Price:\$32.55  
<http://www.pexsupply.com/Wirsbo-Uponor-F2040500-1-2-AQUAPEX-Red-100-ft-coil-2184000-p>
  - SKU: F2040500
2. 1/2" AQUAPEX White - (100 ft. coil)
1. Product Requirements
    - a. meets NSF requirements
    - b. meets DIN 4726
    - c. meets ASTM F877
  2. Product Specifications
    - a. Dimensions
 

1. Size	½ in.
2. Outside diameter	0.625 in.
3. Inside diameter	0.475 in.
4. PEX Size	½ in.
    - b. Mechanical Data
 

1. Max. pressure	160 psi
2. Max. temp.	200°F
    - c. Fitting System
 

1. Crimp/Clamp	HydroPEX
2. Expander	ProPEX
3. PEX Compression Press	Viega
4. Push Fit	Sharkbite
    - d. Misc. Data
 

1. Material	PEX
2. Grade	PEX-a
3. Color	blue
4. Tubing Type	Non-Oxygen Barrier
  3. Manufacturer Information
    - i. Manufacturer: Uponor (Wirsbo)
    - ii. Price: \$32.55 <http://www.pexsupply.com/Wirsbo-Uponor-F1040500-1-2-AQUAPEX-100-ft-coil-2173000-p>
    - iii. SKU: F3040500
3. 3/4" AQUAPEX Red - (100 ft. coil)
- a. Product Requirements
    - a. meets NSF requirements
    - b. meets DIN 4726
    - c. meets ASTM F877
  - b. Product Specifications
    - i. Dimensions
 

1. Size	¾ in.
2. Outside diameter	0.875 in.
3. Inside diameter	0.671 in.
4. PEX Size	¾ in.
    - d. Mechanical Data
 

1. Max. pressure	160 psi
2. Max. temp.	200°F
    - e. Fitting System
 

1. Crimp/Clamp	HydroPEX
2. Expander	ProPEX

- |     |                                                                                                                                                                                           |                    |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 3.  | PEX Compression Press                                                                                                                                                                     | Viega              |
| 4.  | Push Fit                                                                                                                                                                                  | Sharkbite          |
| f.  | Misc. Data                                                                                                                                                                                |                    |
| 1.  | Material                                                                                                                                                                                  | PEX                |
| 2.  | Grade                                                                                                                                                                                     | PEX-a              |
| 3.  | Color                                                                                                                                                                                     | red                |
| 4.  | Tubing Type                                                                                                                                                                               | Non-Oxygen Barrier |
| c.  | Manufacturer Information                                                                                                                                                                  |                    |
| i.  | Manufacturer Information: Uponor (Wirsbo)                                                                                                                                                 |                    |
| ii. | Price: \$55.95                                                                                                                                                                            |                    |
|     | <a href="http://www.pexsupply.com/Wirsbo-Uponor-F2040750-3-4-AQUAPEX-Red-100-ft-coil-2185000-p">http://www.pexsupply.com/Wirsbo-Uponor-F2040750-3-4-AQUAPEX-Red-100-ft-coil-2185000-p</a> |                    |
| ii. | SKU: F2040750                                                                                                                                                                             |                    |
- 4. 3/4" AQUAPEX White - (100 ft. coil)**
- a. Product Requirements
- a. meets NSF requirements
  - b. meets DIN 4726
  - c. meets ASTM F877
- b. Product Specifications
- i. Dimensions
 

1.	Size	¾ in.
2.	Outside diameter	0.875 in.
3.	Inside diameter	0.671 in.
4.	PEX Size	¾ in.
  - ii. Mechanical Data
 

5.	Max. pressure	160 psi
6.	Max. temp.	200°F
  - iii. Fitting System
 

7.	Crimp/Clamp	HydroPEX
8.	Expander	ProPEX
9.	PEX Compression Press	Viega
10.	Push Fit	Sharkbite
  - iv. Misc. Data
 

11.	Material	PEX
12.	Grade	PEX-a
13.	Color	blue
14.	Tubing Type	Non-Oxygen Barrier
- c. Manufacturer Information
- i. Manufacturer Information: Uponor (Wirsbo)
  - ii. Price: \$55.95 <http://www.pexsupply.com/Wirsbo-Uponor-F1040750-3-4-AQUAPEX-100-ft-coil-2174000-p>
  - iii. SKU: F3040750
- 5. ProPEX fittings**
- a. Product Requirements
    - i. Complies with the CA Plumbing Code 2010
    - ii. Complies with the CA Mechanical Code 2010
    - iii. Complies with the International Plumbing Code 2009
    - iv. Complies with the International Residential Code 2009
  - b. Potable water distribution system shall use appropriate approved ProPEX fittings to supply water to all plumbing fixtures and equipment.

**END OF SECTION**

## SECTION 22 11 23 – Domestic Water Packaged Booster Pumps

### Part 1 – GENERAL

#### 1.1 Summary

##### A. Section includes:

1. Booster pump for the entire water distribution system

#### 1.2 Related Sections

1. 223330.13 – Residential Small-Capacity Electric Domestic Water Heaters

#### 1.3 Section Requirements

##### A. Submittals

1. Product Data

### Part 2 – PRODUCTS

#### A. Domestic Water booster pump

1. Grundfos MQ3-45 Flow based pressure boosting system

##### a. Product Requirements

- i. UL listed

##### b. Product Specifications

- i. System pressure Max 109 psi
- ii. Inlet pressure Max 44 psi
- iii. Suction lift Max 26 ft (8m)
- iv. Liquid Temperature 32 F to 95 F
- v. Main Voltage 1x220-240V, 60Hz
- vi. Voltage tolerances: -10% / +6%
- vii. Sound pressure level <55dB
- viii. Flow rate at 75 feet head 4 GPM
- ix. Price: \$475 ([http://www.freshwatersystems.com/p-4439-grundfos-mq3-45-230v-1-hp-pressure-booster-pump-96860207.aspx?affiliateid=10050&qid=0&utm\\_source=Googlebase&utm\\_medium=Feed&utm\\_campaign=Product&utm\\_term=MQ3-45-2](http://www.freshwatersystems.com/p-4439-grundfos-mq3-45-230v-1-hp-pressure-booster-pump-96860207.aspx?affiliateid=10050&qid=0&utm_source=Googlebase&utm_medium=Feed&utm_campaign=Product&utm_term=MQ3-45-2))

##### c. Manufacturer Information and Product Link

- i. Manufacturer: Grundfos
- ii. Link: <http://noteswww.grundfos.com/web/HOMEus.NSF/Webopslag/PAVA-5CHJE7>

### Part 3 – EXECUTION

#### 3.1 Installation

- ##### A. Follow manufacturer's installation instructions

### END OF SECTION

## SECTION 22 12 23 – Facility Plastic, Indoor Potable-Water Storage

### Part 1 – General

#### 1.1 Summary

- A. Section Includes:
  1. 625 gallon potable water storage tank

#### 1.2 Related Sections

- A. Section 22 13 53 - Facility Septic Tanks

#### 1.3 Section Requirements

- A. Submittals
  1. Product Data

### Part 2 – Products

#### 2.1 Products

- A. Elliptical Storage Tank
  1. Product specifications
    - a. capacity: 625 gallons
    - b. medium-density polyethylene plastic
    - c. UV stabilizers
    - d. translucent for water level viewing
    - e. contains liquids with specific gravity up to 1.7
    - f. 64" diameter x 50" height
    - g. 8" manway and 2" drain fitting
  2. Manufacturer Information and Product Link
    - a. Ace
    - b. part # A-VT0625-64
    - c. Price: \$350.99 (<http://www.plastic-mart.com/item.aspx?id=737>)
    - d. Drawing: [http://www.plastic-mart.com/tech\\_drawings/ace/VT0625-64.pdf](http://www.plastic-mart.com/tech_drawings/ace/VT0625-64.pdf)

### Part 3 – Execution

#### 3.1 Installation

- A. Install according to manufacturer instructions.
- B. Leave at least 12 in of easily accessible clearance above the opening for water delivery and removal.
- C. Tanks must be completely shaded from the sun.
- D. Fill the potable-water storage tank with 735 gallon of water on site.

END OF SECTION

## SECTION 22 13 16 – SANITARY WASTE AND VENT PIPING

### Part 1 – GENERAL

#### 1.1 Section Requirements

- A. Minimum Pressure Requirement for Soil, Waste, and Vent: 30 kPa.
- B. Comply with NSF 14, "Plastic Piping Components and Related Materials," for plastic piping components.

### Part 2 – PRODUCTS

#### 2.1 Pipes and fittings:

- A. ABS Plastic DWV Pipe and Fittings: ASTM D 2665, Schedule 40, plain ends with PVC socket-type, DWV pipe fittings.
  - 1. NIBCO ABS DWV Hub x Slip P-Trap 1-1/2". Model #: C5893
    - a. Maximum working pressure: 5psi.
  - 2. ABS DWV Hub x Hub x Hub Sanitary Tee.
    - a. NIBCO 1-1/2" Model # C5811
    - b. MUELLER STREAMLINE 3" x 3" x 1-1/2" Model # 02764H
  - 3. ABS DWV Pipe:
    - a. Charlotte Pipe Foam Core Schedule 40 Pipe. 1-1/2", 3"
      - i. For use in non-pressurized systems.
      - ii. Not to exceed 160 oF.
  - 4. <http://www.homedepot.com/>

### Part 3 – EXECUTION

#### 3.1 Installation

- A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.
- B. Install wall or floor penetration system at each pipe penetration through foundation wall or floor. Make installation watertight.
- C. 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. 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. Do not reduce size of piping in the direction of flow.
- D. 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 DN 80 and smaller; 1 percent downward in direction of flow for piping 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.
- E. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- F. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- G. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

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

**3.2 Pipe Schedule:**

- A. ABS plastic, DWV pipe and fittings with solvent-cemented joints.

**END OF SECTION**

## SECTION 22 13 19 – SANITARY WASTE PIPING SPECIALTIES

### Part 1 – GENERAL

#### 1.1 Summary

- A. Section Includes:
1. Kitchen Floor Drain
  2. Bath Floor Drain
  3. Bath Overflow Drain
  4. Air admittance valve

#### 1.2 Related Sections:

- A. 22 41 00 Plumbing Fixtures

#### 1.3 Section Requirements

- A. Submittals
1. Product Data

### Part 2 – PRODUCTS

#### 2.1 Drains:

- A. Kitchen Floor Drain
1. Product Requirements:
    - a. Compatible with ABS piping
  2. Product Specifications:

a. Item number	821-2APK
b. Material	ABS, stainless steel
c. Weight	1.2 lbs
d. Connection	hub
e. Height	3.75"
f. Width	6.75"
g. Fitting Size	2"
h. Price	\$9.89

Quote: Home Depot
  3. Manufacturer Information and product link:
    - a. Manufacturer: Sioux Chief
    - b. Product link:  
[http://www.homedepot.com/h\\_d1/N-5yc1v/R-202313070/h\\_d2/ProductDisplay?langId=-1&storeId=10051&catalogId=10053](http://www.homedepot.com/h_d1/N-5yc1v/R-202313070/h_d2/ProductDisplay?langId=-1&storeId=10051&catalogId=10053)
- B. Bath Drain:
1. Product Specifications:

a. Item Number	42150
b. Material	Brass, stainless steel
c. Weight	0.101 lbs
d. Fitting size	3"
e. Width	4.25"
f. Price	\$19.96

Quote: Home Depot
  2. Manufacturer Information and product link:
    - a. Manufacturer: Oatey
    - b. Product link:  
<http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?langId=-1&storeId=10051&catalogId=10053&productId=100092829&R=100092829>
- C. Trip Lever Tubular Bath Waste and Overflow Assembly:
1. Product Specifications:

- a. Product Number                      WB79220CP
- b. Material                                Brass, polished chrome
- c. Weight                                 5 lbs
- d. Tubes                                 1.5" OD, 20 gauge brass
- e. Price                                  \$38.48

Quote: Home Depot

2. Manufacturer Information and product link:

- a. Manufacturer: Westbrass
- b. Product Link:  
<http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?langId=1&storeId=10051&catalogId=10053&productId=202551032&R=202551032>

## 2.2 Air Admittance Valve

### A. Studor Mini-Vent Air-Admittance Valve

1. Product Requirements:

- a. Materials:
  - i. Polystyrene
  - ii. ABS valve with elastometric membrane
  - iii. ABS or PVC Adaptor
- b. Performance Standards:
  - i. ASSE 1051 single fixture and branch type AAVs
  - ii. ASSE 1050 Stack Type AAVs
  - iii. NSF Standard 14 (plastic components)
- c. Code Approvals:
  - i. International Plumbing Code
  - ii. Southern Building Code Council International
  - iii. Building Official Code Administration
  - iv. International Residential Code
  - v. Uniform Plumbing Code Section 301.2 Alternative Methods
- d. Listings:
  - i. ASSE Seal of approval
  - ii. National Evaluation Services (NES-592)
  - iii. NSF International (NSF Standard 14)
  - iv. NSF International (ASSE Performance Standard 1051 and ASSE 1050)
  - v. IAMPO Classified Marking, file No. C-3803
  - vi. Warnock Hersey ( ITS – Intertek Testing Services)

2. Product Specifications:

- a. Model:                                 MINI-VENT
- b. Item Number:                        20300
- c. Connection Size:                    1 1/2" – 2"
- d. Price:                                 \$31.80

Quote: List Price

3. Manufacturer and Product link:

- a. Manufacturer: Studor
- b. Product Link:  
<http://www.studor.com/mini-vent.htm>

## Part 3 – EXECUTION

### 3.1 Installation

- A. Install according to manufacturers instructions.

## SECTION 22 13 53 – Facility Septic Tanks

### Part 1 – General

#### 1.1 Summary

- A. Section Includes:
1. 625 gallon Wastewater tank
  2. 93 gallon rainwater tank

#### 1.2 Related Sections

- A. Section 22 12 19 - Facility Ground-Mounted, Potable-Water Storage Tanks

#### 1.3 Section Requirements

- A. Submittals
1. Product Data

### Part 2 – Products

#### 2.1 Products

- A. Elliptical Storage Tank
1. Product specifications
    - i. capacity: 625 gallons
    - ii. medium-density polyethylene plastic
    - iii. UV stabilizers
    - iv. translucent for water level viewing
    - v. contains liquids with specific gravity up to 1.7
    - vi. 64" dia x 50" height
    - vii. 8" manway and 2" drain fitting
  2. Manufacturer Information and Product Link
    - a. Price: \$340.99 (<http://www.plastic-mart.com/item.aspx?id=737>)
    - b. Ace
    - c. part # A-VT0625-64
    - d. Drawings: [http://www.plastic-mart.com/tech\\_drawings/ace/VT0625-64.pdf](http://www.plastic-mart.com/tech_drawings/ace/VT0625-64.pdf)
- B. Rainwater Storage Tank
1. Product specifications
    - i. capacity: 93 gallons
    - ii. medium-density polyethylene plastic
    - iii. UV stabilizers
    - iv. translucent for water level viewing
    - v. contains liquids with specific gravity up to 1.7
    - vi. 72" x 42" x 8"
  2. Manufacturer Information and Product Link
    - a. Price: \$299.99 (<http://www.plastic-mart.com/item.aspx?id=2504>)
    - b. Ronco Tanks
    - c. Part # DF93
    - d. Drawings: [http://www.plastic-mart.com/tech\\_drawings/NEW\\_RECT.PDF](http://www.plastic-mart.com/tech_drawings/NEW_RECT.PDF)

### Part 3 – Execution

#### 3.1 Installation

- A. Install according to manufacturer instructions.
- B. Leave at least 12 in of easily accessible clearance above the opening for water removal.
- C. Tanks must be completely shaded from the sun.

END OF SECTION



## SECTION 22 14 29 – Sump Pumps

### Part 1 – General

#### Part 1.1 Summary

- A. Section Includes
  - 1. Sump pump/ tank
  - 2. Discharge hose

#### Part 1.2 Related Sections

- A. Section 22 13 53 - Facility Septic Tank

#### Part 1.3 Section Requirements

- A. Submittals
  - 1. Product Data

### Part 2 – Products

#### Part 2.1 Products

- A. Sump pump with holding tank
  - 1. Product specifications
    - i. Horse Power: 1/6 HP
    - ii. 5 gallon holding tank
    - iii. 15.6" Height x 14.5" Width x 14.5" Length
    - iv. 1 – ½" x 24' FNPT Fittings
  - 2. Manufacturer Information and Product Link
    - i. Price: \$198.95 (<http://tinyurl.com/3tuygmg>)
    - ii. Little Giant
    - iii. Part # 505055
    - iv. Product Specifications: <http://tinyurl.com/43mffbf>
- B. Discharge hose
  - 1. Product specifications
    - i. 1-1/2" diameter x 24' length
  - 2. Manufacturer Information and Product Link
    - i. Price: \$13.75
    - ii. Little Giant
    - iii. Part # 599302

**END OF SECTION**

## SECTION 22 33 30 – Residential Small-Capacity Electric Domestic Water Heaters

### Part 1 – GENERAL

#### 1.1 Summary

##### A. Section Includes:

1. Electric Resistive Domestic Water Heater
2. Heat Pump Retrofit Domestic Water Heater

#### 1.2 Section Requirements

##### A. Submittals

- A. Product Data Sheet

### Part 2 – PRODUCTS

#### 2.1 Domestic Water Heater

##### A. Electric Resistive Domestic Water Heater

- a. Product Requirements
- b. Product Specifications

i. Item: Electric Water Heater with Tank

ii. Model Number: RHES PRO 40-2

iii. Size: 38 gallons capacity

iv. Dimensions:

1. Tank height: 31.5"
2. Height to water conn.: 31.5"
3. Diameter: 23"
4. Approximate Weight (Lbs.): 108

v. Performance Standards

1. First hour rating G.P.H.: 46
2. Energy Factor: 0.92
3. Average annual operation cost: \$508
4. Standard 240 volt AC
5. Single phase non-simultaneous
6. 4500 watt upper and lower heating elements.

vi. Price: \$787.16

1. Quote: <http://bostonheatingsupply.com/rheemrhespro40-2professionalelectricwaterheater.aspx>

##### c. Manufacturer Information and Product Link

● Manufacturer: Rheem

● Data Sheet: <http://globalimageserver.com/fetchDocument.aspx?id=19c61a1f-b2b3-4f4d-9190-eb5870810671>

##### B. Heat Pump Retrofit Domestic Water Heater

- a. Product Requirements
- b. Product Specifications

i. Item: Retrofit DHW Heat Pump

ii. Model Number: A7

iii. Dimensions:

1. Length: 18"
2. Depth: 14"
3. Height: 14"

4. Approximate Weight (Lbs.): 48
- iv. Performance Standards
  1. Max water temperature: 130F
  2. Efficiency: 240%
  3. Energy factor: 2.11
  4. First hour rating G.P.H.: 43
  5. Output: 7000 BTUs
  6. 115V 60 Hz single-phase AC
  7. 12A surge, 6A operating current
- v. Price: \$585
  1. Quote: <http://www.upgreenecofriendlyproducts.com/products/AirTap-A7.html>
- c. Manufacturer Information and Product Link
  - i. Manufacturer: AirGenerate
  - ii. Data Sheet: [http://www.airgenerate.com/pdf/AirTap\\_Installationmanual.pdf](http://www.airgenerate.com/pdf/AirTap_Installationmanual.pdf)

### Part 3 - EXECUTION

#### 3.1 Installation

- A. Follow instructions on manufacturer Professional Use and Care Manual
- B. Follow safety precautions on manufacturer Professional Use and Care Manual

END OF SECTION

## SECTION 22 40 00 – PLUMBING FIXTURES

### SECTION 22 41 13 – Residential Water Closets, Urinals, and Bidets

#### Part 1 – GENERAL

##### 1.1 Summary

- i. Section Includes
  - A. The toilet

##### 1.2 Related Sections

##### 1.3 Section Requirements

- A. Submittals: Product Data for each type of plumbing fixture, including trim, fittings, accessories, appliances, appurtenances, equipment, and supports.
- B. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

#### Part 2 – PRODUCTS

##### 2.1 Water Closet

- 1. Sydney Smart™ 305 Round Front Plus
  - A. Product Requirements
    - i. Meets guidelines of the EPA Water Sense
    - ii. Meets HET standards
    - iii. Meets c-UPC (IAPMO listed for USA & Canada)
  - B. Product Specifications
    - i. Features:
      - 1. Vitreous china
      - 2. Round-front plus
      - 3. Two bottom dual flush system
      - 4. High performance outlet valve
      - 5. 12" (30.5 cm) rough-in
      - 6. 1.28/0.8gpf(4.8/3 lpf)
      - 7. Large trapway
      - 8. Free fitting lid
      - 9. Virtually unblockable
    - ii. Technical Information (Fixture):
      - 1. Configuration two-piece, round
      - 2. Water per flush 1.28/0.8gpf(4.8/3 lpf)
      - 3. 27 3/4"L x 14 1/4"W x 31 7/8"H (bowl height = 15")
      - 4. Weight: 93 lbs (42 kg).
    - iii. Included Components:
      - 1. Sydney Smart Tank: 750109
      - 2. Toilet Seat: 326707
    - iv. Color : White
  - C. Manufacturer Information:
    - i. Manufacturer: Coroma
    - ii. Model Number: 609151AW/ABI
    - iii. Link:

- iv. [http://www.caromasa.com/products/index/cu\\_products71.php](http://www.caromasa.com/products/index/cu_products71.php)  
Price: \$378.70

### **Part 3 – EXECUTION**

#### **3.1 Installation**

- A. Follow manufacturer's installation instructions
- B. ADA, CSA B651, OBC compliant when installed to the specific requirements of these regulations.

**END OF SECTION**

## SECTION 22 41 16 – RESIDENTIAL LAVATORIES AND SINKS

### Part 1 – GENERAL

#### 1.1 Summary

- A. Section Includes
  - 1. Lavatory basin
  - 2. Kitchen sink

#### 1.2 Related Sections

- A. Section 22 41 39 - Residential Faucets, Supplies, and Trim

#### 1.3 Section Requirements

- A. Submittals: Product Data for each type of plumbing fixture, including trim, fittings, accessories, appliances, appurtenances, equipment, and supports.
- B. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

### Part 2 – PRODUCTS

- A. Lavatory Basin.
  - 1. Product Requirements
    - a. Codes/Standards Applicable
      - i. ADA
      - ii. ICC/ANSI A117.1
      - iii. CSA B651
      - iv. OBC
      - v. ASME A112.19.1/CSA B45.2
  - 2. Product Specifications:
    - a. Item: Kohler Inscribe® 16-1/2" cast iron Wading Pool® lavatory
    - b. Model: K-2388
    - c. Features
      - i. Constructed of KOHLER® Cast Iron
      - ii. No faucet holes
      - iii. Above-Counter installation
      - iv. Color: Sea-Salt
    - d. Dimensions
      - i. Length: 16-1/2"
      - ii. Width: 16-1/2"
      - iii. Depth: 6-1/2"
      - iv. Water Depth: 4-9/16"
      - v. Drain Diameter: 1-3/4"
  - 3. Manufacturer Information and Product Link:
    - a. Manufacturer: Kohler
    - b. Price: \$ 280.70
    - c. Quote:
      - <http://www.us.kohler.com/onlinecatalog/detail.jsp?item=13497302&section=2&category=16&retail=false>
    - d. Data Sheet: [http://www.us.kohler.com/onlinecatalog/pdf/1091071\\_4.pdf](http://www.us.kohler.com/onlinecatalog/pdf/1091071_4.pdf)

- B. Kitchen Sink.**
  - 1. Product Specifications
    - a. Custom made
    - b. Stainless steel

### **Part 3 – EXECUTION**

#### **3.1 Installation**

- A. Follow manufacturer's installation instructions
- B. Will comply with ADA when installed per Section 606 Lavatories of the Act.
- C. Will comply with CSA B651 when installed per Clause 4.3.3 of the standard.
- D. Will comply with OBC when installed per Clause 3.8.3.11.

**END OF SECTION**

## SECTION 22 41 19 – RESIDENTIAL BATHTUBS

### Part 1 – GENERAL

#### 1.1 Summary

- A. Section Includes
  - 1. Bathtub

#### 1.2 Related Sections

- A. Section 22 13 19 – Sanitary Waste Piping Specialties
- B. Section 22 41 39 – Residential Faucets, Supplies and Trims

### Part 2 – PRODUCTS

- A. Bathtub
  - 1. Product Specifications
    - a. Custom made
    - b. Stainless steel
    - c. Two-person soaker
    - d. Built into floor pan

### Part 3 – EXECUTION

#### 3.1 Installation

- A. Installation by contractor.

**END OF SECTION**

## SECTION 22 41 39 - RESIDENTIAL FAUCETS, SUPPLIES AND TRIM

### Part 1 - GENERAL

#### 1.1 Summary

- A. Section Includes
  - 1. Lavatory faucet
  - 2. Kitchen sink faucet
  - 3. Shower head
  - 4. Scalding prevention valve
  - 5. Valve trim for shower
  - 7. Shower spout
  - 8. Tub spout

#### 1.2 Related Sections

- A. Section 22 41 16 - Residential Lavatories and Sinks

#### 1.3 Section Requirements

- A. Submittals: Product Data for each type of plumbing fixture, including trim, fittings, accessories, appliances, appurtenances, equipment, and supports.
- B. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

### Part 2 - PRODUCTS

#### 1. Lavatory Faucet– wall mounted hose bib

Wall mounted inside Sill fitting with Rough Chrome finish

##### A. Product Requirements

- i. CSA B125.1
- ii. Meets ASME A112.18.1M

##### B. Product Specifications

- i. Features:
  - a. Sill Fittings
  - b. 2 ¼ " Tee Handle with tapered square
  - c. Ceramic ¼ Turn Operating Cartridge Cartridge
  - d. 1/2" NPT Female Thread Inlet
  - e. Slip Wall Flange
  - f. mounting hardware included
- ii. Performance Specification
  - a. Rating Operating Pressure: 20-125 PSI
  - b. Rated Operating Temperature: 40-140°F

- C. [http://www.chicagofaucet.com/scripts/pdfs/specification\\_sheet.php?item=293-XKRCF](http://www.chicagofaucet.com/scripts/pdfs/specification_sheet.php?item=293-XKRCF)

##### C. Manufacturer Information:

- i. Manufacturer: Chicago Faucets
- ii. Model Number: 293-XKRCF
- iii. Link: [http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part\\_number=293-XKRCF](http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part_number=293-XKRCF)
- iv. Price: \$67.23

**2. Kitchen sink faucet – hot and cold sink faucet**

Wall mounted – adjustable centers

**A. Product Requirements**

- i. CSA B125.1
- ii. Meets ASME A112.18.1M
- iii. certified to NSF/ANSI 61, section 8 by CSA
- iv. ADA ANSI/ICC A117.1

**B. Product Specifications**

i. Features:

- a. Wall Mounted - Adjustable 4" - 8 3/8" Centers
- b. 3 3/8" Body, Adjustable Arms 3" - 8 3/8"
- c. 13" Swing Double Jointed Spout
- d. Full Flow Outlet
- e. 2 3/8" Lever Handle
- f. Quatern Compression Operating Cartridge
- g. Offset 2 1/2" Offset Inlet Supply Arm
- h. 2 1/2" Offset Adjustable Supply Arms with 1/2" NPT Female Thread Inlet
- i. polished chrome plated solid brass construction
- j. 2 3/8" metal lever handle(s) with eight point tapered broach and secured blue and red buttons
- k. Quatern™ rebuildable compression cartridge, opens and closes 90°, closes with water pressure, features square tapered stem

ii. Performance Specification

- a. Rating Operating Pressure: 20-125 PSI
- b. Rated Operating Temperature: 40-140°F
- c. [http://www.chicagofaucet.com/scripts/pdfs/specification\\_sheet.php?item=445-DJ13E1CP](http://www.chicagofaucet.com/scripts/pdfs/specification_sheet.php?item=445-DJ13E1CP)

**C. Manufacturer Information:**

- i. Manufacturer: Chicago Faucets
- ii. Model Number: 445-DJ13E1CP
- iii. Link: [http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part\\_number=445-DJ13E1CP](http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part_number=445-DJ13E1CP)
- iv. Price: \$383.71

**3. Chicago wall mounted Hand shower fitting**

**A. Product Requirements**

- i. Meets guidelines of the EPA Water Sense
- ii. Meets ASME A112.18.1
  - i. CSA B125.1
  - ii. 1 year warranty

**B. Product Specifications**

i. Features:

- ii. Wall mounted hand shower fitting design
- iii. ½" NPSM female threat inlet
- iv. Hand spray
- v. 60" chrome plated steel hose
- vi. 82" stretch length
- vii. Built in flow control with 2.5 GPM (9.5 L/min) flow rate
- viii. 24" spray adjustable wall bar
- ix. Bar hook with adjustable control knob

- X. Mounting hardware included
  - ii. Color : Chrome plated finish
  - iii. Rated Operating Pressure: 20-125 PSI
  - iv. Rated Operating Temperature: 40-140° F
  - v. <http://www.chicagofaucet.com/CompleteDrawings/pdf/SS151-CP.pdf>
- C. Manufacturer Information:
  - i. Manufacturer: Chicago Faucets
  - ii. Model Number: 151-CP
  - iii. Link: [http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part\\_number=151-CP](http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part_number=151-CP)
  - v. Price: \$267.03
- 4. Kohler Rite-Temp® Valve with Pex-Expansion (Scalding Prevention Valve)
  - A. Product Requirements
    - i. Meets ASSE 1016
    - ii. Meets ASME A112.18.1/CSA B125.1
  - B. Product Specifications
    - i. 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
      - without screwdriver stops – PEX inlets (cold expansion)
    - ii. Technical Information (Fixture):
      - iii. Configuration two-piece, round
      - iv. Flow rate: 1.75 gpm, below the mandated st
      - v. Water per flush 1.28 gpf (4.8 lpf)
      - vi. Passageway 2-1/8" (5.4 cm)
      - vii. Water area 10-1/2" (26.7 cm) x 7-3/4" (19.7 cm)
      - viii. Water depth from rim 5-1/4" (13.3 cm)
      - ix. Seat post hole centers 5-1/2" (14 cm)
    - iii. Included Components:
      - Bowl K-4197
      - Tank K-4467
      - Tank cover 1138565
      - Trip lever K-9379
      - Tank attachment kit 1016548
      - Bolt cap accessory pack 1013092
    - iv. Color : White
    - v. [http://www.us.kohler.com/onlinecatalog/pdf/1110626\\_4.pdf](http://www.us.kohler.com/onlinecatalog/pdf/1110626_4.pdf)
  - C. Manufacturer Information:
    - i. Manufacturer: Kohler
    - ii. Model Number: K-304-UX
    - iii. Price: \$104.80
    - iv. Link:  
[http://www.us.kohler.com/onlinecatalog/detail.jsp?from=thumb&frm=null&module=Valves&item=13951602&prod\\_num=304-UX&section=2&category=12&resultPage=0--527124692](http://www.us.kohler.com/onlinecatalog/detail.jsp?from=thumb&frm=null&module=Valves&item=13951602&prod_num=304-UX&section=2&category=12&resultPage=0--527124692)

**5. Chicago Shower Spout – single inlet remote fitting**

Remote Spouts mounted

**A. Product Requirements**

- i. CSA B125.1
- ii. Meets ASME A112.18.1M

**B. Product Specifications**

- i. Features:
  - a. wall mount
  - b. 1/2" NPT Female Thread Inlet
  - c. polished chrome plated solid brass construction
  - d. mounting hardware included
- ii. Performance Specification

- d.** Rating Operating Pressure: 20-125 PSI
- e.** Rated Operating Temperature: 40-140°F
- f.** [http://www.chicagofaucet.com/scripts/pdfs/specification\\_sheet.php?item=629-LESSSPTCP](http://www.chicagofaucet.com/scripts/pdfs/specification_sheet.php?item=629-LESSSPTCP)

**C. Manufacturer Information:**

- i. Manufacturer: Chicago Faucets
- ii. Model Number: 629-LESSSPTCP
- iii. Link: [http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part\\_number=629-LESSSPTCP](http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part_number=629-LESSSPTCP)
- iv. Price: \$67.82

**6. Chicago Tub Spout – wall mounted hose bib**

Wall mounted inside Sill fitting with Rough Chrome finish

**A. Product Requirements**

- i. CSA B125.1
- ii. Meets ASME A112.18.1M

**B. Product Specifications**

- i. Features:
  - a. Sill Fittings
  - b. 2 ¼ " Tee Handle with tapered square
  - c. Ceramic ¼ Turn Operating Cartridge Cartridge
  - d. 1/2" NPT Female Thread Inlet
  - e. Slip Wall Flange
  - f. mounting hardware included
- ii. Performance Specification

- g.** Rating Operating Pressure: 20-125 PSI
- h.** Rated Operating Temperature: 40-140°F
- i.** [http://www.chicagofaucet.com/scripts/pdfs/specification\\_sheet.php?item=293-XKRCF](http://www.chicagofaucet.com/scripts/pdfs/specification_sheet.php?item=293-XKRCF)

**C. Manufacturer Information:**

- i. Manufacturer: Chicago Faucets
- ii. Model Number: 293-XKRCF
- iii. Link: [http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part\\_number=293-XKRCF](http://www.chicagofaucet.com/catalog/catalog.php?name=OurProducts&part_number=293-XKRCF)
- iv. Price: \$67.23

**Part 3 – EXECUTION**

### **3.1 Installation**

- A.** Follow manufacturer's installation instructions
- B.** Avoid cross-flow conditions. Do not install a shut-off device on either valve outlet.
- C.** Cap the shower outlet if a deck-mount spout, diverter, or handshower is connected to a spout outlet.
- D.** 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. Refer to the installation instructions for proper configuration of the connection between the valve and bath spout.

**END OF SECTION**

Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC)

SECTION 23 06 00 - SCHEDULES FOR HVAC

NAME	TYPE	MAKE	MODEL	MASTER FORMAT CODE
TS-1	TEMPERATURE SENSOR	OMEGA	TC-PVC-K	23 09 13
TS-2	TEMPERATURE SENSOR	OMEGA	TC-PVC-K	23 09 13
TS-3	TEMPERATURE SENSOR	OMEGA	TC-PVC-K	23 09 13
TS-4	TEMPERATURE SENSOR	OMEGA	TC-PVC-K	23 09 13
TS-5	TEMPERATURE SENSOR	OMEGA	TC-PVC-K	23 09 13
TS-6	TEMPERATURE SENSOR	OMEGA	HSTC-TT-K	23 09 13
TS-7	TEMPERATURE SENSOR	OMEGA	HSTC-TT-K	23 09 13
TS-8	TEMPERATURE SENSOR	OMEGA	HSTC-TT-K	23 09 13
TS-9	TEMPERATURE SENSOR	APHNET	USBTENKI-T-RH-SHT	23 09 13
TL-1	THERMOCOUPLE DATA LOGGER	PICO	TC-08	23 09 13
TM-1	COOLING IN-LINE THERMOSTAT	LUX	LV1	23 09 13
TM-2	HEATING IN-LINE THERMOSTAT	LUX	LV3	23 09 13
DM-1	DEHUMIDISTAT	HONEYWELL	H46C1166	23 09 13

SECTION 23 06 20 - HVAC PIPING AND PUMPS

NAME	TYPE	MAKE	MODEL	MASTER FORMAT CODE
WP-1	WATER HYDRONIC PUMP	GRUNDFOS	ALPHA 15-55 F/LC	23 21 23
WP-2	WATER PUMP	GRUNDFOS	ALPHA 15-55 F/LC	23 21 23
FL	FLANGE	MCMMASTER-CARR	4596K159	23 21 13
NR-1	NPT REDUCER	MCMMASTER-CARR	4880K349	23 21 13
NR-2	NPT REDUCER	MCMMASTER-CARR	4880K348	23 21 13
PX-1	PEX WATER PIPING	UPONOR	F2040500	23 21 13
PX-2	PEX WATER PIPING	UPONOR	F2040750	23 21 13
PX-3	PEX WATER PIPING	UPONOR	F1040500	23 21 13
PX-4	PEX WATER PIPING	UPONOR	F1040750	23 21 13
RF-1	REFRIGERANT	HONEYWELL	R-410A	23 23 23
RFL-1	REFRIGERANT LINE SET	GENERIC	LS143850F	23 23 16

SECTION 23 06 30 - HVAC AIR DISTRIBUTION

NAME	TYPE	MAKE	MODEL	MASTER FORMAT CODE
WHF-1	WHOLE-HOUSE FAN	BROAN	L700	23 34 16
EF-1	MECHANICAL ROOM EXHAUST FAN	PANASONIC	FV-10NLF1	23 34 16
EF-2	BATHROOM EXHAUST FAN	PANASONIC	FV-08VKS3	23 34 16
EF-3	RANGE HOOD	GENERAL ELECTRIC	JV930SCBR	11 31 13
ERV	ENERGY RECOVERY VENTILATOR	PANASONIC	FV-04VE1	23 34 23

SECTION 23 06 50 - CENTRAL HEATING EQUIPMENT

NAME	TYPE	MAKE	MODEL	MASTER FORMAT CODE
HEX-1	DESUPERHEATER COIL	PACKLESS	CDAX-5030-H	23 57 16
HEX-2	LIQUID-TO-LIQUID HEAT EXCHANGER	BRAZETEK	BT3X8-30	23 57 19

SECTION 23 06 70 - CENTRAL HVAC EQUIPMENT

NAME	TYPE	MAKE	MODEL	MASTER FORMAT CODE
TT-1	THERMAL STORAGE TANK	Norwesco	NW120MINI	23 71 13

SECTION 23 06 80 - DECENTRALIZED HVAC EQUIPMENT

NAME	TYPE	MAKE	MODEL	MASTER FORMAT CODE
HP-1	DUCTLESS MINI-SPLIT HEAT PUMP	mitsubishi	MXZ-2B20NA	23 81 26
FCU-1	FAN COIL UNIT	mitsubishi	MSZ-FE09NA	23 81 26
FCU-2	FAN COIL UNIT	mitsubishi	MSZ-FE09NA	23 81 26

## SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

### SECTION 23 09 13 - Instrumentation and Control Devices for HVAC

#### Part 1 – General

##### 1.1 Summary

1. Section Includes
  - A. Thermocouple Probes for Thermal Control
  - B. Heating Thermostat
  - C. Cooling Thermostat
  - D. Dehumidistat

##### 1.2 Related Sections

1. Section 23 34 16 - Centrifugal HVAC Fans
2. Section 23 81 26 - Building Control - Control4
3. Section 25 14 00 - Mitsubishi Unit Section

##### 1.3 Section Requirements

1. Submittals
  - i. Product Data Sheets

#### Part 2 – Products

##### 2.1 Thermal Control

- A. USB Temperature and Humidity Sensor
  1. USBTenki
    - a. Product Requirements
    - b. Product Specifications
      - i. RH operating range: 0 – 100% RH
      - ii. Temperature operating range: -40 C to 125 C
      - iii. Compatible with Linux and Mac OSX
      - iv. Powered through USB
      - v. Price: \$95
    - a. Quote: [http://www.raphnet-tech.com/products/usbtenki\\_temperature\\_humidity/index.php?category=Sensors](http://www.raphnet-tech.com/products/usbtenki_temperature_humidity/index.php?category=Sensors)
  2. Manufacturer Information and Product Link
    - A. Manufacturer: Raphnet Technologies
    - B. [http://www.raphnet-tech.com/products/usbtenki\\_temperature\\_humidity/index.php?category=Sensors](http://www.raphnet-tech.com/products/usbtenki_temperature_humidity/index.php?category=Sensors)
- B. Thermocouple Probes
  1. Omega Thermocouples
    4. Product Requirements
      - i. Measure temperature s in the System
      - ii. Epoxy sealed junction tip
      - iii. Max temperature rating of 105C (221 F)
    - a. Tip Diameter: 3.3mm
    - b. Probe Length per sensor: 4.5m (15')
    - c. Includes subminiature male window connector

- d. 24 gage solid polyvinyl rip-cord wire
  - e. Price: \$16/each
  - 5. Manufacturer Information and Product Link
    - a. Manufacturer: Omega
  - b. Item number: 5TC-PVC-K-24-180
    - c. [http://www.omega.com/ppt/pptsc.asp?ref=TC-PVC EPXOY TC PROBE&Nav=tema09](http://www.omega.com/ppt/pptsc.asp?ref=TC-PVC_EPXOY_TC_PROBE&Nav=tema09)
- C. Hermetically Sealed Omega Thermocouples**
- 1. Omega Thermocouples
    - 4. Product Requirements
      - i. Measure temperature s in the system
      - ii. hermetically sealed
      - iii. Max temperature rating of 250C (482 F)
    - f. Tip Diameter: 3.3mm
    - g. Probe Length per sensor: 3.0m (10')
    - h. Includes subminiature male window connector
    - i. 24 gage stranded thermocouple grade wire
    - j. Price: \$25/each
  - 5. Manufacturer Information and Product Link
    - d. Manufacturer: Omega
  - e. Item number: HSTC-TT-K-24S-120-SMPW-CC)
  - f. <http://www.omega.com/pptst/HSTC.html>
- D. Thermocouples/Thermometers**
- 1. Pico Thermocouple Data Logger
  - 2. Product Requirements
    - a. Read temperature from thermocouples
    - b. Transfer data to logging subsystem
  - 3. Product Specifications
    - a. Has 8 Thermocouple Channels
    - b. USB Connection to PC
    - c. 201mm x 104mm x 34mm
    - d. item # TC-08
    - e. Price: \$380
    - i. Quote:  
[http://cgi.ebay.com/ws/eBayISAPI.dll?ViewItem&item=260738647210&hlp=false&rvr\\_id=216916703437&rlp=1\\_263602\\_304652&UA=M\\*S%3F&GUID=3040a83a12e0a06c1af71c77fff5291d&itemid=260738647210&ff4=263602\\_304652](http://cgi.ebay.com/ws/eBayISAPI.dll?ViewItem&item=260738647210&hlp=false&rvr_id=216916703437&rlp=1_263602_304652&UA=M*S%3F&GUID=3040a83a12e0a06c1af71c77fff5291d&itemid=260738647210&ff4=263602_304652)
  - 4. Manufacturer Information and Product Link
    - a. Manufacturer: Pico
    - b. <http://www.picotech.com/document/datasheets/usb-tc08.pdf>
- D. Heating thermostat**
- 1. Lux Single-Pole Heating-Only Line-Voltage Thermostat
    - a. Product Requirements:
      - i. Control the mechanical room fan based on temperature feedback
      - ii. UL listed
    - b. Product Specifications:
      - i. Model Number: LV1
      - ii. 1-stage heat only
      - iii. Single Pole 120/240 VAC
      - iv. 22A maximum
      - v. Setting range: 50 F to 90 F
    - c. Manufacturer Information and Product Link

- i. Manufacturer Information: Lux
      - ii. Price: \$13.66 ([http://www.amazon.com/Lux-Products-LV1-Thermostat-Sterling/dp/B000VYNCU0/ref=sr\\_1\\_1?ie=UTF8&qid=1312841328&sr=8-1](http://www.amazon.com/Lux-Products-LV1-Thermostat-Sterling/dp/B000VYNCU0/ref=sr_1_1?ie=UTF8&qid=1312841328&sr=8-1))
      - iii. Spec sheet: [http://www.luxproducts.com/support/52013\\_LV1-LV2-LV3\\_ENG.pdf](http://www.luxproducts.com/support/52013_LV1-LV2-LV3_ENG.pdf)
- E. Heating thermostat**
  1. Lux Single-Pole Cooling-Only Line-Voltage Thermostat
    - a. Product Requirements:**
      - i. Control the mechanical room fan based on temperature feedback
      - ii. UL listed
    - b. Product Specifications:**
      - i. Model Number: LV3
      - ii. 1-stage cool only
      - iii. Single Pole 120/240 VAC
      - iv. 22A maximum
      - v. Setting range: 50 F to 90 F
    - c. Manufacturer Information and Product Link**
      - i. Manufacturer Information: Lux
      - ii. Price: \$16.95 ([http://www.amazon.com/LuxPro-Line-Voltage-Thermostat-Cool/dp/B000E7BTFO/ref=sr\\_1\\_1?s=hi&ie=UTF8&qid=1312841417&sr=1-1](http://www.amazon.com/LuxPro-Line-Voltage-Thermostat-Cool/dp/B000E7BTFO/ref=sr_1_1?s=hi&ie=UTF8&qid=1312841417&sr=1-1))
      - iii. Spec sheet: [http://www.luxproducts.com/support/52013\\_LV1-LV2-LV3\\_ENG.pdf](http://www.luxproducts.com/support/52013_LV1-LV2-LV3_ENG.pdf)
- F. Dehumidistat Wall-Mounted Dehumidistat**
  1. Honeywell
    - a. Product Requirements:**
      - i. Control the bathroom fan based on humidity feedback
      - ii. UL listed
    - b. Product Specifications:**
      - i. Model Number: H46C
      - ii. 1-stage cool only
      - iii. 24/120/240 VAC
      - iv. 7.5 A full load at 120 VAC
      - v. 3.8 A full load at 240 VAC
      - vi. Wall mount
      - vii. Differential: 4% to 6% RH
      - viii. Temperature range: 50 F to 125 F
      - ix. Operating humidity range: 20% to 80% RH
      - x. Dimensions: 4-11/16" x 2-15/16" x 2-1/8"
    - c. Manufacturer Information and Product Link**
      - i. Manufacturer Information: Honeywell
      - ii. Price: \$34.85  
([http://www.drillspot.com/products/686197/honeywell\\_h46c1166\\_humidity\\_control\\_dhumidistat?s=1](http://www.drillspot.com/products/686197/honeywell_h46c1166_humidity_control_dhumidistat?s=1))
      - iii. Spec sheet:  
<http://customer.honeywell.com/honeywell/ProductInfo.aspx/H46C1166#LiteratureDownload>

## Part 3 – Execution

### 3.1 Installation

- A. Follow manufacturer instructions**

**END OF SECTION**

## SECTION 23 21 13 – Hydronic Piping

### Part 1 – General

#### 1.1 Summary

- A. Section Includes
  - 1. Hydronic Piping

#### 1.2 Related Sections

- A. Section 23 21 23 - Hydronic Pumps
- B. Section 23 81 00 - Decentralized Unitary HVAC Equipment
- C. Section 23 81 26 - Split System Air-Conditioners

#### 1.3 Section Requirements

- A. Submittals
  - 1. Product Data
  - 2. Manufacturer Data

### Part 2 – Products

#### 2.1 Hydronic Piping

- B. Crosslinked PE Tubing
  - 2. 1/2" AQUAPEX Red - (100 ft. coil)
    - a. Product Requirements
      - i. Meets Standards:
        - 4. DIN4726
        - 5. ASTM F877
        - 6. NSF
    - 2. Product Specifications
      - e. Dimensions
        - 1. Outside diameter 0.625 in.
        - 2. Inside diameter 0.475 in.
        - 3. PEX Size ½ in.
      - f. Mechanical Data
        - 1. Max. pressure 160 psi
        - 2. Max. temp. 200°F
      - g. Fitting System
        - 1. Crimp/Clamp HydroPEX
        - 2. Expander ProPEX
        - 3. PEX Compression Press Viega
        - 4. Push Fit Sharkbite
      - h. Misc. Data
        - 1. Material PEX
        - 2. Grade PEX-a
        - 3. Color red
        - 4. Tubing Type Non-Oxygen Barrier
    - 3. Manufacturer Information
      - Manufacturer: Uponor (Wirsbo)

- Price:\$31.95  
<http://www.pexsupply.com/Wirsbo-Uponor-F2040500-1-2-AQUAPEX-Red-100-ft-coil-2184000-p>
  - SKU: F2040500
2. 1/2" AQUAPEX White - (100 ft. coil)
4. Product Requirements
    - a. meets NSF requirements
    - b. meets DIN 4726
    - c. meets ASTM F877
  5. Product Specifications
    - a. Dimensions
 

1. Size	½ in.
2. Outside diameter	0.625 in.
3. Inside diameter	0.475 in.
4. PEX Size	½ in.
    - b. Mechanical Data
 

1. Max. pressure	160 psi
2. Max. temp.	200°F
    - c. Fitting System
 

1. Crimp/Clamp	HydroPEX
2. Expander	ProPEX
3. PEX Compression Press	Viega
4. Push Fit	Sharkbite
    - d. Misc. Data
 

1. Material	PEX
2. Grade	PEX-a
3. Color	blue
4. Tubing Type	Non-Oxygen Barrier
  6. Manufacturer Information
    - IV. Manufacturer: Uponor (Wirsbo)
    - V. Price: \$31.95 <http://www.pexsupply.com/Wirsbo-Uponor-F1040500-1-2-AQUAPEX-100-ft-coil-2173000-p>
    - VI. SKU: F1040500
3. 3/4" AQUAPEX Red - (100 ft. coil)
- a. Product Requirements
    - a. meets NSF requirements
    - b. meets DIN 4726
    - c. meets ASTM F877
  - b. Product Specifications
    - i. Dimensions
 

1. Size	¾ in.
2. Outside diameter	0.875 in.
3. Inside diameter	0.671 in.
4. PEX Size	¾ in.
    - d. Mechanical Data
 

1. Max. pressure	160 psi
2. Max. temp.	200°F
    - e. Fitting System
 

1. Crimp/Clamp	HydroPEX
2. Expander	ProPEX

- |     |                                                                                                                                                                                           |                    |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 3.  | PEX Compression Press                                                                                                                                                                     | Viega              |
| 4.  | Push Fit                                                                                                                                                                                  | Sharkbite          |
| f.  | Misc. Data                                                                                                                                                                                |                    |
| 1.  | Material                                                                                                                                                                                  | PEX                |
| 2.  | Grade                                                                                                                                                                                     | PEX-a              |
| 3.  | Color                                                                                                                                                                                     | red                |
| 4.  | Tubing Type                                                                                                                                                                               | Non-Oxygen Barrier |
| c.  | Manufacturer Information                                                                                                                                                                  |                    |
| i.  | Manufacturer Information: Uponor (Wirsbo)                                                                                                                                                 |                    |
| ii. | Price: \$54.95                                                                                                                                                                            |                    |
|     | <a href="http://www.pexsupply.com/Wirsbo-Uponor-F2040750-3-4-AQUAPEX-Red-100-ft-coil-2185000-p">http://www.pexsupply.com/Wirsbo-Uponor-F2040750-3-4-AQUAPEX-Red-100-ft-coil-2185000-p</a> |                    |
| ii. | SKU: F2040750                                                                                                                                                                             |                    |
- 4. 3/4" AQUAPEX White - (100 ft. coil)**
- a. Product Requirements
    - b. meets NSF requirements
    - b. meets DIN 4726
    - c. meets ASTM F877
  - b. Product Specifications
    - V. Dimensions
 

1.	Size	3/4 in.
2.	Outside diameter	0.875 in.
3.	Inside diameter	0.671 in.
4.	PEX Size	3/4 in.
    - Vi. Mechanical Data
 

5.	Max. pressure	160 psi
6.	Max. temp.	200°F
    - Vii. Fitting System
 

7.	Crimp/Clamp	HydroPEX
8.	Expander	ProPEX
9.	PEX Compression Press	Viega
10.	Push Fit	Sharkbite
    - Viii. Misc. Data
 

11.	Material	PEX
12.	Grade	PEX-a
13.	Color	blue
14.	Tubing Type	Non-Oxygen Barrier
  - c. Manufacturer Information
    - i. Manufacturer Information: Uponor (Wirsbo)
    - ii. Price: \$54.95
    - <http://www.pexsupply.com/Wirsbo-Uponor-F1040750-3-4-AQUAPEX-100-ft-coil-2174000-p>
    - iii. SKU: F1040750
- 5. ProPEX fittings**
- a. Product Requirements
    - v. Complies with the CA Plumbing Code 2010
    - vi. Complies with the CA Mechanical Code 2010
    - vii. Complies with the International Plumbing Code 2009
    - viii. Complies with the International Residential Code 2009
  - b. Custom-designed thermal storage system shall use appropriate approved ProPEX fittings to connect all parts of the HVAC/DHW preheating system.

**6. 1" NPT PVC pump flange**

a. Product Requirements

- i. American Society for Testing and Materials (ASTM),
- ii. National Sanitation Foundation (NSF)

b. Product Specifications

- Product Number 4596K154
- Shape Flange
- Flange Type Standard
- Pipe to Pipe Connection NPT x NPT
- System of Measurement Inch
- Schedule 80
- Pipe/Thread Size 1"
- Flange OD (A) 4-1/4"
- Bolt Circle Diameter (B) 3-1/8"
- Flange Thickness (C) 19/32"
- Number of Bolt Holes 4
- Bolt Size 1/2" x 2"
- Material PVC
- Color Dark Gray
- Maximum Pressure @ 73° F 150 psi
- Temperature Range Up to 140° F
- For Use With Drinking Water (Potable)
- Specifications Met ASTM, NSF
- ASTM Specification ASTM D2464,

ASTM

D2467

- NSF Specification NSF 61
- Note: A gasket is required, but not included.
- WARNING: Never use plastic pipe fittings with compressed air or gas.
- Price: \$8.99 (<http://www.mcmaster.com/#4596k154/=bdlsf3>)
- c. Manufacturer Information
  - i. Manufacturer: McMaster
  - ii. <http://www.mcmaster.com/#4596k154/=bdlsf3>

**7. 1" NPT - 3/4" NPT PVC reducer**

a. Product Requirements

- i. American Society for Testing and Materials (ASTM),
- ii. National Sanitation Foundation (NSF)

b. Product Specifications

- Product Number: 4880K349
- Shape Bushing
- Bushing Type Reducing Hex Bushing (Male x Female)
- Pipe to Pipe Connection NPT x NPT
- System of Measurement Inch
- Schedule 40
- Pipe/Thread Size 1" reduced to 3/4"
- Material PVC
- Color White
- Temperature Range Up to 140° F

- Specifications Met American Society for Testing and Materials (ASTM), National Sanitation Foundation (NSF)
  - ASTM Specification ASTM D1784, ASTM D2466
  - NSF Specification NSF 61
  - WARNING Never use plastic pipe fittings with compressed air or gas.
  - Price: \$1.30 (<http://www.mcmaster.com/#4880k349/=bdlw3k>)
- c. Manufacturer Information
- i. Manufacturer: McMaster
  - ii. <http://www.mcmaster.com/#4880k349/=bdlw3k>

**8. 1" NPT - 1/2" NPT PVC reducer**

- a. Product Requirements
- i. American Society for Testing and Materials (ASTM)
  - ii. National Sanitation Foundation (NSF)
- b. Product Specifications
- Product Number: 4880K348
  - Shape Bushing
  - Bdoneushing Type Reducing Hex Bushing (Male x Female)
  - Pipe to Pipe Connection NPT x NPT
  - System of Measurement Inch
  - Schedule 40
  - Pipe/Thread Size 1" reduced to 1/2"
  - Material PVC
  - Color White
  - Temperature Range Up to 140° F
  - Specifications Met American Society for Testing and Materials (ASTM), National Sanitation Foundation (NSF)
  - ASTM Specification ASTM D1784, ASTM D2466
  - NSF Specification NSF 61
  - WARNING Never use plastic pipe fittings with compressed air or gas.
  - Price: \$1.30 (<http://www.mcmaster.com/#4880k348/=bdlxn9>)
- c. Manufacturer Information
- i. Manufacturer: McMaster
  - ii. <http://www.mcmaster.com/#4880k348/=bdlxn9>

**Part 3 – Execution**

**3.1 Installation**

Follow manufacturer’s installation instructions

**END OF SECTION**

## SECTION 23 21 23 - HYDRONIC PUMPS

### Part 1 – General

#### 1.1 Summary

A. Section Includes: Circulating Pumps

#### 1.2 Related Sections

A. Section 23 21 13 - PEX Water Piping

#### 1.3 Section Requirements

A. Submittals

1. Manufacturer Data

### Part 2 – Products

#### 2.1 Hydronic Pumps

A. Hydronic Pumps

i. Grundfos Alpha 15-55 F 165 water pump

1. Product Requirements (*might not be included*)

2. Product Specifications

a. Electrical Data

1. Voltage	115 V
2. Current (AC)	0.1 Amps
3. Frequency	60 Hz
4. Power	5 - 45 W
5. Enclosure class (IEC 34-5)	42
6. Insulation class (IEC 85)	F

b. Mechanical Data

● Volume	87.6 ft <sup>3</sup>
● Net weight	5.95 lb
● Max. operating pressure	145 psi

c. Installation system

1. Pipe connection	GF 15/26
2. Pressure stage	PN 10
3. Port-to-port length	6-1/2 in

d. Misc. Data

1. TF class	110
2. Impeller material	composites, PES
3. Liquid temp. range	35.6 - 230°F
4. Energy label	A
5. Pump housing	Cast iron DIN W.-Nr. GG 15 ASTM 30 B
6. Impeller	Composite, PES
7. Price	\$224.95

a. Quote: <http://www.pexsupply.com/Grundfos-59896832-ALPHA-15-55-F-LC-Cast-Iron-Circulator-Pump>

3. Manufacturer Information and Product Link

i. Manufacturer: Grundfos

1. [http://www.us.grundfos.com/web/download.nsf/Pages/E2FE899F7214E6CE88257574005B41C2/\\$File/L-AL-TL-001.pdf](http://www.us.grundfos.com/web/download.nsf/Pages/E2FE899F7214E6CE88257574005B41C2/$File/L-AL-TL-001.pdf)
2. Item number: 59896832

**Part 3 - Execution**

**3.1 Installation**

- A. Follow manufacturer's installation instructions

**END OF SECTION**

## SECTION 23 23 00 - REFRIGERANT PIPING

### Part 1 – General

#### 1.1 Summary

- A. Section Includes:
  - a. Refrigerant line set for ductless HVAC system

#### 1.2 Related Sections

- 1. Section 23 23 23 - Refrigerants
- 2. Section 23 81 26 - Split System Air-Conditioners

#### 1.3 Section Requirements

- a. Submittals: Product Data

### Part 2 – Products

#### 2.1 Products

- A. Refrigerant line set
  - i. Flared refrigerant line set
    - 1. Product Requirements
    - 2. Product specifications
      - a. Length 50 ft
      - b. Liquid line diameter 1/4"
      - c. Suction line diameter 3/8"
      - d. Insulation thickness 3/8"
      - e. End connection Flared
      - f. Price \$181.75
    - i. Quote: <http://www.pexsupply.com/Generic-LS143850F-1-4-LL-x-3-8-SL-x-50-ft-Refrigerant-Line-Set-Flare-Ends-12675000-p>
  - 3. Manufacturer Information
    - a. Manufacturer: Generic
    - b. Manufacturer data: <http://www.pexsupply.com/Generic-LS143850F-1-4-LL-x-3-8-SL-x-50-ft-Refrigerant-Line-Set-Flare-Ends-12675000-p>

### Part 3 - Execution

#### 3.1 Installation

Follow manufacturer's installation instructions

**END OF SECTION**

## SECTION 23 23 23 - REFRIGERANTS

### Part 1 - General

#### 1.1 Summary

- A. Section Includes:
  - 1. Refrigerants used in HVAC system

#### 1.2 Related Sections

- A. Section 23 81 26 - Split-System Air-Conditioners
- B. Section 23 57 16 - Steam-to-Water Heat Exchangers

#### 1.3 Section Requirements

- A. Submittals
  - 1. Product data

### Part 2 – Products

#### 2.1 Refrigerants

- A. HVAC Refrigerants
  - i. Genetron® AZ-20 (R-410A)
    - a. Product Requirements
      - i. Conforms to MXZ-2B20NA spec
      - i. Team-provided liquid
    - b. Product Specifications
      - i. Composition: pentafluoroethane 50.0%, difluoromethane 50.0%
      - ii. Ignition temperature: > 750°C
      - iii. Quantity: 5 lb. 15 oz.
      - iv. Delivery date: 9/14/2011
      - v. Manufacturer data sheet:  
<http://www51.honeywell.com/sm/genetron/common/documents/R-410A.pdf>

### Part 3 – Execution

#### 3.1 Installation Instructions

- A. Install and maintain according to the service instructions for the Mitsubishi MXZ-2B20NA Outdoor HVAC Unit.

**END OF SECTION**



## SECTION 23 30 00 - HVAC AIR DISTRIBUTION

### SECTION 23 31 13 - METAL DUCTS

#### Part 1 - General

##### 1.1 Summary

- A. Section Includes:
  1. Ducting for ventilation and exhaust systems

##### 1.2 Related Sections

- A. Section 23 34 16 - Centrifugal HVAC Fans
- B. Section 23 34 23 – HVAC Power Ventilators

##### 1.3 Section Requirements

- A. Submittals: Product data
- B. Comply with UL 94V0 for flammability.
- C. Comply with UL 181 for air ducts and air connectors.
- D. Comply with CA Mechanical Code 2010
- E. Comply with International Mechanical Code 2009

#### Part 2 – Products

##### 2.1 Products

- A. Custom sheet metal ductwork
  1. Ductwork consists of an array of custom-made metal ducts. These include ducts for the range hood, ERV fan, bathroom fan, mechanical room fan, whole-house fan, and dryer exhaust.
  2. Ducts shall be installed by a licensed contractor with minimal pressure loss and with proper sealing of all joints with approved methods.
  3. Ducts that are prone to condensation shall be insulated with approved insulation materials to a minimum value of R-6.0.

#### Part 3 – Execution

##### 3.1 Installation

- A. Follow manufacturer's installation instructions
- B. Duct installation shall comply with UL 181 and NFPA 90A and 90B standards
- C. Duct installation shall comply with all applicable local codes

**END OF SECTION**

## SECTION 23 34 00 - HVAC FANS

### SECTION 23 34 16 - CENTRIFUGAL HVAC FANS

#### Part 1 - General

##### 1.1 Summary

- A. Section Includes:  
I. Fans for exhaust

##### 1.2 Related Sections

- A. Section 23 31 13 - Metal Ducts  
B. Section 23 34 23 – HVAC Power Ventilators

##### 1.3 Section Requirements

- A. Submittals: Product data

#### Part 2 – Products

##### 2.1 Whole House Fan

- A. Ceiling Mount Whole House Fan
- I. Broan high capacity ventilation fan
    1. Product Requirements
      - a. 701 CFM, 4.7 Sones. (AMCA)
    2. Product Specifications
      - i. Electrical Data
        1. Voltage 120 V AC
        2. Amperage 2.9 A
      - ii. Mechanical data
        1. Dimensions W x H x D 21 ½ x 12 ¼ x 11 ¾ inch
        2. Duct connector 4 ½ \* 18 ½ inch
        3. Ceiling Opening Dimensions 23 ¼ x 14 in.
        4. Shipping Weight 33.9 lb
        5. Flow rate 701 CFM
      - iii. Misc. Data
        1. Steel Grille Color white enamel
        2. Acoustic insulation inside ½ inch
        3. Automatic backdraft damper inside duct connector
        4. 2 impact-resistant centrifugal blower wheels
        5. <http://www.broan.com/ImageLibrary/broan/pdf/Specifications/99042734.pdf>
    3. Manufacturer Information
      - i. Manufacturer: Broan
      - ii. Model: L700
      - iii. Website: <http://www.broan.com/display/router.asp?ProductID=721>

##### 2.2 Ventilation Fan

- A. Centrifugal Ventilation Fan
1. WhisperLine 120 cfm in-line fan, FV-10NLF1
    1. Product Requirements
      - c. 120 CFM
      - d. UL listed
    2. Product Specifications

- i. Electrical Data
    - a. Voltage 120 V
    - b. Current (AC) 0.3 Amps
    - c. Frequency 60 Hz
    - d. Power 36 W
  - ii. Mechanical Data
    - a. Dimensions 13" X 9" X 8"
    - b. Duct size 4 in diameter
    - c. Weight 14 lb.
    - d. Flow rate 120 CFM
    - e. Fan speed 1590 rpm
3. Manufacturer Information
- a. Manufacturer: Panasonic
  - b. website:  
<http://www2.panasonic.com/webapp/wcs/stores/servlet/ModelDetail?storeId=11201&catalogId=13051&itemId=62510&catGroupId=119515&surfModel=FV-10NLF1&displayTab=O>
  - c. Price: \$251.00 (MSRP)

## 2.3 Bathroom Fan

### A. Bathroom Ventilation

#### 1. WisperGreen 80 CFM Premium Ceiling Fan

##### a) Product Requirements

- i. 80 CFM

##### b) Product Specifications

###### i. Electrical Data

- Voltage 120 V. DC
- Frequency 60 Hz
- Power 7 Watts max.

###### ii. Mechanical data

- Dimensions W x H x D 14.25 x 11.0 x 17.0 in.
- Duct diameter 4 in.
- Weight 12.5 lb
- Mounting Opening 10 ½ inch
- Flow rate 80 CFM
- Motor speed 832-1130 RPM
- Installation opening 10 1/2 inches sq.

###### iii. Misc. Data

- Intake grill outside dimension 13 inches sq.
- Motor bearing ball
- Price \$280

##### c) Manufacturer Information

###### i. Manufacturer: Panasonic

###### ii. Model: FV-08VKS3

###### iii. Website :

<http://www2.panasonic.com/webapp/wcs/stores/servlet/ModelDetail?storeId=11201&catalogId=13051&itemId=487154&catGroupId=119505&surfModel=FV-08VKS3&displayTab=F>

## Part 3 – Execution

### 3.1 Installation

- A. Follow manufacturer's installation instructions

- B. Duct installation shall comply with UL 181 and NFPA 90A and 90B standards

### **Part 3 – Execution**

#### **3.1 Installation**

- A. Follow manufacturer's installation instruction
- B. Duct installation shall comply with UL 181 and NFPA 90A and 90B standards

**END OF SECTION**

SECTION 23 34 23 - HVAC POWER VENTILATORS

**Part 1 – General**

**1.1 Summary**

- A. Section Includes:
  - a. Bathroom Ventilation

**1.2 Related Sections**

- A. Section 23 81 26 - Split-System Air-Conditioners

**1.3 Section Requirements**

- A. Submittals: Product data

**Part 2 – Products**

**2.1 Energy Recovery Ventilator**

A. Ceiling Insert ERV

- 1. WhisperComfort™ Spot ERV Ceiling Insert Ventilator  
 Balanced Ventilation and Patent-Pending Capillary Core

a. Product Requirements

- i. California Title 24 Compliant
- ii. Washington State VIAQ Code
- iii. Mfg. in ISO 9001 Certified facility
- iv. Static Pressure (in inch w.g.) 0.1
- v. Air volume (CFM)
  - 40 @ 0.1 Static Pressure
  - 20 @ 0.1 Static Pressure
  - 10 @ 0.1 Static Pressure
- vi. Air volume Supply (CFM)
  - 30 @ 0.1 Static Pressure
  - 20 @ 0.1 Static Pressure
  - 10 @ 0.1 Static Pressure
- vii. Noise (sones) 0.8 @ 40 CFM, <0.3 @ 20 CFM

b. Product Specifications

iii. Electrical Data

- i. Power consumption (W)
  - 23 @ 40 CFM
  - 21 @ 20 CFM
  - 17 @ 10 CFM
- i. Speed (RPM)
  - 1479 @ 40 CFM
  - 1292 @ 20 CFM
  - 1095 @ 10 CFM
- i. Current (A)
  - 0.15 @ 40 CFM
  - 0.10 @ 20 CFM
  - 0.09 @ 10 CFM
- ii. Power Rating (V/Hz) 120/60
- iii. Motor Type AC Condenser
- iv. Blower Wheel Type 2 x Sirocco

iv. Mechanical Data

- f. Heating % 66 % @ 30 CFM
- g. Cooling % 36 % @ 29 CFM
- h. Mouting Openeing (inch sq) 19 ½ x 14 ¼

- i. Grill Size (in sq) 20  $\frac{3}{4}$  x 16  $\frac{3}{4}$
- j. duct size 2 x 4" diameter
- k. Weight 24 lb.
- c. Manufacturer Information
  - d. Manufacturer: Panasonic
  - e. Model Number: FV-04VE1
  - f. website: [http://www2.panasonic.com/consumer-electronics/shop/Building-Products/Ventilation-Systems/Energy-Recovery-Ventilators/model.FV-04VE1.S\\_11002\\_700000000000005702#tabsection](http://www2.panasonic.com/consumer-electronics/shop/Building-Products/Ventilation-Systems/Energy-Recovery-Ventilators/model.FV-04VE1.S_11002_700000000000005702#tabsection)

## SECTION 23 57 16 - STEAM-TO-WATER HEAT EXCHANGERS

### Part 1 - General

#### 1.1 Summary

- A. Section Includes:
  - A. Heat exchanger for transferring heat from hot refrigerant to thermal storage tank water

#### 1.2 Related Sections

- 1. Section 23 71 13 - Water Thermal Storage Tank
- 2. Section 23 81 26 - Split-System Air-Conditioners

#### 1.3 Section Requirements

- 1. Submittals: Product Data

### Part 2 – Products

#### 2.1 Refrigerant-to-Water Heat Exchangers

- A. Refrigerant-to-Water Heat Exchanger Coils
  - 1. Packless HXR Series Desuperheater Coil
    - i. Product Requirements
      - a. UL listed
      - b. CSA listed
    - ii. Product Specifications
      - a. Nominal tonnage 2 tons
      - b. Length 14 1/16"
      - c. Refrigerant pipe ID 1/2"
      - d. Water pipe OD 1/2"
      - e. Inner Tube Material Red Brass
      - f. Outer Tube Material Copper
      - g. Refrigerant Connections Copper
    - iii. Manufacturer Information and Product Link
      - a. Manufacturer: Packless Industries
      - b. Model: CDAX-5030-H
      - c. Link: <http://www.packless.com/catalog/ItemView.aspx?id=146>
      - d. Price: \$83.00 ([http://cgi.ebay.com/PACKLESS-IND-CDAX-5030-H-09-48-HEAT-RECLAIMER-163696-/190416149677?pt=LH\\_DefaultDomain\\_0&hash=item2c55afdcad&x=51&y=4#shld](http://cgi.ebay.com/PACKLESS-IND-CDAX-5030-H-09-48-HEAT-RECLAIMER-163696-/190416149677?pt=LH_DefaultDomain_0&hash=item2c55afdcad&x=51&y=4#shld))

### Part 3 - Execution

#### 3.1 Installation

Follow manufacturer's installation instructions

### END OF SECTION

## SECTION 23 57 19 - LIQUID-TO-LIQUID HEAT EXCHANGERS

### Part 1 – General

#### 1.1 Summary

- A. Section Includes:
1. Heat exchanger to transfer heat from thermal storage tank to DHW

#### 1.2 Related Sections

- A. Section 23 71 13 - Thermal Storage Tank  
B. Section 23 81 26 - Split-System Air-Conditioners

#### 1.3 Section Requirements

- A. Submittals
1. Product Data

### Part 2 – Products

#### 2.1 Water-to-Water Heat Exchangers

A. Refrigerant-to-Water Heat Exchanger Coils

1. Brazetek BT3X-30 Series Plate Heat Exchangers
  - a. Product Requirements
    - i. UL listed
  - b. Product Specifications
    - i. Design pressure 435 psi (30 bar/3.0 Mpa)
    - ii. Test pressure 650 psi (45 bar/4.5 Mpa)
    - iii. Design temperature -256°F/437°F (-160°C/ 225°C)
    - iv. Length 2.99''
    - v. Width 8.11''
    - vi. Height 3.11''
    - vii. No. of plate 30
    - viii. Max GPM 15
    - ix. Conn MNPT ¾''
    - x. Brazing Material Copper 99.9%
    - xi. Cover plate 316L Stainless Steel
    - xii. Channel plate 316L Stainless Steel
    - xiii. Connections 316L Stainless Steel
  - c. Manufacturer Information and Product Link
    - i. Manufacturer: Brazetek Industries
    - ii. Model: BT3X8-30
    - iii. Link: <http://www.brazetek.com/products/details/28/7/3-x-8-inch-3/4-inch-mpt-connections-stainless-steel-copper-brazed-plate-heat-exchangers/-chillers/30-plate-heat-exchanger/-chiller-3/4>

### Part 3 – Execution

#### 3.1 Installation

- A. Follow manufacturer's installation instructions

END OF SECTION

## SECTION 23 71 13 - THERMAL HEAT STORAGE

### Part 1 – General

#### 1.1 Summary

1. Section Includes:
  - a. Thermal storage tank for cooling refrigerant and preheating DHW

#### 1.2 Related Sections

- a. Section 23 21 13 - Hydronic Piping
- b. Section 23 21 23 - Hydronic Pumps
- c. Section 23 57 16 - Steam-to-Water Heat Exchangers
- d. Section 23 57 19 - Liquid-to-Liquid Heat Exchanger

#### 1.3 Section Requirements

1. Submittals:
  - a. Product Data

### Part 2 – Products

#### 2.1 Thermal Storage

- A. Thermal Storage Tank
  - a. Norwesco 120 Gallon Mini Bulk Tank
    - A. Product Requirements
      1. Tank is to be an ASME Grade Pressure Vessel custom modified from a commercial unit to be specified in shop drawings.
    - B. Product Specifications
      1. Mechanical Data
        - a. Diameter: 38"
        - b. Height: 31"
        - c. Size: 120gal
        - d. Material: Polyethylene
        - e. Liner: None
        - f. Ports: 5" NPT fill fitting located at the top of the tank along with a 2" female threaded bulkhead. Customized ports to be specified on shop drawings.
        - g. Insulation: Denim batting
        - h. Jacket: None
        - i. Price: \$138.81
          1. Quote: <http://www.norwescotanks.net/p-138-120-gallon-mini-bulk-tank.aspx>
      2. Manufacturing Data
        - a. Manufacturer: Norwesco
        - b. Link to manufacturer data sheet: <http://www.norwescotanks.net/p-138-120-gallon-mini-bulk-tank.aspx>

### Part 3 – Execution

#### 3.1 Installation

- A. Install per manufacturer instructions.
- B. Tank will be modified

### END OF SECTION

## SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

### Part 1 – General

#### 1.1 Summary

1. Section Includes:
  - i. Ductless HVAC system

#### 1.2 Related Sections

- a. Section 22 33 30 - Residential, Electric Domestic Water Heaters
- b. Section 23 09 13 - Instrumentation and Control Devices for HVAC
- c. Section 23 21 13 - Hydronic Piping
- d. Section 23 21 23 - Hydronic Pumps
- e. Section 23 23 16 - Refrigerant Piping Specialties
- f. Section 23 57 16 - Steam-to-Water Heat Exchangers
- g. Section 23 57 19 - Liquid-to-Liquid Heat Exchangers
- h. Section 23 71 13 - Thermal Heat Storage

#### 1.3 Section Requirements

1. System Description:
  - A. The heat pump air conditioning system shall be a Mitsubishi Electric MXZ-B variable capacity multi-zone series. The system shall consist of two (2) slim silhouette, compact, wall mounted indoor fan coil sections with digital wireless remote controller and/or low-profile ductless indoor units with a wire remote controller connected to a compact horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
  - B. Indoor unit model numbers is MSZ-FE09NA
  - C. Outdoor unit model number is MXZ-2B20NA (2:1).
1. Quality Assurance:
  - a. The system components shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
  - b. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
  - c. The units shall be rated in accordance with Air-conditioning Refrigeration Institute's (ARI) Standard 210 / 240 and bear the ARI Certification label.
  - d. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to product and manufacturing quality and environmental management and protection set by the International Standard Organization (ISO).
  - e. A dry air holding charge shall be provided in the indoor section.
  - f. System efficiency shall meet or exceed 13 SEER when part of a multi system (2:1 / 3:1 / 4:1)
1. Delivery, Storage and Handling
  - i. Unit shall be stored inside and carefully handled according to the manufacturer's recommendations.
  - ii. The wireless remote controller shall be shipped inside the carton and packaged with the indoor unit and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

### Part 2 – Products

#### 2.1 MXZ-2B20NA Outdoor HVAC Unit

General: Mitsubishi MXZ-2B20NA multi split inverter heat pump series. The MXZ-B outdoor units shall be specifically designed to work with the MSZ-A, MSZ-FD, and SEZ-KD family of indoor units. The outdoor unit must have a fused powder coated finish in a Munsell 5Y 8/1 color (MXZ-20A20NA) and Munsell 3Y 7.8/1.1. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory prior to shipment.

A. Unit Cabinet:

- All casing and cabinet components shall be fabricated of galvanized steel, bonderized finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for durable, corrosion resistant surface protection.

B. Fan:

- i. The unit shall be furnished with a direct drive, high performance propeller type fan.
- ii. The condenser fan motor shall be a variable speed, direct current (DC) motor and shall have permanently lubricated bearings.
- iii. Fan speed shall be switch automatically according to the number of operating indoor units and the compressor operating frequency.
- iv. The fan motor shall be mounted with vibration isolation for quiet operation.
- v. The fan shall be provided with a raised guard to prevent contact with moving parts.
- vi. The outdoor unit shall have horizontal discharge airflow.

C. Coil:

- i. The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
- ii. The coil shall be protected with an integral guard.
- iii. Refrigerant flow from the outdoor unit shall be independently controlled by means of individual electronic linear expansion valves for each indoor unit.

D. Compressor:

- i. The compressor motor shall be direct current (DC) type designed for variable speed operation.
- ii. The compressor shall be a high performance, hermetic, inverter driven, variable speed, rotary type.
- iii. The outdoor unit shall be equipped with a suction side refrigerant accumulator.
- iv. The compressor will be equipped with an internal thermal overload.
- v. The compressor shall be mounted to avoid the transmission of vibration.

E. Manifold:

The outdoor unit shall have manifold connections providing a separate set of flared fittings for each indoor unit per the table below:

Port Connections	A	B
MXZ-2B20NA	¼ " Liquid : 3/8" Gas	¼ " Liquid : 3/8" Gas

[Some indoor unit combinations may require port adapters for proper connection]

F. Piping Requirements:

The outdoor unit must have the ability to operate within the following refrigerant piping and height limitations without the need for line size changes, traps or additional oil.

Piping Lengths:

Refrigerant Piping Data	Length to each indoor unit	Total piping length
MXZ-2B20NA	82 feet (Max)	164 feet (Max)

Height Differential:

Model	Indoor unit above outdoor unit	Indoor unit below outdoor unit
MXZ-2B20NA	49 feet (Max)	33 feet (Max)

- G. Electrical:
  - i. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
  - ii. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.
  - iii. The outdoor unit shall be controlled by the microprocessors located in the indoor unit and in the outdoor unit communicating system status, operation, and instructions digitally over A-Control wiring.
  - iv. The outdoor unit shall be equipped with Pulse Amplitude Modulation (PAM) compressor inverter drive control for maximum efficiency with minimum power consumption.
- H. Manufacturer service manual: [http://www.e-comfortusa.com/PDF\\_files/Mitsubishi/Mitsubishi\\_MXZ-2B20NA\\_Service\\_Manual.pdf](http://www.e-comfortusa.com/PDF_files/Mitsubishi/Mitsubishi_MXZ-2B20NA_Service_Manual.pdf)
- I. Price: \$2644.95 (includes indoor units)
  - i. Quote: <http://www.younits.com/mitsubishi-mr-slim-dual-zone-9-9-mxz-2b20na-wall-heat-pump-18-seer-18000-btu-1.5-ton-p-3804.html>

## 2.2 MSZ-FE09NA Ductless Indoor Units

### General:

The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board, fan and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit shall be charged with dry air before shipment from factory.

- A. Unit Cabinet:
  - A. The casing shall have a white finish – Munsell 1.0Y 9.2/0.2.
  - B. Multi directional drain connection and refrigerant piping, offering three (3) direction pipe alignments for all refrigerant piping and two (2) direction pipe alignments for condensate draining shall be standard.
  - C. There shall be a separate, metal back-plate that secures the indoor unit firmly to the wall. The back plate shall be securely attached to the wall.
- B. Fan:
  - A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor.
  - B. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearing.
  - C. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
  - D. An integral, motorized, multi-position, horizontal air sweep flow louver shall provide for uniform air distribution, up and down.
  - E. The indoor fan shall operate at of three (3) selectable speeds: High, Medium and Low.
- C. Filter:
  - A. Return air shall be filtered by means of easily removed, Blue-Enzyme Filter with permanently charged surface and a Platinum Catalyst Deodorizing Filter with ceramic surface and pore sizes ranging from 1 to 10 nanometers.
- D. Coil:
  - A. The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing.
  - B. The tubing shall have inner grooves for high efficiency heat exchange.
  - C. All tube joints shall be brazed with phoscopper or silver alloy.
  - D. The coils shall be pressure tested at the factory.

- E. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil.
- E. Electrical:
  - A. The indoor unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
  - B. The system shall be equipped with A-Control – a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire, 14 ga. AWG connection plus ground.
  - C. The indoor unit shall not have any supplemental electrical heat elements.
  - D. The outdoor unit shall be equipped with Pulse Amplitude Modulation (PAM) compressor motor control for maximum efficiency.
- F. Manufacturer service manual:  
[http://www.e-comfortusa.com/PDF\\_files/Mitsubishi/Mitsubishi\\_MSZ-FE09-12NA\\_Service\\_Manual.pdf](http://www.e-comfortusa.com/PDF_files/Mitsubishi/Mitsubishi_MSZ-FE09-12NA_Service_Manual.pdf)

### **Part 3 - Execution**

#### **3.1 Installation**

- A. MXZ-2B20NA Outdoor HVAC Unit
  - 1. Install per manufacturer specifications
  - 2. After standard installation procedures, a licensed refrigerant contractor shall drain the system of refrigerant and cut open the copper pipe coming immediately out of the compressor. Then, additional lengths of copper pipe shall be brazed to where the pipe has been cut so that refrigerant coming out of the compressor will flow through a desuperheater coil in series with the refrigerant loop before going back into the standard refrigerant loop. After the coil has been installed, the system will be pressure-tested and purged before refrigerant is reinstalled into the system.
- B. MSZ-FE09NA Ductless Indoor Unit
  - i. Install per manufacturer specifications

**END OF SECTION**

## Division 25 – Integrated Automation

### SECTION 25 13 00 – Integrated Automation Control and Monitoring Network

#### Part 1 - GENERAL

##### 1.1 Summary

- A. This section includes hardware devices used for the monitoring of energy use in the electrical breaker box.

##### 1.2 Related Sections

- A. 26.28.18
- B. 27.21.00

##### 1.3 Section Requirements

- A. Submittals
  - 1. Product Data: Manufacture specification sheets for all products listed under products section

##### 1.4 Quality Assurance

- A. Electrical Components, Devices, and Accessories are listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70

#### Part 2 - PRODUCTS

##### 2.1 Davis Instruments 6250- WEATHERLINKIP Weather Station

- A. Specifications
  - 1. Measures indoor temperature, outdoor temperature, humidity, wind speed, wind direction, rainfall,
  - 2. Solar-powered with stored energy backup
  - 3. Sealed electronics in the integrated sensor suite
  - 4. Frequency-hopping spread spectrum radio for reliable data transmission
  - 5. Updates every 2.5 seconds
  - 6. Dimensions – sensor: 18.25" x 7.25" x 15.25"
  - 7. Dimensions – Console: 8" x 8" x 4"

##### 2.2 eGauge Monitoring Device

- A. eGauge Main Unit
  - 1. Measures electric AC power on upto 12 circuits which include building-demand/consumption, solar energy production, and individual appliances (HVAC, Fridge).
  - 2. Conforms to UL STD 61010-1 and is Certified to CAN/CSA STD C22.2 No. 61010-1
  - 3. Dimensions: 7" x 3.4" x 1.2"
  - 4. FCC Class B
  - 5. Manufacturer: eGauge
  - 6. Product Link: <http://www.egauge.net/prod/egauge.php>
  - 7. Warranty: 5 years
  - 8. MSRP: 850\$
  - 9. Measurement Capacity
    - a. Voltage: 3channels, 85-277V (L1), 0-277 (L2, L3)
    - b. Current : 12 channels

- c. Power : any voltage/current combination
- B. HomePlug Adapter
  - 1. Facilitates communication with the eGauge Main Unit via existing power lines and with the user through LAN or Internet.
  - 2. Standards : IEEE 802.3 HomePlug Turbo PowerLine Spec 1.0.1
  - 3. Data Rate: Up to 85 Mbps
  - 4. Security: 56-bit DES Data Encryption
  - 5. Safety: UL Listed
  - 6. FCC: Part 15 Class B
  - 7. Dimensions: 3.9" x 2.6" x 1.2"
  - 8. Manufacturer: eGauge
  - 9. Product Link: <http://www.egauge.net/prod/homeplug.php>
- C. Current Transformers
  - 1. Measures the current across any size wire/bus-bar (0.4" to 3.0") and with any current settings (5A to 3000A)
  - 2. 2 x 150A CTs + 10 x 50A CTs
  - 3. Safety: UL recognized, CE
  - 4. Openings: 0.4", 0.75", 1.25"
  - 5. Leads: 2.44, twisted pair, jacketed, 24AWG
  - 6. Accuracy: 1%
  - 7. Manufacturer: eGauge
  - 8. Product Link: <http://www.egauge.net/prod/cts.php>

### Part 3 - EXECUTION

#### 3.1 Installation

- A. Comply with product installation manual and related NEC codes

**END OF SECTION**

## SECTION 25 14 00 – Integrated Automation Local Control Units

### Part 1 – GENERAL

#### 1.1 Summary

- A. Section includes:
  1. 25 14 00 – Microprocessor Based Control Unit
  2. 25 14 13 – Integrated Automation Remote Control Panels

#### 1.2 Related Sections

- A. Section 25 14 13 – Integrated Automation Remote Control Units
- B. Section 27 22 00 – Data Communication Hardware
- C. Section 25 13 00 – Integrated Automation Control and Monitoring Network
- D. Section 25 15 00 – Integrated Automation Software

#### 1.3 Section Requirements

- A. Submittals
  1. Product Data

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Microprocessor based control unit
  1. Control4 Home Controller HC-300 C4-HC300C-E-B
    - a. Product Specification
      - i. Voltage 100 - 240 VAC
      - ii. Amps 0.26 A
      - iii. Hertz 50 - 60 Hz
      - iv. H x W x D 2.8" x 12" x 7.25" (71 mm x 305 mm x 184 mm)
      - v. Weight 5.2 lbs (2.35 kg) with remote
      - vi. Output: Component, IR, Zigbee
    - b. Manufacturer Information and Product Link
      - i. Product Link: <http://www.control4.com/files/products/data-sheets/Control4-HC-300-Datasheet.pdf>
      - ii. Manufacturer Information: <http://control4.com/>
    - c. MSRP Price: \$699
  2. Fit-PC2i Home gesture and location controller
    - a. Product Specification
      - i. CPU Intel Atom Z550 2Ghz
      - ii. RAM 2 GB DDr2-533
      - iii. Hard-disc 160 GB 2.5" SATA HDD
      - iv. OS Windows 7 Professional
      - v. Graphics – GMA500
      - vi. DVI output up to 1920 x 1200 with HDMI
      - vii. 2x 1000 BaseT Ethernet
      - viii. 802.11n WLAN
      - ix. 4 USB 2.0 ports
      - x. H x W x D; 4" x 4.5" x 1.05" (101 x 115 x 27)mm
      - xi. Weight 370 grams or 13 ounces
      - xii. Power: 12V

- b. Manufacturer information and Product Link
  - i. Manufacture Info Link: <http://www.fit-pc.com/web/fit-pc2/fit-pc2i-specifications/>
  - ii. Product Link: <http://www.fit-pc.com/web/>
- c. MSRP - \$683
- B. Integrated Automation Remote Control Panels**
  - 1. Control4 System Remote SR-250: C4-SR250-Z-B
    - a. Product Specification
      - i. Batteries 4 AAA 4 AA
      - ii. L x W x D: 8.3" x 2.1" x 1.1" (190 mm x 55 mm x 27 mm)
      - iii. Weight (Including Batteries): 8.8 oz (250 g)
    - b. Manufacturer Information and Product Link
      - i. Product Link: <http://www.control4.com/files/products/data-sheets/Control4-UI.pdf>
    - c. MSRP Price: \$199

### **Part 3 - EXECUTION**

#### **3.1 Installation**

- A.** Follow Manufacturer instruction.

**END OF SECTION**

## SECTION 25 15 00 – Integrated Automation Software

### Part 1 - GENERAL

#### 1.1 Summary

- A. This section details software used in the house that manages and integrates lighting, HVAC, home entertainment, and other automated systems.

#### 1.2 Related Sections

- A. 1. 27 13 00 – Integrated Automation Control and Monitoring Network
- 2. 27 14 00 – Integrated Automation Local Control Units

#### 1.3 Section Requirements

- A. Submittals
  - 1. See product data

### Part 2 - PRODUCTS

#### 2.1 Products

- A. iPad / iPhone Home Controlling Application
  - 1. Requires iOS-running device (iPad / iPhone)
  - 2. Controls home automation elements such as lighting, HVAC, and home entertainment
  - 3. Visualize energy generation / usage in the house
- B. Computer Home Controlling Application
  - 1. Allows user to control home automation elements
  - 2. Connects to the Control 4 Controller via IP address in a Java interface
- C. House Planning
  - 1. Custom algorithm that will plan out actions for the house based on weather input and HVAC models
  - 2. Communicates with Control 4 to control any devices necessary in order to reach specified energy budget
- D. Solar Panel Prediction
  - 1. Model using System Advisor Model provided by the NREL.
  - 2. By inputting predictive weather data obtained from online weather stations, future solar outputs can be forecasted.
  - 3. Script automates feed of weather files in the TMY3 into SAM.
  - 4. Another script scraps internet websites for relevant upcoming weather information.
  - 5. SAM is run with data and the output is fed to planning software.
- E. HVAC Modeling
  - 1. DOE2.2 is a popular and versatile home thermal modeling software used to model home HVAC systems
  - 2. Runs PV predictions and weather data to find out what the predicted HVAC energy usage will be over a certain period of time
- F. Composer Pro
  - 1. Version 2.0.6.102864
  - 2. Allows modification to the HC-300's configuration
    - a. Can add devices that are to be controlled to the controller
    - b. Can program macros and scenes into controller
- G. HVAC Control Logic
  - 1. Custom HVAC Control Logic
    - a. Acquires thermal data from temperature and humidity sensors at specified locations in the house, and temperature data from thermocouples located throughout the thermal tank.

- b. The logic will determine how far off the temperature and humidity of the house is from the specified range for the competition.
  - c. Based on that data, it will control the HVAC Mitsubishi MSZ-FE09NA Indoor Unit and the solenoid valves to control air flow through the house and water flow through the custom HVAC/DHW system.
  - d. To be implemented on the Control4 Composer via Lua.
- H. Eragy Monitoring Plus
- 1. Supports eGauge multi-circuit power sensors and integrates energy monitoring with Control4 through the Eragy 4Store application.
  - 2. Provides end-user dashboard user interface including real time displays of energy usage and cost, circuit level displays and alert configurations.
  - 3. Eragy 4Store Application supports circuit level usage and cost charts and provides real-time circuit monitoring and real-time charting.

### Part 3 - EXECUTION

#### 3.1 Installation

- A. iPad / iPhone Home Controlling Application
  - 1. Can be downloaded onto the iOS-running device via the App Store.
- B. Composer Pro
  - 1. Needs to be installed by a Control4 license dealer.
  - 2. Any ambiguities should be resolved by consulting the manufacturer of the product.
- C. HVAC Control Logic
  - 1. Logic will be implemented on Control4 Composer.
  - 2. For hardware communication:
    - a. Use the Control 4 Composer software and HVAC MSZ-FE09NA Controller to program IR signals to the Control4 HC-300.
    - b. Connect the solenoid valves to the Contact Relays on the Control4 I/O extender.
    - c. Connect the Pico Thermocouple reader to the Control4 HC-300 with a USB connection.
  - 3. User interface will be implemented as an iPad application for the home iPad screen.
- D. Eragy Monitoring Plus
  - 1. Needs to be installed by a Eragy authorized dealer.
  - 2. Configure an Eragy Web account for Energy Monitoring and then download and install the Driverworks\_EragyEnergy.c4i Driver into Composer.
  - 3. Download and Install the Eragy Energy 4Store Application to your Navigator User Interface.

END OF SECTION

## Division 26 – Electrical

### SECTION 26 00 00 - COMMON WORK RESULTS FOR ELECTRICAL

#### Part 1- GENERAL

##### 1.1 Related Documents

- A. Solar Decathlon 2011 Rules
- B. Solar Decathlon 2011 Building Code
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section and to all following sections within Division 26

##### 1.2 Summary

- A. Section Includes
  1. Electrical equipment coordination and installation
  2. Common electrical installation requirements
  3. Components that are required to allow the project to function, including materials, labor, supervision, supplies, tools, equipment, and transportation.

##### 1.3 Section Requirements

- A. These specifications apply to all Division 26 as a set of minimum system requirements. The requirements of this section supersede requirements of other Sections of Division 26
  1. Compliance with the following codes:
    - a. Solar Decathlon 2011 Building Code
    - b. ASTM American Society of Testing Materials
    - c. IBC International Building Code
    - d. IRC International Residential Code
    - e. NEC National Electrical Code, NFPA 70
    - f. NECA National Electrical Contractors Association
    - g. NEMA National Electrical Manufacturer's Association
    - h. NFPA National Fire Protection Association
    - i. OSHA Occupational Safety and Health Act
    - j. UL Underwriter's Laboratories
  2. Compliance with applicable local rules and regulations

##### 1.4 Submittals

- A. Product data sheets

#### Part 2 – PRODUCTS

##### 2.1 Conductors and Cables

- A. See section 26 20 00 – Low-Voltage Electrical Distribution. Products selected comply with all requirements specified.

##### 2.2 Grounding Materials

- A. See section 26 05 26 – Grounding and Bonding for Electrical Systems

##### 1.3 Electrical Identification Materials

- A. See section 26 05 53 – Identification for Electrical Systems

### **Part 3 – EXECUTION**

#### **3.1**

- A. Perform all electrical work in compliance with applicable safety regulations, including OSHA regulations.
- B. All safety equipment required for compliance shall be provided by the Contractor

#### **3.2 Quality Assurance**

- A. All work and materials shall be in accordance with the requirements and codes listed above, as well as all requirements and codes applicable to the structure's terminal location.

### **END OF SECTION**

## SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

### Part 1 - GENERAL

#### 1.1 Summary

- A. Section Includes:
  - 1. Identification for electrical systems, in particular stickers and labeling
  - 2. Identification for raceways, conductors, and related cabling

#### 1.2 Related Sections

- A. Section 26 20 00 – Low-Voltage Electrical Distribution
- B. Section 48 14 00 – Solar Energy Electrical Power Generation Equipment
- C. Section 48 19 16 – Electrical Power Generation Inverters

#### 1.3 Section Requirements

- A. Submittals
  - 1. Product Data Sheet
- B. Building Code/Safety Guidelines:
  - 1. Comply with ANSI A13.1 and IEEE C2.
  - 2. Comply with NFPA 70.
  - 3. Comply with 29 CFR 1910.144 and 29 CFR 1910.145
  - 4. Comply with ANSI Z535.4 for safety signs and labels.
  - 5. Adhesive labeling materials shall comply with UL 969.
  - 6. Comply with NEC 2005 690.17, 690.53, and similar documents.
  - 7. Colors for 208/120-V Circuits:
    - a. Phase A: Black
    - b. Phase B: Red
    - c. Phase C: Blue

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Electricity Distribution Identification Materials
  - 1. Power Raceway Identification Materials (600V or less)
    - a. Product Requirements
      - i. Comply with ANSI A13.1 for size of letters
      - ii. Meet code requirements by ensuring colors of black letters on orange field and having legends indicating voltage and system type.
    - b. Self-Adhesive Vinyl Labels
      - i. Mechanical Data
        - 1. Preprinted, flexible labels with weather and chemical-resistant coating and matching wraparound adhesive tape.
    - c. Metal Tags
      - i. Mechanical Data
        - 1. Brass or aluminum, 2 x 2 x 0.05 in., with stamped legend.
    - d. Write-On Tags
      - i. Mechanical Data
        - 1. Permanent, waterproof, black ink marker as in tag manufacturer installation instructions.
  - 2. Conductor Identification Materials
    - a. Color-coding Conductor Tape
      - i. Mechanical Data
        - 1. Colored, self-adhesive vinyl tape not less than 3 mm thick by 1 in to 2 in wide.
    - b. Write-On Tags
      - i. Mechanical Data

1. Permanent, waterproof, black ink marker as in tag manufacturer installation instructions.
- B. Inverter and PV Panel Identification Materials
1. Inverter
    - a. Materials that may be opened by unqualified persons shall be marked with adhesive, as per 690.5C:
      - i. WARNING - ELECTRIC SHOCK HAZARD IF A GROUND FAULT IS INDICATED, NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED
  2. Switch or Circuit Breaker
    - a. Materials shall be marked with adhesive:
      - i. WARNING - ELECTRIC SHOCK HAZARD - DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION
  3. Inverter Output panelboard
    - a. Materials shall be marked with adhesive:
      - i. WARNING INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE
  4. PV Panels
    - a. Permanent adhesive label shall be applied near the PV disconnect switch with information including:
      - i. Operating Current (maximum power current)
      - ii. Open-Circuit Voltage
      - iii. Operating Voltage (maximum power voltage)
      - iv. Maximum Permissible System Voltage
      - v. Short-Circuit Current
      - vi. Maximum Power

### Part 3 - EXECUTION

#### 3.1 Installation

- A. Comply with section 260500 "Common Work Results for Electrical"
- B. Safety
  1. Label where appropriate.
- C. Implementation
  1. Follow manufacturer installation instructions

#### 3.2 Efficiency Testing

- A. Verify equipment is properly functioning

**END OF SECTION**

## SECTION 26 09 00 – LIGHTING CONTROL DEVICES

### Part 1 - GENERAL

#### 1.1 Summary

- A. Lighting controls for the building interior and exterior lights as well as motion and contact sensors to monitor the state of the house

#### 1.2 Related Sections

- A. 26 50 00 Lighting
- B. 25 14 00 Integrated Automation Local Control Unit

#### Section Requirements

- B. Submittals
  - 1. Product Data

### Part 4 - PRODUCTS

#### 4.1 Products

- A. Lighting Control Devices
  - 1. Control4 120V Wireless Dimmer C4-DIM1-Z
    - a. Product Specification
      - i. 108-132 VAC
      - ii. 60/50 Hz
      - iii. Power Consumption: 350 mW
      - iv. Minimum Load: 25 W
      - v. Control Communications: ZigBee
    - b. Manufacturer Information and Product Link
      - i. Product Link: <http://control4.com/files/products/data-sheets/Control4-120V-Lighting.pdf>
    - c. MSRP Price: \$129
  - 2. Control4 120V Wireless Outlet Switch LOZ-5S1
    - a. Product Specification
      - i. 108-132 VAC
      - ii. 60/50 Hz
      - iii. Power Consumption: 1.4-1.7 W
      - iv. Control Communications: ZigBee
    - b. Manufacturer Information and Product Link
      - i. Product Link: <http://control4.com/files/products/data-sheets/Control4-120V-Lighting.pdf>
    - c. MSRP Price: \$129
  - 3. Control4 120V Six Button Keypad KPZ-6B1-W
    - a. Product Specification
      - i. Programmable buttons: 6
      - ii. Power requirement: 1.4W LED off, 1.7W LED on
      - iii. Control Communications: ZigBee
    - b. Manufacturer Information and Product Link
      - i. Product Link: <http://www.control4.com/files/products/data-sheets/Control4-UI.pdf>
    - c. MSRP Price: \$179
- B. Lighting Control Sensors

1. Skylink PS-434A Motion Sensor
  - a. Product Specifications
    - i. Protects your home by detecting movement inside your house
    - ii. Motion detecting range: 40 feet by 110 degree arc.
    - iii. 9V Alkaline battery needed and included
    - iv. Low battery indication
    - v. FCC/IC approved
    - vi. CE Mark
    - vii. One year warranty
  - b. Manufacturer Information and Product Link
    - i. Installation-diagram:  
[http://www.skylinkhome.com/docs/manuals/security/PS434A\\_manual.pdf](http://www.skylinkhome.com/docs/manuals/security/PS434A_manual.pdf)
2. Honeywell Ademco 944TRE-WH 3/8" Contact with Terminals and Rare Earth Magnet (White)
  - a. Product Specifications
    - i. Switch Type: Form A (SPST) reed switch/closed when energized with rare earth actuator magnet
    - ii. Contact Rating: 100ma@ 28VDC
    - iii. Wiring: Screw terminals for wire gauge of 24 to 18awg solid or stranded wire
    - iv. dimensions: switch 3/8" diameter x 1.20", magnet 3/8" diameter x .125"
    - v. 3/8" diameter press fit design
    - vi. rare earth button magnet
    - vii. Standard gap: 1/2" (13mm)
    - viii. Staggered T Terminals ensure secure electrical connection
    - ix. color: white
  - b. Manufacturer Information and Product Link
    - i. Product-Specifications: <http://www.securitystoreusa.com/Ademco-944TRE-WH-3-8-Recessed-Contact-with-Scre-p/52227.htm>

## Part 5 - EXECUTION

### 5.1 Installation

- A. Follow Manufacturer instruction.
- B. Install 5 door contact sensors in the inside rim of all 4 windows/doors with two sensors in the southern most window
- C. Install the motion sensors in the southern most beam shelf so the majority of the home is in their detection range

## END OF SECTION

## SECTION 26 20 00 – Low-Voltage Electrical Distribution

### Part 1 - GENERAL

#### 1.1 Summary

- A. Section includes:
  - 1. Wiring diagram for lights, switches, and outlets in the house

#### 1.2 Related Sections

- A. Section 26 05 00 – Common Work Results for Electrical
- B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
- C. Section 26 06 00 – Schedules for Electrical
- D. Section 26 30 00 – Facility Electrical Power Generating and Storing

#### 1.3 Section Requirements

- A. Submittals
  - 1. Load schedule
  - 2. Wiring diagram for lights and switches
  - 3. Wiring diagram for electrical outlets
- B. Building Code/Safety Guidelines:
  - 1. Tamper resistant receptacles in dwelling unit (applies to all 125-volt, 15- and 20-ampere receptacles)
  - 2. Weatherproof enclosures for receptacles in damp or wet locations
  - 3. Arc Fault Circuit Interrupter Protection
  - 4. Ground Fault Circuit Interrupter
  - 5. Electrical equipment must carry approved testing agency's listings or be approved by the official decathlon electrical inspector
  - 6. Provided with two modified grounding electrodes placed a minimum of 10 ft apart. Specific characteristics of the electrodes are 12 in. by 12 in. (30.5 cm by 30.5 cm) copper or copper-plated plate, 0.25 in. (0.64 cm) in thickness. The electrode plate shall be provided with a 0.625 in (1.59 cm) nominal diameter hole in the center containing a 0.625 in (1.59 cm) diameter ground rod that extends 18 in. (46 cm) below the plate and 2 in. (5.1 cm) above the plate.

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Wires
  - 1. AWG #14 Wire
    - a. Product Specifications
      - i. Grainger Item #6X794
      - ii. Weight 8.5 lbs
      - iii. **Wire Type:** THHN
      - iv. **Stranding:** 19
      - v. **Temp. Rating (F):** 194
      - vi. **Nominal Outside Dia. (In.):** 0.109
      - vii. **Jacket:** Nylon
      - viii. **Insulation:** PVC
      - ix. **Spool Length:** 500 Ft.
      - x. **Standards:** UL,E34382
      - xi. 500 ft. length

- b. Electrical Data
  - i. **Voltage:** 600
  - ii. **Max. Amps:** 15
- c. <http://www.grainger.com/Grainger/THHN-Wire-6X794?Pid=search>
- 2. AWG #12 Wire
  - a. Product Specifications
    - i. Part Number 7587K2 in McMaster-Carr
    - ii. Stranded Single-Conductor Wire
    - iii. UL 1007/1569
    - iv. Outer Diameter (in): 0.125
    - v. 200 ft length
  - b. Electrical Data
    - i. 45 Amps
  - c. [http://www.mcmaster.com/#about-american-wire-gauge-\(awg\)/=9rmlpl](http://www.mcmaster.com/#about-american-wire-gauge-(awg)/=9rmlpl)
- 3. AWG #1 Wire
  - a. Product Specifications
    - i. Grainger Item #4WZR8
    - ii. Weight 154.0 lbs
    - iii. **Wire Type:** THHN
    - iv. **Stranding:** 19
    - v. **Temp. Rating (F):** 194
    - vi. **Nominal Outside Dia. (In.):** 0.435
    - vii. **Jacket:** Nylon
    - viii. **Insulation:** PVC
    - ix. **Spool Length:** 500 Ft.
    - x. **Standards:** UL
  - b. Electrical Data
    - i. **Voltage:** 600
    - ii. **Max. Amps:** 130
  - c. <http://www.grainger.com/Grainger/Building-Wire-4WZR8?Pid=search>
- B. Receptacles
  - 1. Leviton 12650-I 15 Amp, 125 Volt, Co/Alr Duplex Receptacle, Straight Blade, Residential Grade, Ivory
    - a. Product Specifications
      - i. 15 Amp
      - ii. 125 Volt
      - iii. NEMA 5-15R
      - iv. 2P
      - v. 3W
      - vi. CO/ALR Duplex Receptacle
      - vii. Straight Blade
      - viii. Residential Grade
      - ix. Grounding
      - x. Side Wired
      - xi. Steel Strap
      - xii. Weight: 3.2 oz
    - b. [http://www.amazon.com/gp/offer-listing/B000HEIU24/ref=dp\\_olp\\_new?ie=UTF8&condition=new](http://www.amazon.com/gp/offer-listing/B000HEIU24/ref=dp_olp_new?ie=UTF8&condition=new)
  - 2. Leviton X7599-W SmartlockPro Slim GFCI Tamper-Resistant Receptacle with LED Indicator, 15-Amp, White
    - a. Product Specifications
      - i. 15 Amp
      - ii. 125 Volt

- iii. NEMA 5-15R
  - iv. 2P
  - v. 3W
  - vi. GFCI Duplex Receptacle
  - vii. Grounding, Self-Grounding
  - viii. Side Wired
  - ix. Tamper-resistant, as in accordance with NEC 2008 406.11: Tamper-Resistant Receptacles in Dwelling Units
  - b. [http://www.amazon.com/gp/offer-listing/B0048WPV4Q/ref=dp\\_olp\\_new?ie=UTF8&qid=1304146962&sr=8-4&condition=new](http://www.amazon.com/gp/offer-listing/B0048WPV4Q/ref=dp_olp_new?ie=UTF8&qid=1304146962&sr=8-4&condition=new)
  - c. [http://www.leviton.com/OA\\_HTML/ibeCCTpltmDspRte.jsp?item=680338&section=33614&minisite=10051&language=US](http://www.leviton.com/OA_HTML/ibeCCTpltmDspRte.jsp?item=680338&section=33614&minisite=10051&language=US)
3. Leviton W7599-TRW 15 Amp, 125 Volt, SmartlockPro GFCI Duplex Receptacle, Weather-Resistant, Tamper- Resistant, White
- a. Product Specifications
    - i. 15 Amp
    - ii. 125 Volt
    - iii. NEMA 5-15R
    - iv. 2P
    - v. 3W
    - vi. GFCI Duplex Receptacle
    - vii. Grounding, Self-Grounding
    - viii. Side Wired
    - ix. Tamper-resistant, as in accordance with NEC 2008 406.11: Tamper-Resistant Receptacles in Dwelling Units
    - x. Weather-resistant, as in accordance with 406.8(B)(1): 15- and 20-Ampere Receptacles in a Wet Location
  - b. [http://www.amazon.com/gp/offer-listing/B0038OMTH2/ref=dp\\_olp\\_new?ie=UTF8&qid=1304149413&sr=1-3&condition=new](http://www.amazon.com/gp/offer-listing/B0038OMTH2/ref=dp_olp_new?ie=UTF8&qid=1304149413&sr=1-3&condition=new)
4. Discount Weatherproof Electrical Outlet Box, 2-13/16" X 4-9/16" X 2-3/16", 3/4" Holes, Die Cast Aluminum, Ace Hardware 31654
- a. Product Specifications
    - i. Weatherproof
    - ii. Measurements: 2 13/16" x 4 9/16" x 2 3/16"
    - iii. Single gang outlet box 3-3/4" holes
    - iv. Volume: 18.3 cubic inches
    - v. Includes 2 closure plugs, mounting lugs, and ground screw
    - vi. Powder coat finish
    - vii. Aluminum die-cast
  - b. <http://www.buyacehardware.com/ace-weatherproof-outlet-box-31654.html>
5. Carlon HB1DP Single Gang Handy Box Duplex Outlet Cover
- a. Product Specifications
    - i. Includes Corrosion Resistant Stainless Steel Screws
    - ii. Solid PVC Construction
  - b. <http://www.thegreathardwarestore.com/Thomas-Betts-DPLX-Handy-BX-Cover-HB1DP-p/860874.htm?click=2744>

## Part 3 - EXECUTION

### 3.1 Installation

#### A. Requirements

1. Must follow guidelines in the National Electrical Code Handbook as well as SD rules

2. Kitchen and bathroom need to be on their own circuit
  3. Need GFCI breakers for the kitchen and bathroom circuits
- B. Safety
1. Do not stick objects that are not electrical plugs into outlets
  2. Do not strip wires of insulating jacket
  3. Work only in dry conditions, with dry products and dry tools
- C. Implementation
1. Follow manufacturer installation instructions when available

## 2.2 Testing

- A. Verify equipment is properly wired and set up properly
- B. Verify equipment is properly functioning

**END OF SECTION**

## SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### Part 1 - GENERAL

#### 1.1 Summary

- A. Section Includes:
  - 1. Components of Photovoltaic Power System, Connection to Grid

#### 1.2 Related Sections

- A. Section 481400 – Solar Energy Electrical Power Generation Equipment
- B. Section 481916 – Electrical Power Generation Inverters

#### 1.3 Section Requirements

- A. Submittals
  - 1. Product Data Sheet
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Fusible and Nonfusible Switches
  - 1. Fusible Switches
    - a. Comply with UL 50
  - B. Enclosures
    - 1. SQUARE D QO148L125GRB Load Center
      - a. Product Requirements
        - i. UL Listed
      - b. Product Description
        - i. Product combines AC loads from inverters
      - c. Product Specifications
        - i. Electrical Data

1. Main Type	Fixed – Factory installed main lugs
2. Maximum Single Pole Circuits	8
3. Maximum Tandem Circuit Breakers	4
4. Phase	1-phase
5. Spaces	4
6. Ampere Rating	125A
7. Voltage Rating	120/240VAC
8. Wire Size	#12 to #2/0 AWG (Al), #14-#2/0 AWG (Cu)
9. Wire Configuration	3-wire
10. Short Circuit Current Rating	10kA
        - ii. Mechanical Data

1. Dimensions WxHxD	4.81 x 9.30 x 3.19 in
2. Cover Type	Surface
3. Bus Material	Tin Plated Copper
4. Enclosure Type	Outdoor
5. Enclosure Rating	NEMA 3
6. Grounding Bar	Included
      - d. Manufacturer Information and Product Link

- i. Product Info Page: <http://ecatalog.squared.com/fulldetail.cfm?partnumber=QO148L125GRB>
- ii.
- 2. SQUARE D QO142L225GRB Load Center
  - a. Product Requirements
    - i. UL Listed
  - b. Product Description
    - i. Main Load Center for House
  - c. Product Specifications
    - i. Electrical Data
 

1. Main Type	Fixed – Factory installed main lugs
2. Maximum Single Pole Circuits	42
3. Maximum Tandem Circuit Breakers	0
4. Phase	1-phase
5. Spaces	42
6. Ampere Rating	225A
7. Voltage Rating	120/240VAC
8. Wire Size	#300 to #6 AWG (Al/Cu)
9. Wire Configuration	3-wire
10. Short Circuit Current Rating	65kA
    - ii. Mechanical Data
 

1. Dimensions WxHxD	37.98 x 14.75 x 4.52 in
2. Cover Type	Surface
3. Bus Material	Tin Plated Copper
4. Enclosure Type	Outdoor
5. Enclosure Rating	NEMA 3
6. Grounding Bar	Included
  - d. Manufacturer Information and Product Link
    - i. Product Info Page: <http://ecatalog.squared.com/fulldetail.cfm?partnumber=QO142L225GRB>

### Part 3 - EXECUTION

#### 3.1 Installation

- A. Comply with section 260500 “Common Work Results for Electrical”
- B. Follow manufacturer installation instructions
- C. Solar Load Center
  - 1. Square D-QO24L70S Solar Load Center
    - a. Product Requirements
      - i. Meets NEC 690.64(B) requirements
    - b. Product Specifications
      - i. Electrical Data
 

1. Bus amp rating	70 A
2. Voltage rating	120/240VAC
3. Max Wire in Main Lug	# 4
4. Wire Size	#12 to 3 AWG(Al) - #14 to 4 AWG(Cu)
5. Wiring Configuration	3-Wire
6. Max Single Pole Circuits	4
7. Max Tandem Circuit Breakers	2
8. Phase	1-phase
9. Short Circuit Current Rating	10 kAmp
      - ii. Mechanical Data
 

1. Main Type	Fixed - Factory installed main lugs
--------------	-------------------------------------

- |    |                  |                        |
|----|------------------|------------------------|
| 2. | Module Area      | 13.56 ft <sup>2</sup>  |
| 3. | Weight           | 35.3 lbs               |
| 4. | Dimensions HxWxD | 9.30 x 4.81 x 3.19 in. |
| 5. | Depth            | 3.19 in                |
| 6. | Spaces(single)   | 2                      |
| 7. | Bus Material     | Tin Plated Aluminum    |
- iii. Misc. Data
- |    |                  |                        |
|----|------------------|------------------------|
| 1. | Ground kit       | PK4GTA                 |
| 2. | Enclosure Type   | Indoor                 |
| 3. | Box Number       | 2                      |
| 4. | Cover            | Surface (without door) |
| 5. | Enclosure Rating | NEMA1                  |
- c. Manufacturer Information and Product Link
- i. Manufacturer Web Site:  
<http://static.schneider-electric.us/docs/Electrical%20Distribution/Load%20Centers/QO%20Three%20Phase%20Load%20Centers/1100CT0501.pdf>

**END OF SECTION**

## SECTION 26 31 00 – PHOTOVOLTAIC COLLECTORS

### Part 1 – GENERAL

#### 1.1 Summary

- A. Section Includes:
  - 1. Photovoltaic Modules for Electricity Generation

#### 1.1 Related Sections

- A. Section 48 14 00 – Solar Energy Electrical Power Generation Equipment
- B. Section 48 19 16 – Electrical Power Generation Inverters

#### 1.2 Section Requirements

- A. Submittals
  - 1. Product Data Sheet

### Part 2- PRODUCTS

#### 2.1 Products

- A. Photovoltaic Modules
  - 2. Bosch Solar Module c-Si M 60 235 Wp
    - a. Product Requirements
      - i. Meets UL 1703 requirements
      - ii. Meets cUL requirements
      - iii. Meets CEC requirements
      - iv. Meets IEC 61215 and 61730-1 requirements
    - b. Product Specifications
      - i. Electrical Data
        - 1. Peak Power: 235 W
        - 2. Vpm 29.41 V
        - 3. Ipm 7.99 A
        - 4. Voc 36.48 V
        - 5. Isc 8.47 A
        - 6. Max System Voltage 600 V
        - 7. Watts per sqft 13.31 W/ft<sup>2</sup>
        - 8. Reverse-current load capacity 17A
        - 9. Maximum series fuse 15A
      - ii. Mechanical Data
        - 1. Module Area 17.65 ft<sup>2</sup>
        - 2. Weight 51.81 lbs
        - 3. Dimensions LxWxH 64.57 x 39.37 x 1.65 in.
        - 4. Snow and Wind Load 30 PSF
        - 5. Cable Size #14-4 AWG
        - 6. Cable Connectors MC4™ Locking Connectors
      - iii. Misc. Data
        - 1. Ambient Operating Temperature -45°C to 85°C
        - 2. Fire Safety Classification Class C
    - c. Manufacturer Information and Product Link
      - i. Installation (US/Canada):  
[http://www.bosch-solarenergy.com/fileadmin/downloads/Datenblaetter/en\\_Montageanleitung\\_Solon\\_Modules\\_2spaltig.pdf](http://www.bosch-solarenergy.com/fileadmin/downloads/Datenblaetter/en_Montageanleitung_Solon_Modules_2spaltig.pdf)

- ii. Datasheet:  
[http://www.bosch-solarenergy.com/fileadmin/downloads/Datenblaetter/Bosch\\_Solar\\_Module\\_c\\_Si\\_M\\_60\\_englisch.pdf](http://www.bosch-solarenergy.com/fileadmin/downloads/Datenblaetter/Bosch_Solar_Module_c_Si_M_60_englisch.pdf)

## Part 3 – EXECUTION

### 3.1 Installation

A. Comply with section 260500 “Common Work Results for Electrical”

B. Safety

1. Cover the entire front surface of the PV modules with a dense, opaque material during installation and handling.
2. Work only in dry conditions, with dry modules and dry tools
3. Do not stand or step on a module
4. Do not drop anything on the surfaces of a module
5. Do not drop a module
6. Do not puncture, cut, scratch, or damage the back sheet of the module
7. Completely ground all modules
8. There are no user serviceable parts within the module or junction box. Do not disassemble a module, attempt any repair, open the junction box cover, nor remove any part installed by the manufacturer
9. Unauthorized persons except qualified licensed professional should not do the wiring.
10. Wear clothing that will protect a minimum of 30 VDC
11. Wear non-slip gloves and carry modules by the frame with at least two persons
12. Do not carry a module by its wires or junction box
13. Do not touch the junction box terminals
14. Do not change the wiring of bypass diodes.

C. Implementation

1. Follow manufacturer installation instructions
2. Earth Grounding Solar Panels
  1. Should be in accordance with NEC Article 250.
3. Grounding shall be done in accordance with NEC 2008 regulations, i.e. grounding via inverter.
4. Mounting shall be done in accordance with section 05 14 13 – Architecturally Exposed Structural Aluminum Framing

3.2 Efficiency Testing

- A. Verify equipment is properly wired and set up properly
- B. Verify equipment is properly functioning

**END OF SECTION**

## SECTION 26 51 00 – INTERIOR LIGHTING

### Part 4 - GENERAL

#### 4.1 Summary

- A. This section includes information on the indoor lighting. These include the:
  - 1. Lighting Science Definity A19 LED Bulb
  - 2. Lighting Science Definity PAR20 LED Bulb
  - 3. Lighting Science Definity PAR30 LED Bulb
  - 4. MP Lighting L121 S28
  - 5. Elite Lighting LED-4 4" LED Downlight
  - 6. Elite Lighting SL2-LED Festoon Cove Light
  - 7. Elite Lighting EUM-LED LED Link Slim Undercabinet

#### 4.2 Related Sections

- A. 265113 for related trims and fixtures.
- B. 265613 for related exterior lighting

#### 4.3 Section Requirements

- A. Submittals
  - 1. Product Data Table
  - 2. Lighting Design (2D)
- B. Fixtures, Trims, Electrical Components, Devices, and Accessories
- C. Comply with National Electrical Safety Code

### Part 5 - PRODUCTS

#### 5.1 Products

- A. LED Bulb
  - 1. Lighting Science Definity A19 LED Bulb
    - a. Product Description and/or specifications
      - i. Power Consumption: 8 Watts
      - ii. Input Voltage: 120 VAC or 230 VAC
      - iii. Efficacy: 51lm/w
      - iv. Color Temperature: 4000k
      - v. CRI: 90
      - vi. Lumen output: 410
      - vii. Lifespan: 50,000 hours with 70% lumen depreciation
      - viii. Overall Length: 112mm
      - ix. Diameter: 60mm
      - x. Weight: 0.033lb, 0.15kg, 278gz
      - xi. Color: Neutral White
      - xii. Operating Temperature: -20°C to 40°C
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Lighting Science
      - ii. Model: DFN 19 NW 12
      - iii. [http://www.lsgc.com/commercial/products/product-family/interior/definity\\_lamps/A19](http://www.lsgc.com/commercial/products/product-family/interior/definity_lamps/A19)

2. Lighting Science Definity PAR20 LED Bulb
    - a. Product Description and/or specifications
      - i. Power Consumption: 8 Watts
      - ii. Input Voltage: 120 VAC or 230 VAC
      - iii. Efficacy: 44lm/w
      - iv. Color Temperature: 4000k
      - v. CRI: 88
      - vi. Lumen output: 350
      - vii. Lifespan: 50,000 hours with 70% lumen depreciation
      - viii. Overall Length: 85.08mm, 3.35in
      - ix. Diameter: 64mm, 2.5in
      - x. Beam Spread: 40°
      - xi. Weight: 0.33lbs, 0.15kg
      - xii. Color: Neutral White (flood)
      - xiii. Operating Temperature: -20°C to 40°C
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Lighting Science
      - ii. Model: DFN 20 NW FL 12
      - iii. [http://www.lsgc.com/commercial/products/product-family/interior/definity\\_lamps/PAR20](http://www.lsgc.com/commercial/products/product-family/interior/definity_lamps/PAR20)
  3. Lighting Science Definity PAR30 LED Bulb
    - a. Product Description and/or specifications
      - i. Power Consumption: 15 Watts
      - ii. Input Voltage: 120 VAC or 230 VAC
      - iii. Efficacy: 53lm/w
      - iv. Color Temperature: 4000k
      - v. CRI: 87
      - vi. Lumen output: 800
      - vii. Lifespan: 50,000 hours with 70% lumen depreciation
      - viii. Overall Length: 118.24mm, 4.66in
      - ix. Diameter: 96mm, 3.79in
      - x. Beam Spread: 40°
      - xi. Weight: 0.099lbs, 0.45kg
      - xii. Color: Neutral White (flood)
      - xiii. Operating Temperature: -20°C to 40°C
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Lighting Science
      - ii. Model: DFN 30 NW FL 120
      - iii. [http://www.lsgc.com/commercial/products/product-family/interior/definity\\_lamps/PAR30](http://www.lsgc.com/commercial/products/product-family/interior/definity_lamps/PAR30)
- B. LED Downlight
1. Elite Lighting LED-4 4" LED Downlight
    - a. Product Description and/or specifications
      - i. Power Consumption: 11 Watts
      - ii. Voltage: 120V

- iii. Input Frequency: 50/60Hz
    - iv. Input Current: 92mA
    - v. LED Driver Current: 900mA
    - vi. Lifetime: 50,000 hours
  - b. Manufacturer Information and Product Link
    - i. Manufacturer: Elite Lighting
    - ii. Model: LED-4
    - iii. <http://www.iuseelite.com/en/product.php?p=led-4>
- C. Xenon Bulbs
  - 1. Hinkley Lighting MR16 Xenon Lamps (for Hinkley Lighting Fixtures)
    - a. Product Description and/or specifications
      - i. Power Consumption: 20 Watts
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Hinkley Lighting
      - ii. Model: MR16
- D. Linear LED Luminaire
  - 1. Elite Lighting SL2-LED Festoon Cove Light
    - a. Product Description and/or specifications
      - i. Power Consumption: 3 watt/ft
      - ii. Voltage: 12V
      - iii. Lifespan: 50,000 hours
      - iv. Color: Warm White
      - v. Lamp Spacing: 3" O.C.
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Elite Lighting
      - ii. Model: SL2-LED
      - iii. <http://www.iuseelite.com/en/product.php?p=sl2-led>
  - 2. Elite Lighting EUM-LED LED Link Slim Undercabinet
    - a. Product Description and/or specifications
      - i. Power Consumption: 3.3 watt/ft
      - ii. Light Intensity: 160 lumens/ft
      - iii. Voltage: 24V
      - iv. Lifespan: 50,000 hours
      - v. Length: 12"
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Elite Lighting
      - ii. Model: EUM-LED
      - iii. <http://www.iuseelite.com/en/product.php?p=eum-led>
- E. Recessed Strip LED Light
  - 1. MP Lighting L121 S28
    - a. Product Description and/or specifications
      - i. Power Consumption: 1.9 watt/ft
      - ii. Input Current: 80mA/ft

- iii. Input Voltage: 120V or 277V
- iv. Output Voltage: 24VDC
- v. Overall Length: 1219mm
- vi. Width: 111mm
- vii. Weight: 16.08lb, 7.3kg
- viii. Beam Spread: 120°
- b. Manufacturer Information and Product Link
  - i. Manufacturer: MP Lighting
  - ii. Model: L121 S28
  - iii. [http://www.mplighting.com/pdf/spec/L/L121\\_spec.pdf](http://www.mplighting.com/pdf/spec/L/L121_spec.pdf)

## **Part 6 - EXECUTION**

### 6.1 Installation

- A. Comply with all manufacturer's written recommendations and specifications

**END OF SECTION**

## SECTION 265113 - INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

### Part 1 - GENERAL

#### 1.1 Summary

- A. This section includes information on the indoor lighting fixtures. These include the:
  1. Definity A19 Fixtures (Quorum International 6822-65 Large Pendant Light)
  2. Elite Lighting LED-4 Trim (LED-1402)
  3. George Kovacs Reading Room Collection Wall Lamp
  4. Natural Light Electric Light Kit
  5. Natural Light 13" Flat Roof Flashing

#### 1.2 Related Sections

- A. Section 265100 for related interior lighting.

#### 1.3 Section Requirements

- A. Submittals
  1. Product Data Table
  2. Lighting Design Floor Plan (2D)

### Part 2 - PRODUCTS

#### 2.1 Products

##### A. Fixtures

1. Quorum International 6822-65 Large Pendant Light (for Definity A19 LED Light Bulb)
  - a. Product Description and/or specifications
    - i. Shade Size: W 16" x H 8"
    - ii. Mounting: 6' Black Wire (Adjustable)
    - iii. Shade Finish: Satin Nickel
    - iv. Max Wattage Per Socket: 150W Standard Incandescent
    - v. Number of Sockets: 1
  - b. Manufacturer Information and Product Link
    - i. Manufacturer: Quorum International
    - ii. Model: 6822-65
    - iii. <http://www.quoruminternational.com/index.cfm?do=app.productDetails&product=6822-65>

##### B. Trims

1. Elite Lighting EX-4114 (for Elite Lighting EX4-LED)
  - a. Product Description and/or specifications
    - i. Reflector Finish: Natural Metal
    - ii. Ring Finish: White
    - iii. Opening Dimensions: 6-1/2"
  - b. Manufacturer Information and Product Link
    - i. Manufacturer: Nora Lighting
    - ii. Model: NT-5021N[http://www.noralighting.com/catalog/lighting/Reflector\\_Cone\\_Trim-8477-0.html](http://www.noralighting.com/catalog/lighting/Reflector_Cone_Trim-8477-0.html)

##### C. Lamps

1. George Kovacs Reading Room Collection Wall Lamp (for Bedside Definity A19 LED Light Bulb)
  - a. Product Description and/or specifications
    - i. Finish: Brushed Nickel
    - ii. Size: 5"W x 21 1/2"H x 21 1/2"Ext
    - iii. Glass/Shade: Metal
    - iv. Max: 1-50W GU10 Halogen
  - b. Manufacturer Information and Product Link
    - i. Manufacturer: George Kovacs
    - ii. Model: P254-084
    - iii. <http://www.minka.com/ProductDetails.aspx?id=16726&brand=George%20Kovacs%C2%AE&sku=P254-084&name=Wall%20Lamp>
- D. Light Tube Accessories
  1. Natural Light Electric Light Kit
    - a. Product Description and/or specifications
      - i. Type: Single Bulb
      - ii. Bulbs Supported: CFL, LED
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Natural Light
      - ii. <http://www.nltubular.com/skylight-models/13-tubular-skylight.html#>
  2. Natural Light 13" Flat Roof Flashing
    - a. Product Description and/or specifications
      - i. Interior Diameter: 13.375"
      - ii. Exterior Diameter: 27.635"
      - iii. Height: 5.5"
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Natural Light
      - ii. <http://www.nltubular.com/skylight-models/13-tubular-skylight.html>

### Part 3- EXECUTION

#### 2.2 Installation

- A. Comply with all manufacturers' written recommendations and specifications

**END OF SECTION**

## SECTION 265613 - LIGHTING POLES AND STANDARDS

### Part 1 - GENERAL

#### 1.1 Summary

- A. This section includes information on the outdoor lighting fixtures including the:
  - 1. Hinkley Lighting Atlantis Light Rectangle Outdoor Wall Light No. 164
  - 2. Hinkley Atlantis Light Exterior Wall Sconce No. 164b

#### 1.2 Related Sections

- A. Section 265600 for related exterior lighting.

#### 1.3 Section Requirements

- A. Submittals
  - 1. Product Data Table
  - 2. Lighting Design Floor Plan for Exterior Lighting (2D)

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Fixture
  - 1. Hinkley Lighting Atlantis Light Rectangle Outdoor Wall Light No. 164
    - a. Product Description and/or specifications
      - i. Width: 2.75"
      - ii. Height: 16"
      - iii. Depth: 6.75"
      - iv. Finish: Titanium
      - v. Material: Aluminum, etched glass lens
      - vi. Max Wattage Per Socket: 20W MR16 Xenon Lamps
      - vii. Voltage: 120V
      - viii. Number of Sockets: 2
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Hinkley Lighting
      - ii. Model: 1644TT
      - iii. <http://www.hinkleylighting.com/products/product-detail.aspx?pid=1700>
  - 2. Hinkley Lighting Light Exterior Wall Sconce No. 164b
    - a. Product Description and/or specifications
      - i. Width: 6"
      - ii. Height: 16"
      - iii. Finish: Titanium
      - iv. Material: Aluminum, etched glass lens
      - v. Max Wattage Per Socket: 20W MR16 Xenon Lamps
      - vi. Voltage: 120V
      - vii. Number of Sockets: 2
    - b. Manufacturer Information and Product Link
      - i. Manufacturer: Hinkley Lighting
      - ii. Model: 1648TT
      - iii. <http://www.hinkleylighting.com/products/product-detail.aspx?pid=1700>

- B. Xenon Lamps
  - 1. MR16 Xenon Lamps (for Hinkley Lighting Fixtures)
    - a. For product description and manufacturer information, refer to SECTION 265100 – INTERIOR LIGHTING under the PRODUCTS part.

**Part 3 - EXECUTION**

3.1 Installation

- A. Comply with all manufacturers' written recommendations and specifications

**END OF SECTION**

## Division 27 – Communications

### SECTION 27 15 00 – Communications Horizontal Cabling

#### PART 1 - GENERAL

##### Part 1 - Summary

- ii. This section includes all Audio Video Communications Horizontal Cabling
- iii. This section includes all RJ cable, connectors, and terminators.
- iv. This section includes all wall plates for Data, Telecom, and A/V Cable and connectors
- 1. Related Sections
  - i. 27 21 00 - Data Communications Network Equipment
  - ii. 27 41 16 - Integrated Audio-Video Systems and Equipment
- 2. Section Requirements
  - i. Submittals
    - 1. Manufacturer specifications and instructions for all products in products section
- 3. Quality Assurance
  - i. 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.
  - ii. Comply with NFPA 70.
  - iii. Grounding: Comply with ANSI-J-STD-607-A.

##### Part 2 PRODUCTS

###### a. Products

- A. Audio Video Cabling
  - 1. Speaker Cable
    - a. 12 AWG copper
    - b. CL2 rated for in-wall use
    - c. 50 ft
    - d. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=2816](http://www.monoprice.com/products/product.asp?p_id=2816)
  - 2. HDMI Cable
    - a. High Speed
    - b. 30 ft Male to Male
    - c. CL2 rated for in-wall use
    - d. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=3990](http://www.monoprice.com/products/product.asp?p_id=3990)
  - 3. Digital Coax Cable
    - a. 25 ft with Male/Male RCA connectors
    - b. 75 ohm
    - c. CL2 rated for in-wall use
    - d. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=2683](http://www.monoprice.com/products/product.asp?p_id=2683)
  - 4. USB Cable
    - a. 33ft, active
    - b. Male B to Male A
    - c. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=7531](http://www.monoprice.com/products/product.asp?p_id=7531)
- B. Network Cabling
  - 1. Cat6 UTP unterminated
    - a. 23AWG Solid, PVC jacket

- b. CMR rating for in-wall use
- c. UL Listed
- d. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=2263](http://www.monoprice.com/products/product.asp?p_id=2263)
- 2. Cat6 termination
  - a. RJ45 punchdown keystone jack
  - b. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=5384](http://www.monoprice.com/products/product.asp?p_id=5384)
- C. Wall Plates and Connectors
  - 1. Keystone Wall Plates
    - a. 2 hole, single-gang
    - b. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=6727](http://www.monoprice.com/products/product.asp?p_id=6727)
  - 2. HDMI keystone
    - a. Female to female coupler
    - b. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=6852](http://www.monoprice.com/products/product.asp?p_id=6852)
  - 3. 5.1 Surround Sound Distribution Wall Plate
    - a. NEMA 2-gang wall plate
    - b. Banana plugs on outside, banana plugs or bare wires in wall
    - c. Subwoofer connection is RCA coupler
    - d. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=4012](http://www.monoprice.com/products/product.asp?p_id=4012)
  - 4. Patch Panel
    - a. 24 ports (expect to use 13 ports)
    - b. RJ-45 punchdown jacks
    - c. Monoprice - [http://www.monoprice.com/products/product.asp?p\\_id=7253](http://www.monoprice.com/products/product.asp?p_id=7253)

### Part 3 EXECUTION

- 3. Installation
  - i. Follow Manufacturer's Instructions
  - ii. Ethernet terminations shall use T568B pinout
- 2. Testing
  - i. Ethernet terminations shall be continuity tested to ensure that all 8 conductors are properly connected

END OF SECTION

## SECTION 27 21 00 – Data Communications Network Equipment

### Part 1 - GENERAL

#### 1.1 Summary

- A. This section details any networking and data communications hardware.

#### 1.2 Related Sections

- A. 27 22 00 – Data Communication Hardware

#### 1.3 Section Requirements

- A. Submittals
  - 1. See product data

#### 1.4 Quality Assurance

- A. Devices, electrical components, and accessories listed as defined in NFPA 70, Article 100, marked for intended use
- B. Complies with NFPA 70

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Data communication routers
  - 1. D-Link DIR-601 Wireless-N 150 Router
    - a. Product Description
      - i. Dimensions: 1.2"H x 4.4"W x 5.7"D
      - ii. Weight: 0.1 lbs
      - iii. IEEE 802.11g
      - iv. IEEE 802.3
      - v. IEEE 802.3 u
      - vi. Wi-Fi Protected Access™ (WPA/WPA2)
      - vii. WI-FI Protected Setup (WPS)
      - viii. 4 10/100 LAN Ports
      - ix. 1 10/40 WAN Port
    - b. Manufacturer Information and Product Link
      - i. Product link: <http://www.dlink.com/dir-601>
    - c. MSRP Price: \$49.99
- B. Non IP Network
  - 1. Control4 IO Extender: C4-IOX-E-B
    - a. Product Description
      - i. Status LEDs: 4
      - ii. Serial Ports (Male DB9 RS232): 4
      - iii. IR Outputs: 8
      - iv. Contacts: 8
      - v. Relays: 8
      - vi. Network Connectivity: 10/100 BaseT Ethernet
      - vii. Voltage: 100-240 VAC
      - viii. Amps 0.55 A
      - ix. Hertz : 50-60 Hz
      - x. Wattage: 30 W

- xi. HxWxD: 1.59" x 16.84" x 6.44" (36.5mmx217mmx127mm)
- xii. Weight: 4.8lbs/2.18 Kgs
- b. Manufacturer Information and Product Link
  - i. Product link: <http://www.control4.com/files/products/data-sheets/Control4-IOExtender-datasheet.pdf>
  - ii. Manufacturer information: <http://www.control4.com>
- c. MSRP Price: \$399

### **Part 3 - EXECUTION**

#### **3.1 Installation**

- A. Requirements
  - 1. Follow instructions from product installation manuals and relevant NEC codes

**END OF SECTION**

## SECTION 27 22 00 – Data Communications Hardware

### Part 1 - GENERAL

#### 1.1 Summary

- A. This section details any data communication hardware intended to be used directly by the user

#### 1.2 Related Sections

- A. Section 272100 – Data Communication Hardware

#### 1.3 Section Requirements

- A. Submittals
  - 1. Product Data

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Communication Devices

- 1. Apple iPad

- a. Product Requirements

- i. Wi-Fi Certified 802.11a, 802.11b, 802.11g, or 802.11n. Internet Connection recommended
    - ii. PC or Mac with USB 2.0
    - iii. Charging through power adapter or USB to computer system

- b. Product Description and/or specifications

- i. Dimensions: 9.6 in x 7.3 in x 0.3 in (241 mm x 186 mm x 9 mm)
    - ii. Weight: 1.33 lb (603 g)
    - iii. Wi-Fi Certified 802.11a, 802.11b, 802.11g, or 802.11n network router
    - iv. Bluetooth 2.1 + EDR technology
    - v. Built-in 25-watt-hour rechargeable lithium-polymer battery
    - vi. Up to 10 hours of surfing the web on Wi-Fi, watching video, or listening to music

- c. Manufacturer Information and Product Link

- i. <http://www.apple.com/ipad/>

- 2. [PointOn](#)

- a. [Hardware Product Requirements: Kinect](#)

- i. Horizontal Field: 57 Degrees
    - ii. Vertical Field: 43 Degrees
    - iii. Tilt Range: 27 Degrees
    - iv. 320 x 240 16-bit depth @ 30 frames/sec
    - v. 640x 480 32-bit color @ 30 frames/sec
    - vi. 16 bit audio @ 16kHz
    - vii. Power: 12 W

- b. Manufacturing Information and Product Link

- i. Product Link: <http://www.xbox.com/en-US/kinect>

- c. Software:

- i. OpenNI- Framework for Kinect
      - 1. Translates data stream into 3D map

2. API for recognizing users, users skeletons and gestures
        - ii. Nite –Middleware for hardware and framework
          1. Reads the data in from the Kinect
        - iii. Distribution:
          1. OpenNI - <http://www.openni.org/downloadfiles>
          2. PrimeSense ( NITE) - <http://www.openni.org/downloadfiles>
          3. GPL Licensing Agreement
        - iv. Custom Software
          1. Gesture Based Interface: 3D lines are made from the user skeleton which can be used to control appliances in the house
          2. Location Based Interface: The location of the user can be used to trigger automated actions when they enter or leave locations
          3. Menu/Setup: An extensive menu allows locations of appliances and places of interest to be put into a virtual map so they can be selected by our interface.
  3. Fit-PC2i 2GB/1.6GHz SSD32 Win7 Pro
    - a. Product Description and/or specifications
      - i. DVI up to 1920x1080
      - ii. Dual Gigabit Ethernet with wake-on-LAN support
      - iii. S/PDIF 5.5 channels, stereo line-out, line-in and mic
      - iv. 4 USB 2.0 ports
      - v. mini-SD slot
      - vi. Secured Power jack
      - vii. Serial port
      - viii. 1.6 GHz
      - ix. 2GB RAM
      - x. 32GB SSD
      - xi. Windows7 Professional
    - b. Manufacturer Information and Product Link
      - i. Technical Link: <http://www.fit-pc.com/web/purchase/order-fit-pc2i/>
- B. Secondary Laptop Display
  1. Computer Monitor E2041T-BN
    - a. Product Description and/or specifications
      - i. Screen Size: 20"
      - ii. Aspect Ratio 16:9
      - iii. Resolution 1600 x 900
      - iv. Resonse time: 5 ms
      - v. Viewing Angle: 170-160 degrees
      - vi. AV Outputs: D-sub, DVI-D
      - vii. Power: 100-240 V, 20 W, 0.3W (sleep)
    - b. Manufacturer Information and Product Link
      - i. <http://www.lg.com/us/computer-products/monitors/LG-led-monitor-E2041T-BN.jsp>

**END OF SECTION**

## SECTION 27 41 16 – Integrated Audio-Video Systems and Equipment

### Part 1 - GENERAL

#### 1.1 Summary

- A. Provides specifications and installation instructions for home entertainment equipment.

#### 1.2 Related Sections

- A. 251400 – Integrated Automation Local Control Units
- B. 271500 – Communications Horizontal Cabling
- C. 272100 – Data Communications Network Equipment
- D. 272200 – Data Communication Hardware

#### 1.3 Section Requirements

- A. Submittals
  - 1. Product Data

### Part 2 - PRODUCTS

#### 2.1 Products

##### A. Digital Media Players

- 1. Blu-ray Player LG BD630
  - a. Dimensions: 1.8" x 16.9" x 7.5"
  - b. Weight: 3.97 lbs
  - c. Blue-ray Disc 1080p Playback
  - d. DVD Upscaling to 1080 via HDMI
  - e. Video Output: Composite, Component, HDMI
  - f. Power Consumption: 13 W, 0.5 W (Standby)

##### B. AV Receivers, Processors, Amplifiers

- 1. Pioneer VSX-820-K
  - a. 5.1-Channel 3-D Ready A/V Receiver
  - b. Manufacturer: Pioneer Electronics
  - c. MSRP: \$299
  - d. Additional product information at: <http://www.pioneerelectronics.com/PUSA/Home/AV- Receivers/Pioneer+Receivers/VSX-820-K>

##### C. Audio Hardware

- 1. Pioneer SP-FS51-LR
  - a. Floorstanding Loudspeakers (1 pair)
  - b. Manufacturer: Pioneer Electronics
  - c. MSRP: \$199.99 (per pair)
  - d. <http://www.pioneerelectronics.com/PUSA/Home/Speakers/Home+Theater+Speakers/SP-FS51-LR>
- 2. Pioneer SP-C21
  - a. Center Channel Speaker
  - b. Manufacturer: Pioneer Electronics
  - c. MSRP: \$79.99
  - d. <http://www.pioneerelectronics.com/PUSA/Home/Speakers/Home+Theater+Speakers/SP-C21>

3. Pioneer SP-BS21-LR
    - a. Bookshelf Loudspeakers (1 pair)
    - b. Manufacturer: Pioneer Electronics
    - c. MSRP: \$89.99 (per pair)
    - d. <http://www.pioneerelectronics.com/PUSA/Home/Speakers/Home+Theater+Speakers/SP-BS21-LR>
  4. BIC F-12
    - a. 12" Front-firing powered subwoofer
    - b. Manufacturer: BIC America
    - c. MSRP: \$499
    - d. <http://www.bicamerica.com/showpage.php?brand=2&type=8&spkrID=84>
- D. Video Hardware
1. LG TV 22" 22LV2500
    - a. 22" Class HDTV
    - b. Manufacturer: LG
    - c. Resolution: 1366x768
    - d. Power Consumption 23W
    - e. MSRP: \$329.99
    - f. Additional product information at: <http://www.vizio.com/e320vp.html>
  2. LG Electronics CF181D
    - a. Contrast:35,000:1
    - b. Lumens: 1800
    - c. Weight 21.6 lbs
    - d. Resolution 1920x1080
    - e. Aspect Ratio 16:9
    - f. Connections: S-Video, Composite, Component, RGB, HDMI (x2), USB
    - g. Manufacturer: LG
    - h. MSRP: \$599
    - i. Additional product info at: <http://us.acer.com/ac/en/US/content/model/EY.K0701.020>
- E. Source Components
1. Apple TV
    - a. Digital Media Receiver
    - b. Required Number: 2
    - c. MSRP: \$99 (each)
    - d. Manufacturer: Apple
    - e. Additional product information at: <http://www.apple.com/appletv/specs.html>

## Part 3 - EXECUTION

### 3.1 Installation

- A. Place projector screen and VIZIO HDTV at their desired viewing locations.
- B. Place speakers according to Dolby Home theater 5.1 recommendations which can be found at: <http://www.dolby.com/consumer/setup/speaker-setup-guide/index.html>.
- C. Place receiver to the side of the projector screen.
- D. Mount projector on ceiling pointing at the projector screen roughly above the primary viewing position, as denoted by the Dolby Home theater recommendations.

- E. Run in-wall speaker wire from the receiver to the speakers, connect according to user manuals.
- F. Run digital coaxial cable from the receiver to the subwoofer, connect according to user manual.
- G. Place one Apple TV next to receiver, and the other behind the VIZIO HDTV.
- H. Run HDMI and optical cables from Apple TVs to corresponding monitor/receiver.
  - 1. One Apple TV connects to the receiver while the other connects to the VIZIO HDTV.
  - 2. The Apple TV connecting to the receiver also requires an optical cable to be connected to the receiver.
- I. All cable connections and installations should be done according to instructions provided in corresponding user manuals, with the above adjustments as required by our room.

### 3.2 Testing

- A. Perform MCACC auto calibration using the Pioneer AV Receiver according to instructions provided in the user manual.

### 3.3 Maintenance

- A. Perform according to manufacturer instructions.

### 3.4 Cleaning

- A. Perform according to manufacturer instructions.

**END OF SECTION**

Division 28 – Electronic Safety and Security

SECTION 28 06 00 –Schedules for Electronics Safety and Security

**Part 1 - GENERAL**

**1.1 Summary**

A. This section is the schedule for the safety and security equipment

**1.2 Related Sections**

- A. Section 280513
- B. Section 281000 (all)
- C. Section 282000 (all)
- D. Section 283000 (all)
- E. Section 283100

**Part 2 - PRODUCTS**

Appliance Category	Manufacturer	Model Number	Power Consumption	Quantity	Project Manual Division Master Format
Smoke Detector	Kidde	KN-COSM-IB	-	1	283146
Door Lever Lock	Kwikset	SmartCode	-	2	281316
IP Camera	Panasonic	BB-HCM511A	-	2	282313
Bridge to Security System	Card Access	Sensor Bridge	-	1	281619
Window/Door Sensor	GE	Recessed Door – Window Transmitter	-	4	281619

**END OF SECTION**

## SECTION 28 16 19 – Intrusion Detection Remote Devices and Sensors

### Part 1 - GENERAL

#### 1.1 Summary

- A. This section includes products and installation instructions with regards to intrusion detection remote devices and sensors, including, but not limited to, electronic window and door sensors and controls via home automation.

#### 1.2 Related Sections

- A. Section 281316 is related in that the same home automation and security system is used for access control purposes.

#### 1.3 References

- A. Underwriters Laboratories Inc.
  - 1. UL Standard for Safety Access Control System Units (UL268)

#### 1.4 Section Requirements

- A. Submittals
  - 1. Product data and manuals.

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Window/Door Sensor
  - 1. GE Recessed Door-Window Transmitter NX-458
    - a. Four (4) sets required
    - b. Wireless-controlled, window/door closed/open sensor
    - c. Uses a 3.0 VDC custom lithium battery for wireless connectivity
    - d. Sensors are concealed; check on doors and windows with a remote or touch screen
    - e. [http://www.shophhts.com/index.php?\\_a=viewProd&productId=12](http://www.shophhts.com/index.php?_a=viewProd&productId=12)

### Part 3 - EXECUTION

#### 3.1 Installation

- A. Device Space and Location
  - 1. Located according to Floor Plans.
- B. Wiring and Power
  - 1. N/A
- C. Manufacturer's Instructions
  - 1. Comply with all manufacturer's written recommendations and specifications vis-à-vis storage, handling, installation.

#### 3.2 Testing

- A. Site Tests:
  - 1. Test after initial power up and after two (2) years of operation

### 3.3 Maintenance

- A. Site Tests:
  - 1. Test after initial power up and after two (2) years of operation

### 3.4 Cleaning

- A. After installation and testing, remove excess materials and installation tools from site.

## END OF SECTION

## SECTION 28 31 46 – Smoke Detection Sensors

### Part 1 - GENERAL

#### 1.1 Summary

- A. This section includes products and installation instructions with regards to fire detection sensors.

#### 1.2 Related Sections

- A. Section 283149 is related in that the same device is used for Carbon-Monoxide Detection purposes.

#### 1.3 References

- A. California Fire Code
  - 1. The California Code of Regulations, Title 24, Part 9, 2007
- B. Underwriters Laboratories Inc.
  - 1. Smoke Detectors for Fire Alarm Systems (UL268)
  - 2. Standard for Single and Multiple Station Carbon Monoxide Alarms (UL2034)
- C. United States National Fire Alarm Code
  - 1. NFPA 72
- D. National Electrical Code
  - 1. NFPA 70-651: Fire Alarm Systems
- E. International Residence Code
  - 1. Section R313

#### 1.4 Section Requirements

- A. Submittals
  - 1. Product data and manuals.
- B. Automatic Alarm Initiating Devices
  - 1. Open-Air Smoke Detectors

- a. Combination smoke and CO detector needs to be connected to the AC wiring, with integrated battery backup.
- b. All alarms shall be interconnected and all shall sound when one is activated (IRC, Sec. R313).
- c. A smoke detector shall be installed on each story or level in a split-level dwelling including basements, cellars or crawl spaces, but not uninhabitable attics. (IRC, Sec. R313).

## Part 2 - PRODUCTS

### 2.1 Products

- A. Open-Air Smoke Detectors
  1. Kidde KN-COSM-IB, combination CO detector
    - i. Automatic Alarm Initiating Device
    - ii. Power Supply: 120V 60Hz AC input, with 9V battery backup with expected life of 7 years.
    - iii. Combination smoke and CO detector needs to be connected to the AC wiring, with integrated battery backup.
  - b. [http://www.kidde.com/utcfs/ws-384/Assets/KN-COSM-I\\_KN-COSM-IBen.pdf](http://www.kidde.com/utcfs/ws-384/Assets/KN-COSM-I_KN-COSM-IBen.pdf)

## Part 3 - EXECUTION

### 3.1 Installation

- A. Open-Air Smoke Detectors
  1. Combination smoke and CO detector needs to be connected to the AC wiring, with integrated battery backup.
  2. All alarms shall be interconnected and all shall sound when one is activated (IRC, Sec. R313).
  3. A smoke detector shall be installed on each story or level in a split-level dwelling including basements, cellars or crawl spaces, but not uninhabitable attics. (IRC, Sec. R313).
- B. Alarm Initiating Device Space and Location
  1. In accordance with manufacturer's recommendations: in particular, at least 15 feet away from cooking devices.
  2. In accordance with requirements of NFPA 72.
  3. Located according to Ceiling Plans.
- C. Wiring
  1. Wire for 120V circuits: Preliminarily, 12AWG minimum solid copper conductor.
- D. Manufacturer's Instructions

1. Comply with all manufacturer's written recommendations and specifications vis-à-vis storage, handling, installation.
- E. Physical Installation
1. Install detectors according to Ceiling Plans and connect with AC wiring. Detectors are not to be mounted within 3 feet of air outlets and require 24 inches radius of clear space around detectors.
- 3.2 Testing**
- A. Site Tests:
1. Fire alarm system:
    - a. Test after initial power up and after seven (7) years of operation
- 3.3 Maintenance**
- A. Site Tests:
1. Fire alarm system:
    - a. Test after initial power up and after seven (7) years of operation
- 3.4 Cleaning**
- A. After installation and testing, remove excess materials and installation tools from site.

**END OF SECTION**

## SECTION 28 31 49 – Carbon-Monoxide Detection Sensors

### Part 1 - GENERAL

#### 1.1 Summary

- A. This section includes products and installation instructions with regards to carbon-monoxide detection sensors.

#### 1.2 Related Sections

- A. Section 283143 is related in that the same device is used for Fire Detection purposes.

#### 1.3 References

- A. California Fire Code
  - 1. The California Code of Regulations, Title 24, Part 9, 2007
- B. Underwriters Laboratories Inc.
  - 1. Smoke Detectors for Fire Alarm Systems (UL268)
  - 2. Standard for Single and Multiple Station Carbon Monoxide Alarms (UL2034)
- C. United States National Fire Alarm Code
  - 1. NFPA 72
- D. National Electrical Code
  - 1. NFPA 70-651: Fire Alarm Systems
- E. International Residence Code
  - 1. Section R313

#### 1.4 Section Requirements

- A. Submittals
  - 1. Product data and manuals.
- B. Automatic Alarm Initiating Devices
  - 1. Open-Air CO Detectors
    - a. Combination smoke and CO detector needs to be connected to the AC wiring, with integrated battery backup.
    - b. All alarms shall be interconnected and all shall sound when one is activated (IRC, Sec. R313).

### Part 2 - PRODUCTS

#### 2.1 Products

- A. Open-Air CO Detectors
  - 1. Kidde KN-COSM-IB, combination CO detector
    - i. Automatic Alarm Initiating Device
    - ii. Power Supply: 120V 60Hz AC input, with 9V battery backup with expected life of 7 years.
    - iii. Combination smoke and CO detector needs to be connected to the AC wiring, with integrated battery backup.
  - b. [http://www.kidde.com/utcfs/ws-384/Assets/KN-COSM-I\\_KN-COSM-IBen.pdf](http://www.kidde.com/utcfs/ws-384/Assets/KN-COSM-I_KN-COSM-IBen.pdf)

### Part 3 - EXECUTION

#### 3.1 Installation

- A. Open-Air CO Detectors
  - 1. Combination smoke and CO detector needs to be connected to the AC wiring, with integrated battery backup.
  - 2. All alarms shall be interconnected and all shall sound when one is activated (IRC, Sec. R313).
- B. Alarm Initiating Device Space and Location
  - 1. In accordance with manufacturer's recommendations: in particular, at least 15 feet away from cooking devices.
  - 2. In accordance with requirements of NFPA 72.
  - 3. Located according to Ceiling Plans.
- C. Wiring
  - 1. Wire for 120V circuits: Preliminarily, 12AWG minimum solid copper conductor.
- D. Manufacturer's Instructions
  - 1. Comply with all manufacturer's written recommendations and specifications vis-à-vis storage, handling, installation.
- E. Physical Installation
  - 1. Install detectors according to Ceiling Plans and connect with AC wiring. Detectors are not to be mounted within 3 feet of air outlets and require 24 inches radius of clear space around detectors.

#### 3.2 Testing

- A. Site Tests:
  - 1. Fire alarm system:
    - a. Test after initial power up and after seven (7) years of operation

#### 3.3 Maintenance

- A. Site Tests:

1. Fire alarm system:
  - a. Test after initial power up and after seven (7) years of operation

#### 3.4 **Cleaning**

- A. After installation and testing, remove excess materials and installation tools from site.

**END OF SECTION**

## Division 31 Shoring and Bracing

### SECTION 31 48 33 JACKED PIERS

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Temporary Jacked Piers for foundation while house is on display

##### 1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification

Sections that relate directly to work of this Section include, but are not limited to:

1. 05 00 00 Metal
2. All registered Structural Drawings and Shop Drawings

##### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, and recommendations for each product specified.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide large scale plans, elevations, and details of profiles, joints, seams, anchorages, connections and accessory items. Indicate galvanic isolation from adjacent aluminum or carbon steel if applicable.
- C. Material Samples: 2 Jacks for texting purposes
- D. Warranty: Submit manufacturer's standard 10 year warranty.

##### 1.4 QUALITY ASSURANCE

- A. Fabricator: Minimum 5 years experience with projects of similar complexity.
- B. Installer: Minimum 3 years experience with projects of similar complexity. At Architect's request, submit names and locations of recent projects.

##### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions

and recommendations and industry standards. Protect from damage.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.6 SEQUENCING AND SCHEDULING

A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

B. Perform work of this section in coordination with other sections to provide the highest quality work which best fulfills the intent requirements of this work.

### **PART 2 PRODUCTS**

#### 2.1 MATERIALS

A. Acceptable Manufacturers:

1. 5000lb Drive Nut "Scissor" Jack: TBD

Jack must be a minimum of 5000lbs

Jack must be certified and conform to all requirements

Jack must be accepted by Structure Engineer of Record prior to use

B. Accessories: Provide all clips, cleats, straps, anchors, similar items necessary to properly complete the work. Provide accessories that are compatible with sheet metal materials used and which are of sufficient size and gage to perform as intended.

### **PART 3 EXECUTION**

#### 3.1 INSPECTION

A. Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

#### **END OF SECTION**

## Division 32 – Exterior Improvements

### SECTION 32 05 19.13– GEO-TEXTILE GROUND COVERINGS

#### **Part 1 - General**

##### 1.1 Section requirements

PRODUCT DATA SHEET 0 - Submittals: Product Data

#### **Part 2 - Products**

##### 2.1 Components

i. GEOTEX® 135ST

ii. See manufacturers specs for detail

#### **Part 3 - Execution**

##### 3.1 Preparation

- v. Visually observe construction materials such as geomembranes, geotextiles, and geonet delivered to the site to determine general conformance with the material technical specifications;
- vi. Observe and record condition of subgrade prior to placement of all
  1. geomembranes, geotextiles, or geonet;
- vii. Observe and record procedures for stockpiling, storage, and handling;
- viii. Observe and record procedures used for installation of geomembranes, geonet, and geotextile;
- ix. Observe that field placement of geomembrane panels matches approved plans;
- x. Visually observe all geosynthetics after installation for compliance with the Technical Specifications;
- xi. Observe and record procedures used for installation of all liner penetrations;
- xii. Observe leak location procedures and verify that the procedure is properly performed;
- xiii. Conduct final inspection of membranes prior to sand placement;

**End of section**

SECTION 32 80 00 – Schedule for IRRIGATION

Mark	Description	MFR	Model	Notes	Manual Section
RWP-1	Rainwater Pump	Danner	02523		32 82 00

**Part 1 – General**

**1.1 Summary**

- A. Section Includes
  - 1. Rainwater Pump

**1.2 Section Requirements**

- A. Submittals
  - 1. Product Data

**Part 2 – Products**

**2.1 Products**

- A. Rainwater Pump
  - 1. Product specifications
    - i. 350 Gallons Per Hour at 1' Head
    - ii. 35 Watts
    - iii. 120 V/ 60 Hz
    - iv. 1/2" FPT Inlet
    - v. 1/2" MPT Outlet
    - vi. 18' Cable Length
  - 2. Manufacturer Information and Product Link
    - i. Price: \$ 86.99 (<http://tinyurl.com/3d8nt36>)
    - ii. Manufacturer: Danner
    - iii. Part # 02523

**Part 3 – Execution**

**3.1 Installation**

- A. Install according to manufacturer instructions

**END OF SECTION**

## SECTION 32 84 00 – PLANTING IRRIGATION

### Part 1 – General

#### 1.1 Summary

1. Polyethylene Tubing
2. 1" PVC Check Valve
3. 3-way Diverter Valve
4. Float switch
5. Y mesh filter

#### 1.2 Section Requirements

- A. Submittals
  1. Product Data

### Part 2 – Products

#### 2.1 Products

- A. Polyethylene Tubing
  1. Product Requirements
    - i. Specifications Met: United States Food and Drug Administration (FDA)
    - ii. FDA Specification: CFR21 177.1520
    - iii. Compatible Fittings: Compression
    - iv. Chemical Compatibility Link: 5181KAC
  2. Product Specification
    - i. Type: Crack-Resistant Polyethylene Tubing
    - ii. Material: LLDPE (Linear Low-Density Polyethylene)
    - iii. Shape: Single Line
    - iv. Outside Dia.: 1-1/8" (1.125")
    - v. Inside Dia.: 1"
    - vi. Wall Thickness: 1/16" (.0625")
    - vii. Reinforcement: Unreinforced
    - viii. Color: Opaque Black
    - ix. Maximum Pressure: 63 psi @ 70° F
    - x. Operating Temperature Range: -100° to +175° F
    - xi. Bend Radius: 9"
    - xii. Durometer: 95A (Firm)
    - xiii. Tensile Strength: 2,800 psi
    - xiv. For Use With: Air, Beverage, Ethylene Glycol, Food, Water
  3. Manufacturer Information
    - i. Manufacturer: McMaster-Carr
    - ii. Product Number: 5180K18
    - iii. Price: \$0.58/ft

- iv. <http://www.mcmaster.com/#5180k18/=djmi75>
- B. 1" PVC Check Valve**
  - 1. Product Requirements**
    - i. NSF-Certified White PVC Check Valve High Flow
  - 2. Product Specification**
    - i. Maximum Pressure: 150 psi @ 73° F
    - ii. Cracking Pressure: 0.1 psi
    - iii. Temperature Range: 32° to 140° F
    - iv. Body and disc are PVC
    - v. seat is EPDM rubber
    - vi. Color: white
    - vii. Pipe size: 1"
    - viii. End to End length: 4 9/16"
    - ix. CV factor: 65
  - 3. Manufacturer Information**
    - v. Manufacturer: McMaster-Carr
    - vi. Product Number: 45275K34
    - vii. Price: \$10.84
    - viii. <http://www.mcmaster.com/#catalog/117/480/=djn8pc>
- C. 3-way Diverter Valve**
  - 1. Product Requirements**
  - 2. Product Specification**
    - a. Features
      - i. No Lube Required
      - ii. 3-Port Low-Temperature PVC
      - iii. Easily Installed and Simple to Use
      - iv. Fiberglass Reinforced Handle
      - v. Maintenance-Free Diverter Seal
      - vi. Dual O-Rings, Separated by a Hard Spacer, Provide Optimum Shaft Sealing for Dependability
      - vii. Optimum Positive-Seal
      - viii. High Flow Rate
      - ix. Withstands Pressure up to 150 psi
      - x. Chemical-Resistant
      - xi. Used for Diverting, Shut-Off or Mixing Applications
      - xii. Field-Adjustable Stop Positions
      - xiii. Plumbed with Inlet at any PortMaximum Pressure: 150 psi @ 73° F
    - b. Specifications:
      - i. Ports: 3
      - ii. Fits Pipe Sizes: 2" x 2.5" PVC
      - iii. Maximum Body Pressure: 150 psi
      - iv. Maximum Sealing Pressure: 35 psi
  - 3. Manufacturer Information**
    - i. Manufacturer: Pentair
    - ii. Product Number: 263028
    - iii. SKU: 726444
    - iv. Price: \$33.99

- v. <http://www.westsidewholesale.com/2-pvc-3-way-lube-free-diverter-valve-with-2-5-slip-outside.html>
- D. Float Switch – Horizontal Sensor Level**
  - 1. Product Requirements**
    - i. RoHS Compliant
    - ii. Lead free status
  - 2. Product Specification**
    - i. Category: Sensors/Transducers
    - ii. Output Configuration: SPST-NO, 500mA
    - iii. Material - Housing & Prism: Polyamide (PA)
    - iv. Mounting Type: Panel Mount
    - v. Type: Liquid
    - vi. Operating Temperature: -20°C ~ 90°C
    - vii. Voltage Rating:200V
    - viii. Depending on mounting position/movement direction, the sensor opens or closes with the rising, respectively the sinking liquid level
    - ix. Color: Polyamide black
  - 3. Manufacturer Information**
    - i. Manufacturer: MEDER electronic
    - ii. Product Number: LS03-1A66-PA-500W
    - iii. Price: \$16.15
    - iv. <http://parts.digikey.com/1/parts/945803-sensor-level-horiz-liquid-m16-ls03-1a66-pa-500w.html>
- E. Y Mesh Filter**
  - 1. Product Requirements**
  - 2. Product Specification**
    - i. Inlet and outlet are 3/4" Male Pipe Thread (MPT).
    - ii. Stainless steel 200 mesh screen
    - iii. Heavy duty plastic with maximum UV & oxidizer protection
    - iv. Maximum Flow Rate: 16 Gallons Per Minute (GPM)
    - v. Maximum Pressure: 120 Pounds Per Square Inch (PSI)
  - 3. Manufacturer Information**
    - v. Manufacturer: Irrigation Direct
    - vi. Product Number: Part #: DD-YS75-200
    - vii. Price: \$6.50
    - viii. <http://www.irrigationdirect.com/y-filter-3-4-male-pipe-thread-x-3-4-male-pipe-thread-w-200-mesh-ss-filter>

## Part 3 – Execution

### 3.1 Installation

- A. Polyethylene Tubing**
  - a. Install according to manufacturer instructions
- B. PVC Check Valve**

- a. Install according to manufacturer instructions
- b. Valves can be mounted horizontally or vertically (upward flow only)
- c. Please specify NPT female or socket-weld (not threaded) connections
- C. 3 Way Diverter Valve**
  - a. Install according to manufacturer instructions
  - b. the Teflon composite diverter seal requires no lubrication
- D. Float Switch**
  - a. Install according to manufacturer instructions
- E. Mesh Filter**
  - a. Install according to manufacturer instructions
  - b. Not recommended to be installed under static (constant) pressure
  - c. Should be installed after a manual or electric valve
  - d. Should be installed before pressure regulator
  - e. This will not work on hose threaded items

## **SECTION 32 84 13 – DRIP IRRIGATION**

### **Part 1 – General**

#### **1.1 Summary**

- A. Section Includes**
  - 1. DIG Patio Irrigation Kit (Model FM01AS)

#### **1.2 Section Requirements**

- A. Submittals**
  - 1. Product Data

### **Part 2 – Products**

#### **2.1 Products**

- A. Dig Patio Irrigation Kit**
  - 1. Product Specifications:
    - a. Patio Watering Kit Model FM01AS
    - b. Backflow preventer
    - c. Contains:
      - i. 60' - 1/4" micro tubing
      - ii. 1 faucet adapter with screen filter
      - iii. 10 - 1 GPH PC drippers
      - iv. 9- 1/4" tees
      - v. 2 - 1/4" barbs
      - vi. 10 - 1/4" mounting clips
      - vii. 10 tubing holder stakes
      - viii. 2 - 1/4" ball valves
  - 2. Manufacturer information and product link:
    - a. Manufacturer: Dig Irrigation Products
    - b. Price: \$12.69 (amazon.com)
    - c. Product link:  
[http://www.digcorp.com/DIY/555-Patio\\_watering\\_kit/diy\\_products](http://www.digcorp.com/DIY/555-Patio_watering_kit/diy_products)

### **Part 3 – Execution**

### **3.1 Installation**

- A.** Install according to manufacturer instructions

**END OF SECTION**

## Division 48 – Electrical Power Generation

### SECTION 48 14 00 - SOLAR ENERGY ELECTRICAL POWER GENERATION EQUIPMENT

#### Part 1 - GENERAL

##### 1.1 Summary

###### A. Section Includes:

1. Accessory solar energy electrical power generation equipment

##### 1.2 Related Sections

- A. Section 26 31 00 – Photovoltaic Collectors
- B. Section 48 19 16 – Electrical Power Generation Inverters

##### 1.3 Section Requirements

- A. Submittals

#### Part 2 - PRODUCTS

##### A. Tigo Energy Maximizer System

1. Module Maximizer-ES MM-ES50
  - a. Product Requirements
    - i. Meets NIEEE-1547 requirements
    - ii. Meets FCC part 15 standards
    - iii. Compliance with UL 1741
    - iv. Compliance with NEC 2008
  - b. Product Specifications
    - i. Electrical Data

1. Maximum input power	300W
2. Maximum input DC voltage (Voc)	52V
3. Vmp range	16-48v
4. Maximum continuous current (Imp)	9.5A
5. Maximum input current (Isc)	10A
6. Maximum output power	300W
7. Maximum continuous current	9.5A
    - ii. Misc. Data

1. Ambient Temp. Range	-30°C to 70°C
2. Cooling	Natural convection
  - c. Manufacturer Information and Product Link
    - i. Product Datasheet and Manuals  
[http://tigoenergy.com/brochures/literature\\_kit.zip](http://tigoenergy.com/brochures/literature_kit.zip)
2. Tigo Irradiance Sensor
  - a. Product Requirements
    - i. Meets NIEEE-1547 requirements
    - ii. Meets FCC part 15 standards
    - iii. Compliance with UL 1741
    - iv. Compliance with NEC 2008

- b. Product Specifications
    - i. Misc. Data
      - 1. Ambient Temp. Range -30°C to 70°C
  - c. Manufacturer Information and Product Link
    - i. Product Datasheet and Manuals  
[http://tigoenergy.com/brochures/literature\\_kit.zip](http://tigoenergy.com/brochures/literature_kit.zip)
3. Maximizer Management Unit MU-ESW
- a. Product Requirements
    - i. Meets NIEEE-1547 requirements
    - ii. Compliance with UL 1741
    - iii. Compliance with NEC 2008
  - b. Product Specifications
    - i. Electrical Data
      - 1. System connections Up to 360 Module Maximizers
      - 2. Connections Ethernet, optional wireless, optional cellular modem
    - ii. Mechanical Data
      - 1. Dimensions (LXWXH) 245 x 150 x 80 mm
      - 2. Mass 1000g
    - iii. Misc. Data
      - 1. Ambient Temp. Range 0°C to 70°C
      - 2. Cooling Natural convection
  - c. Manufacturer Information and Product Link
    - i. Product Datasheet and Manuals  
[http://tigoenergy.com/brochures/literature\\_kit.zip](http://tigoenergy.com/brochures/literature_kit.zip)

### Part 3 - EXECUTION

#### 3.1 Installation

- A. Comply with section 260500 "Common Work Results for Electrical"
- B. Comply fully with included installation manual

#### 3.2 Efficiency Testing

- A. Product will be set up and tested in operation to test functionality.

END OF SECTION

## SECTION 48 19 00 – ELECTRICAL POWER GENERATION INVERTERS

### Part 1 - General

#### 1.1 Summary

##### A. Section Includes:

1. Electrical Power Generation Inverters

#### 1.2 Related Sections

- ##### A. Section 48 14 00 – Solar Energy Electrical Power Generation Equipment

#### 1.3 Section Requirements

### Part 2 - General

#### A. Inverters

##### 1. SMA SB7000US Grid-Tie Inverter

###### a. Product Requirements

- i. Compliance with IEEE-1547
- ii. Compliance with UL 1741
- iii. Compliance with UL 1998
- iv. Compliance with FCC part 15 A & B
- v. Compliance with CSA C22.2 No. 107.1-2001

###### b. Product Specifications

###### i. Electrical Data

1. DC Max Voltage 600 V
2. DC Max Power 7400 W
3. DC Nominal Voltage 310 V
4. Peak Power Tracking Voltage 250-480 V @ 240 V
5. DC Max Input Current 30 A
6. DC Max Input Current per string 20 A
7. PV Start Voltage 300 V
8. AC Output Power 7000 W
9. AC Max Output Current 29 A @ 240 V
10. AC Frequency 60 Hz
11. Peak Inverter Efficiency 96.9%
12. CEC Efficiency 96%
13. Power Consumption (night) 0.1 W

###### ii. Mechanical Data

1. Dimensions W x H x D 18.5 x 24 x 9 in.
2. Disconnect dimensions 7 x 12 x 7.5 in.
3. Weight 147 lb.
4. Enclosure Type NEMA 3R

###### iii. Misc. Data

1. Noise Emission 46 dB
2. Topology Low Frequency Transformer, true sinewave

###### c. Manufacturer Information and Product Link

- i. Product Specification Sheet Is attached

### Part 3 - EXECUTION

#### 3.1 Installation

- A. Comply with section 260500 "Common Work Results for Electrical"
- B. Comply fully with included installation manual

#### 3.2 Efficiency Testing

- A. Product will be set up and tested in operation to test functionality.

**END OF SECTION**

## SECTION 32 93 00- TEMPORARY PLANTING

### Part 1 - General

#### 1.1 Section requirements

1. Submittals: Product Data
2. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
3. Maintain ground covers and plants until established, but not less than six months.

### Part 2 - Products

#### 2.1 Planting materials:

iii. Tree and Shrub Material: Nursery grown, with healthy root systems, well shaped, fully branched, healthy, and free of insects, eggs, larvae, defects, and disfigurement.

#### iv. Planting material

1. *Aeonium arboretum 'Atropurpureum'*
2. *Arctostaphylos Manzanita 'Dr. Hurd'*
3. *Festuca glauca*
4. *Salvia leucophylla*
5. *Senecio mandralisae*

### Part 3 - Execution

#### 3.1 Preparation

- ii. Spread planting soil mixture to a depth of 4 inches, but not less than required to meet finish grades. Work first layer into top of loosened subgrade.
- iii. Plant ground cover and plants 12 inches apart. Dig holes large enough to allow root spread. Plant stock working soil around roots and leave a slight saucer around plants to hold water. Water after planting. Do not cover plant crowns with wet soil.
- iv. 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

## SECTION 32 94 33- PLANTERS

### 07 60 30 STAINLESS STEEL SHEET METAL

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Provide copper-clad stainless steel for the following applications:
  - 1. Sheet metal roofing including standing seam, flat seam and batten seam types.
  - 2. Sheet metal fascia and wall panels.
  - 3. Rain drainage including gutters, downspouts, scuppers and conductors.
  - 4. Flashing including base, counter, cap, eave, valley, drip and step flashings.
  - 5. Fabricated assemblies, including dormers, cupolas, finials, and spires.

##### 1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification

Sections that relate directly to work of this Section include, but are not limited to:

- 1. Section 05 50 00, Metal Fabrications.
- 2. Section 09 00 00, Finishes

##### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, and recommendations for each product specified.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide large scale plans, elevations, and details of profiles, joints, seams, anchorages, connections and accessory items. Indicate galvanic isolation from adjacent aluminum or carbon steel if applicable.
- C. Material Samples: Submit two 6 by 6 inch flat stainless steel.
- D. Fabricated Samples: Submit full size sample of typical seam, corner and termination as acceptable to the Architect, for approval of fabrication details and workmanship.
- D. Warranty: 5 year warranty.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator: Minimum 5 years experience with projects of similar complexity.
- B. Installer: Minimum 3 years experience with projects of similar complexity. At Architect's request, submit names and locations of recent projects.
- C. Industry Standards for Materials and Fabrication Details: Comply with recommendations of the Sheet

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions  
  
and recommendations and industry standards. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Perform work of this section in coordination with other sections to provide the highest quality work which best fulfills the intent requirements of this work.

### **PART 2 PRODUCTS**

#### 2.1 Components

- i. Metal planter box
  - 1. D18" x L36" x W36"
- ii. Plants
  - 1. See section 32 93 00 for temporary planting

#### 2.1 MATERIALS

- A. Acceptable Manufacturing:
  - 1. Cross Section: stainless steel
  - 2. Standard Thicknesses: As recommended by manufacturer from the following standard thicknesses  
  
and weights:

- a. 0.012 inches thick, 0.4959 pounds per square foot.
  - b. 0.016 inches thick, 0.6612 pounds per square foot.
  - c. 0.0216 inches thick, 0.8927 pounds per square foot.
  - d. 0.027 inches thick, 1.1159 pounds per square foot.
3. Mechanically Fastened Joints: stainless steel fasteners.
4. Soldered Joints: Soft soldered using 50-50 or higher tin content solder, mild fluxes.
5. Shapes: Coils, rolls or sheets up to 48 inches wide, as applicable.

C. Accessories: Provide all clips, cleats, straps, anchors, similar items necessary to properly complete the work. Provide accessories that are compatible with sheet metal materials used and which are of sufficient size and gage to perform as intended.

## 2.2 FABRICATION

- A. Shop fabricates work to the greatest extent possible. Fabricate work to match approved shop drawings and to provide the best possible watertight, weatherproof performance with expansion provisions in running work. Minimize oil-canning, buckling, tool marks and other defects.
- B. Fabricate work with uniform, watertight joints. Make seams as inconspicuous as possible.
- C. Isolate dissimilar materials with isolation coating recommended by the manufacturer or other permanent separation acceptable to the Architect.

## PART 3 EXECUTION

### 3.1 INSPECTION

A. Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 INSTALLATION

- A. Strictly comply with manufacturer's and fabricator's instructions and recommendations and approved details.
- B. Securely anchor work and allow for thermal movement and building movement. Use concealed fasteners to the greatest extent possible. Install work to be permanently weatherproof and watertight.

### 3.3 ADJUSTING, CLEANING, PROTECTION

- A. Adjust work to conform to appear uniform and in proper relationship with adjacent work.
- B. Repair minor damage to eliminate all evidence of repair. Remove and replace work, which cannot be satisfactorily repaired.

C. Clean exposed surfaces using detergent and water. If solder flux residues are evident, remove using mild abrasive cleanser.

**End of section**



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CONSTRUCTION DRAWING SET 03/22/2011

DESIGN DOCUMENTATION SET 11/23/2010

### REVISIONS:

CD SET REVISION 05/02/2011

DATE: 03.22.2011

LOT NUMBER: #402

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### FOUNDATION PLAN

# S-101

### GENERAL SHEET NOTES

4x4 BUILDING POST OR GREATER

DEAD AND LIVE WEIGHTS  
HOUSE WEIGHT - 62 000 lb.  
DECK WEIGHT - 9 000 lb.  
RAMP WEIGHT - 14 000 lb. EACH

FOOTING AREAS  
HOUSE - 44 SQ. FEET  
DECK - 9 SQ. FEET  
RAMP - 12 SQ. FEET EACH

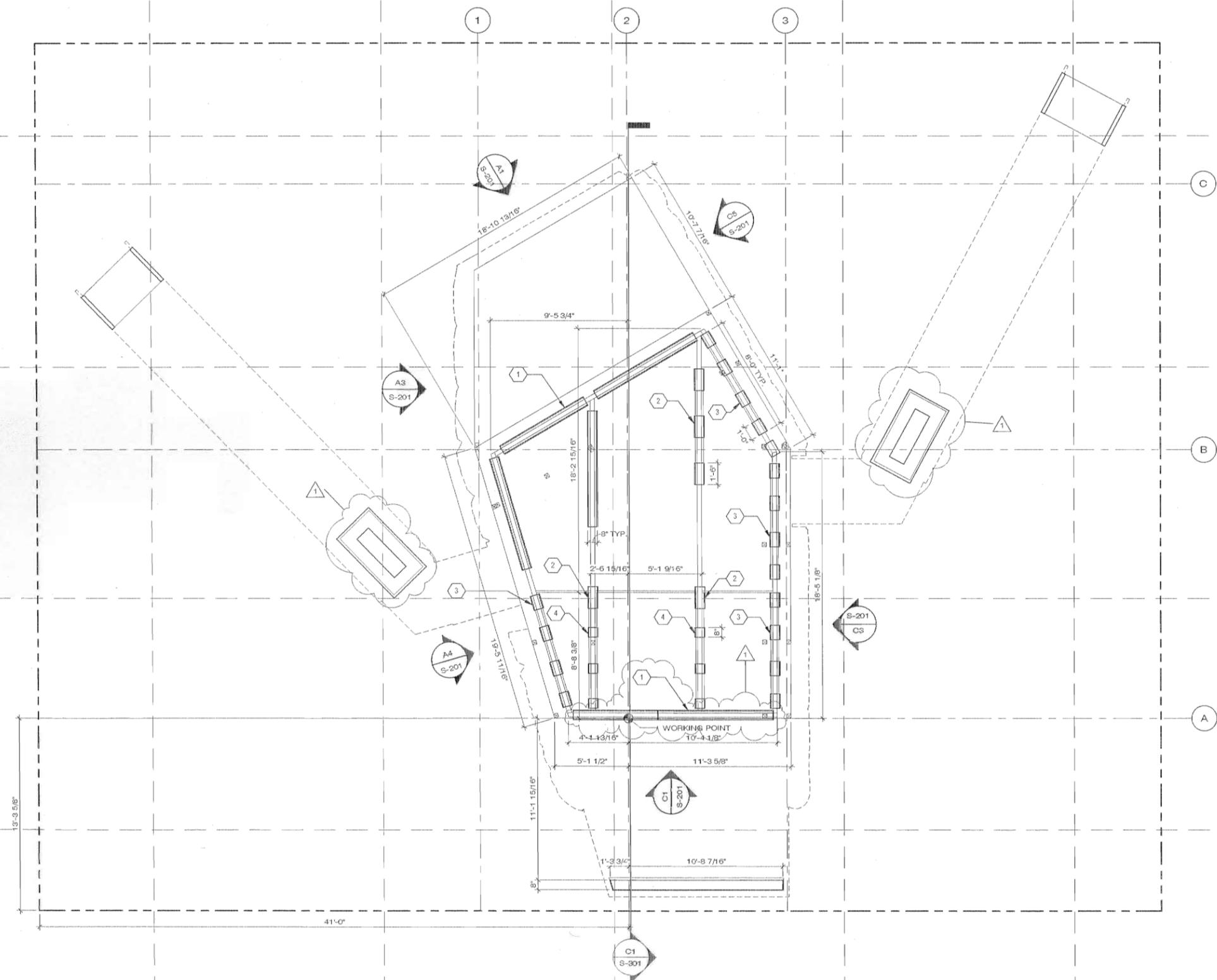
AVERAGE FOOTING PRESSURE  
HOUSE - 1409 psf  
DECK - 1000 psf  
RAMP - 1167 psf

FOR WORST CASE CONDITIONS SEE STRUCTURAL CALCULATIONS IN PROJECT MANUAL

### SHEET NOTES

- 1 CONTINUOUS PLATE (8" WIDE TYP.)
- 2 18" LONG PLATES (8" WIDE)
- 3 12" LONG PLATES (8" WIDE)
- 4 8" X 8" PLATES

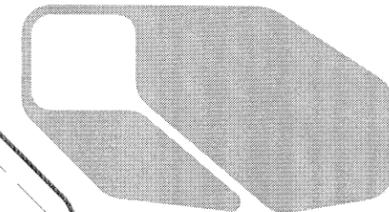
### REFERENCE KEYNOTES



**A1 FOUNDATION**  
1/4" = 1'-0"



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## FLOOR AND ROOF FRAMING PLAN

# S-102

### GENERAL SHEET NOTES

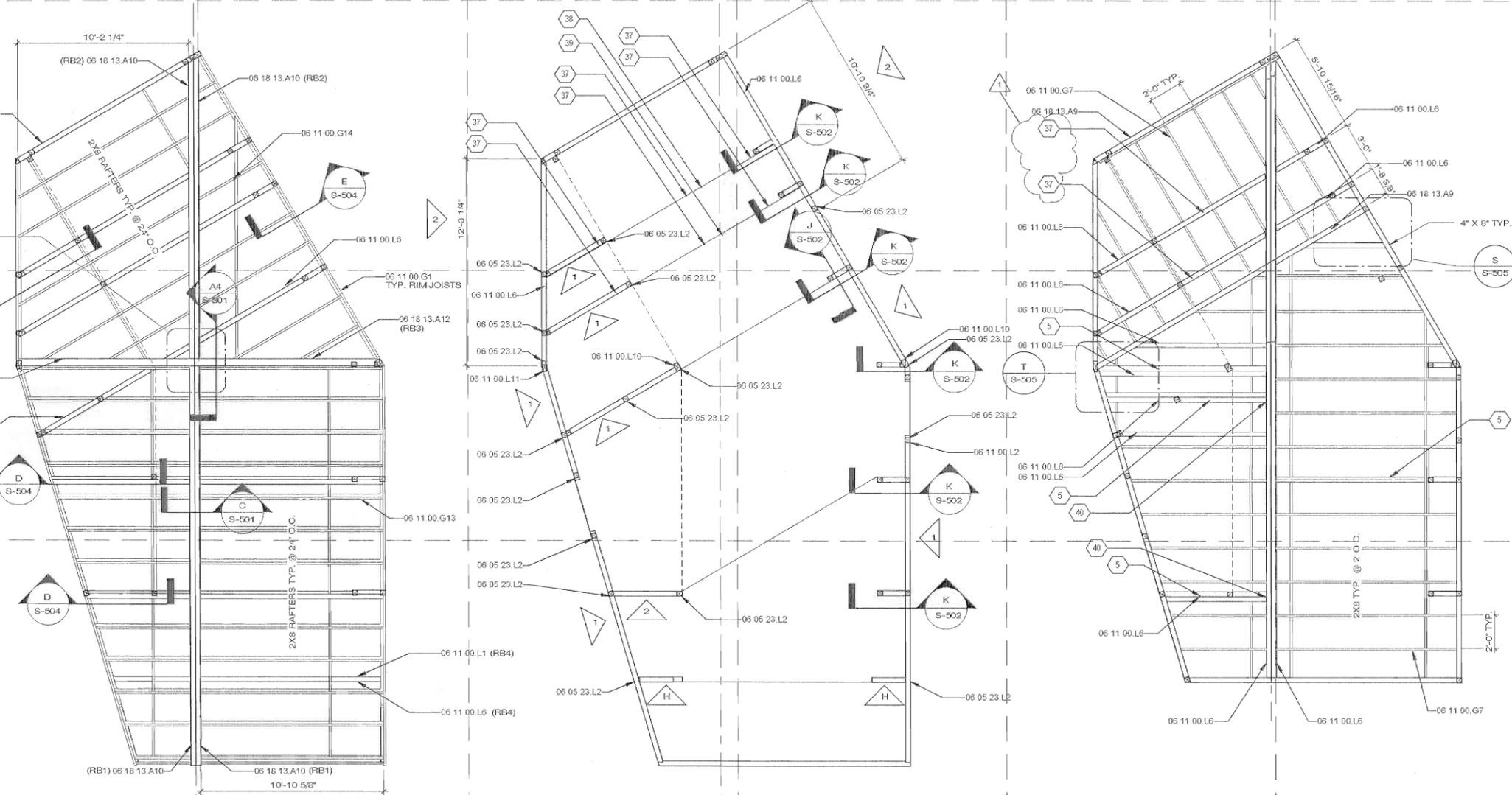
- 1 SHEAR WALL PER STRUCTURAL DETAILS (S 503)
- 4 4X4 POST (06 11 00.L02) OR GREATER

### SHEET NOTES

- 5 TWIN MEMBERS
- 37 15/32" PLY BOTH SIDES STR 1 W/ 10d @ 3", 12"
- 38 26" TALL WALL
- 39 24" TALL WALL
- 40 TYP HUS HANGER @ EACH END

### REFERENCE KEYNOTES

- 06 05 23.L2 HDU5
- 06 11 00.G1 2X8
- 06 11 00.G7 2X8 JOISTS @ 24" O.C.
- 06 11 00.G13 2X8 RAFTERS @ 16" O.C.
- 06 11 00.G14 2X8 RAFTERS @ 24" O.C.
- 06 11 00.L1 4X4
- 06 11 00.L2 4X4 POST
- 06 11 00.L6 4X8 BEAM
- 06 11 00.L7 4X10 BEAM
- 06 11 00.L10 4X6 POST
- 06 11 00.L11 4X8 POST
- 06 18 13.A9 4X8 LAMINATE VENEER LUMBER
- 06 18 13.A10 4X10 LAMINATE VENEER LUMBER
- 06 18 13.A12 6X10 LAMINATE VENEER LUMBER



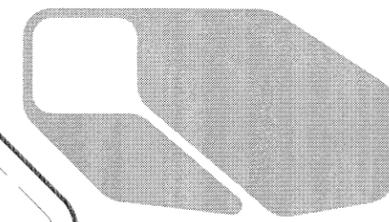
**A1 ROOF FRAMING**  
1/4" = 1'-0"

**A3 SHEAR WALLS**  
1/4" = 1'-0"

**A5 FLOOR FRAMING**  
1/4" = 1'-0"



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# CHIP 2011

COMPACT HOUSE, INFINITE POSSIBILITIES

U.S. DEPARTMENT OF ENERGY  
SOLAR DECATHLON 2011  
TEAM SOL-ARC / CALTECH

SOUTHERN CALIFORNIA INSTITUTE OF ARCHITECTURE  
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### SUBMISSIONS:

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### GENERAL SHEET NOTES

### SHEET NOTES

30 4X BLOCKING

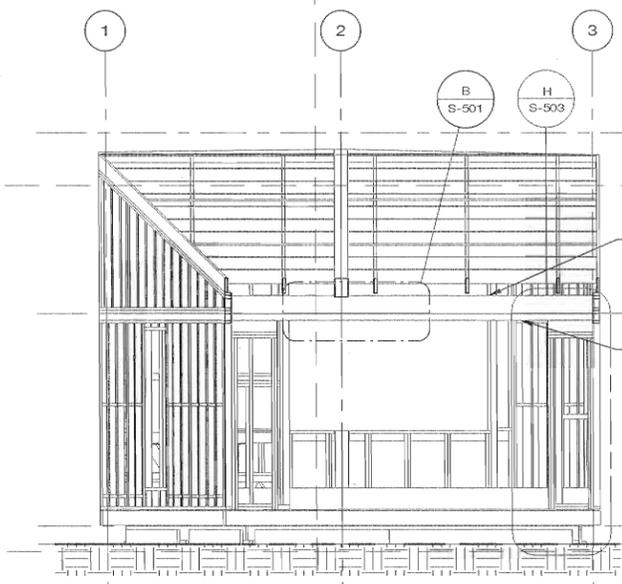
### REFERENCE KEYNOTES

06 05 23.R7 MST48  
06 05 23.R26 CMST14  
06 11 00.D8 2X4 STUDS @ 16" O.C.  
06 11 00.L1 4X4  
06 11 00.L2 4X4 POST  
06 11 00.L6 4X8 BEAM  
06 11 00.L11 4X8 POST  
06 18 13.A9 4X8 LAMINATE VENEER LUMBER

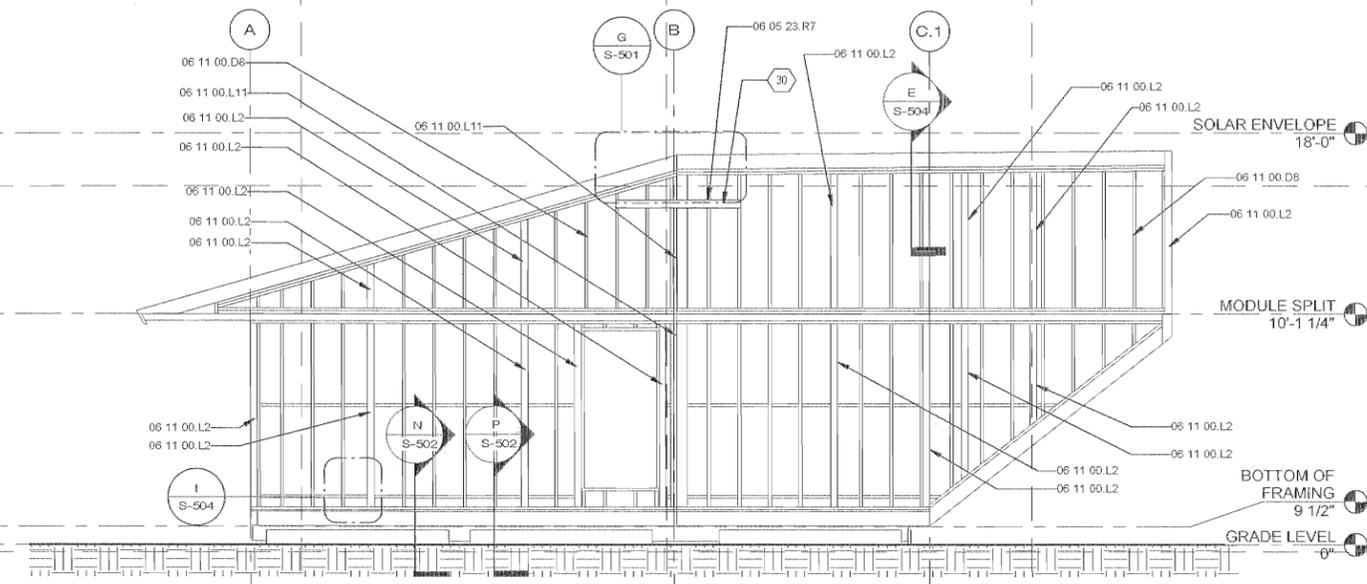


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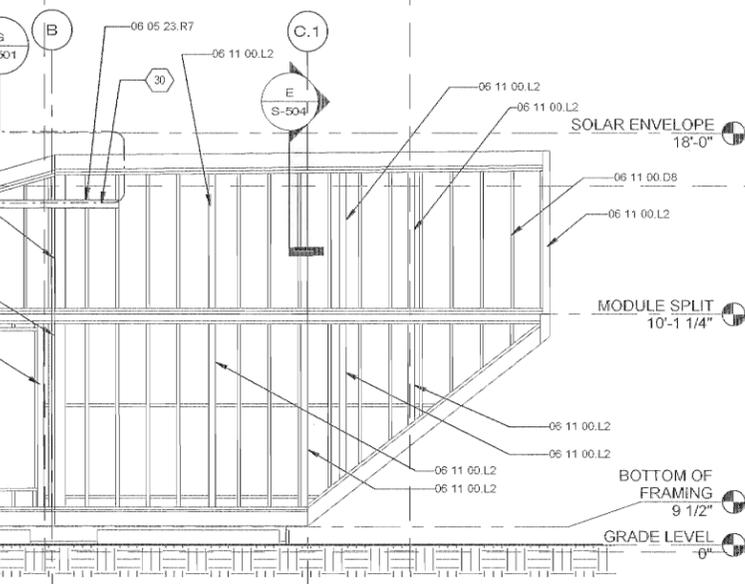
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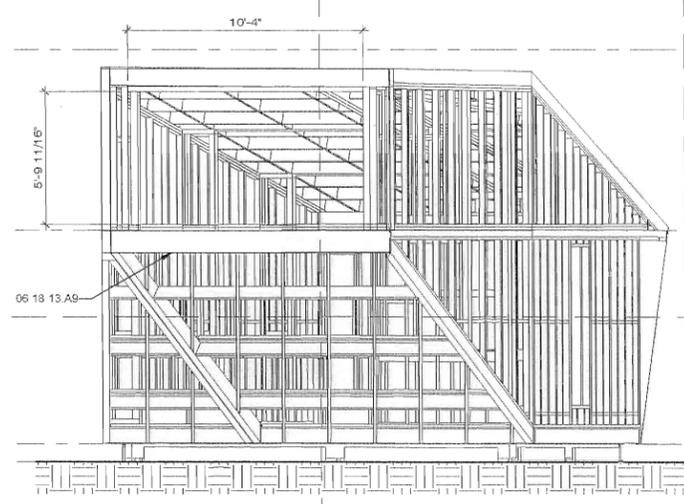
C1 SOUTH ELEVATION  
1/4" = 1'-0"  
0 2 4 8



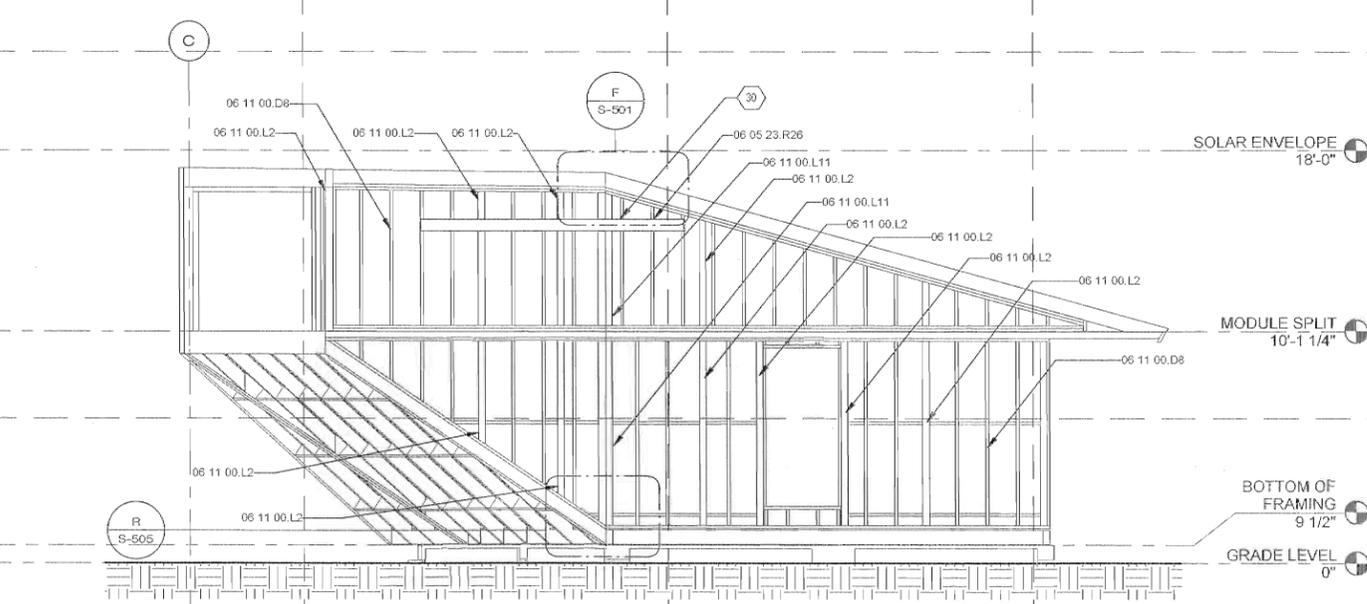
C3 EAST ELEVATION  
1/4" = 1'-0"



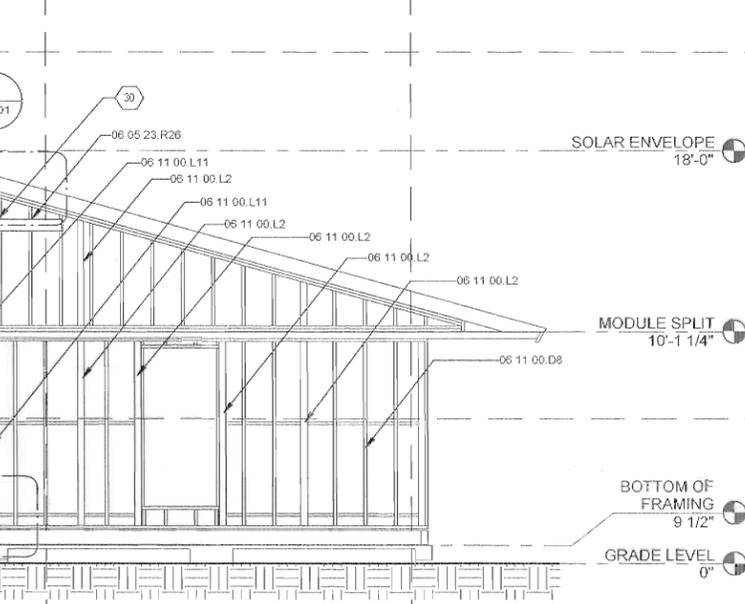
C5 NORTH EAST ELEVATION  
1/4" = 1'-0"



A1 NORTH ELEVATION  
1/4" = 1'-0"  
0 2 4 8

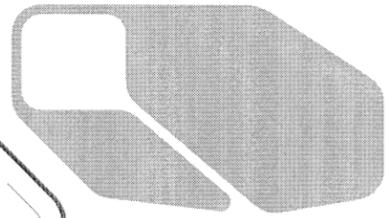


A3 WEST ELEVATION  
1/4" = 1'-0"



A4 SOUTH WEST ELEVATION  
1/4" = 1'-0"

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### FRAMING SECTION

# S-301

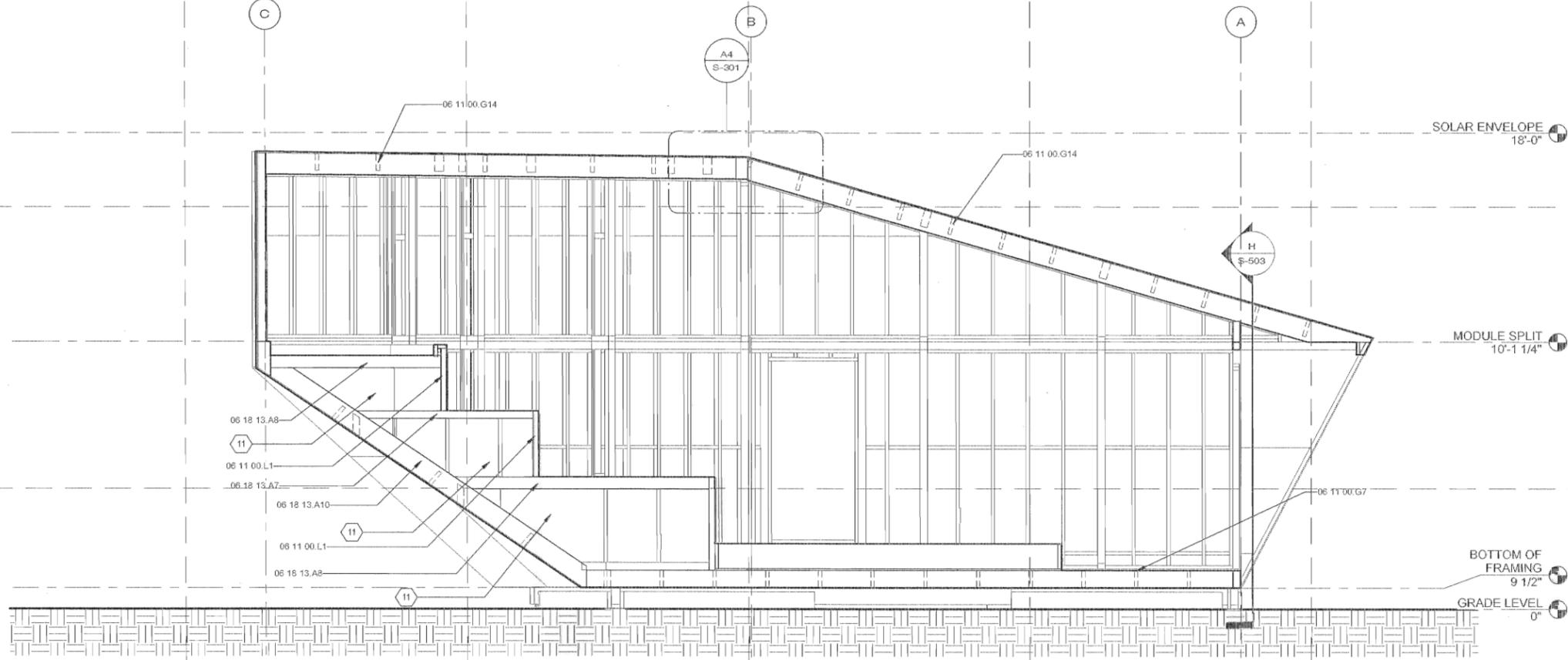
### GENERAL SHEET NOTES

### SHEET NOTES

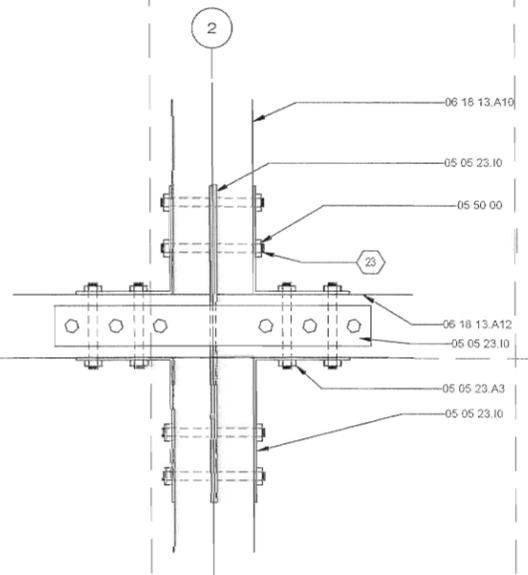
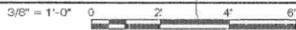
- 11 SHEETED
- 23 3/4" WELDED STUD

### REFERENCE KEYNOTES

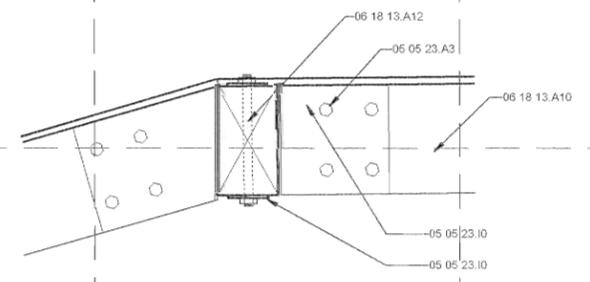
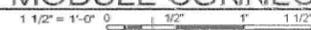
- 05 05 23.A3 3/4" A307 BOLT
- 05 05 23.I0 1/4" STEEL PLATE
- 05 50 00 METAL FABRICATIONS
- 06 11 00.G7 2X8 JOISTS @ 24" O.C.
- 06 11 00.G14 2X8 RAFTERS @ 24" O.C.
- 06 11 00.L1 4X4
- 06 18 13.A7 4X4 LAMINATE VENEER LUMBER
- 06 18 13.A8 4X6 LAMINATE VENEER LUMBER
- 06 18 13.A10 4X10 LAMINATE VENEER LUMBER
- 06 18 13.A12 6X10 LAMINATE VENEER LUMBER



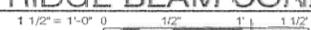
### C1 SECTION FACING EAST



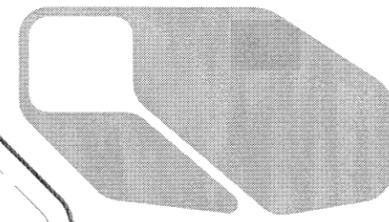
### A1 MODULE CONNECTION AT RIDGE BEAM



### A4 RIDGE BEAM CONNECTION TO WALL



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STRUCTURAL ROOF DETAILS

# S-501

### GENERAL SHEET NOTES

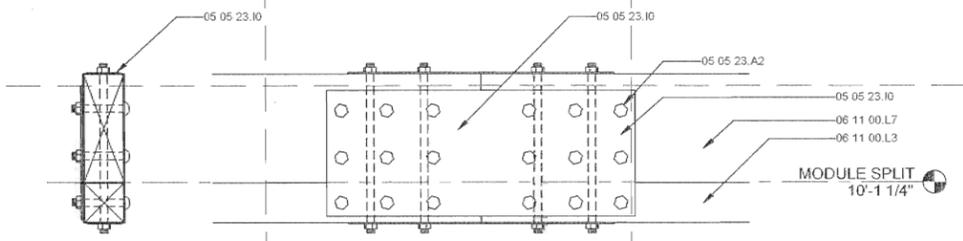
VIEW NAMING CONVENTION PER STRUCTURAL CALCULATIONS IN PROJECT MANUAL

### SHEET NOTES

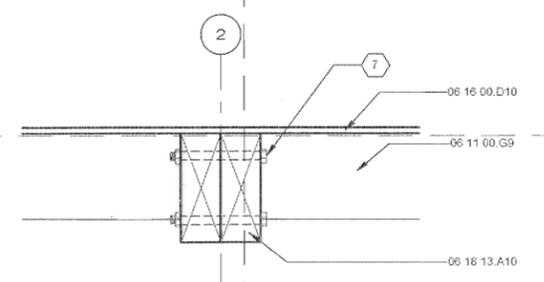
7 3/4" THRU BOLT @ 32" O.C w/ 12" AT EA. END

### REFERENCE KEYNOTES

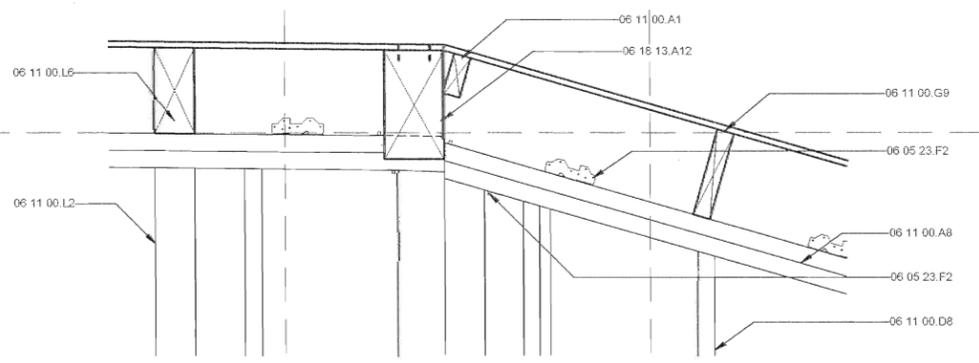
- 05 05 23.A2 5/8" A307 BOLT
- 05 05 23.J0 1/4" STEEL PLATE
- 06 05 23.F2 A35
- 06 11 00.A1 BLOCKING
- 06 11 00.A8 DOUBLE TOP PLATE
- 06 11 00.D7 2X4 STUDS
- 06 11 00.D8 2X4 STUDS @ 16" O.C.
- 06 11 00.G9 2X8 CEILING JOISTS @ 16" O.C.
- 06 11 00.L2 4X4 POST
- 06 11 00.L3 4X4 HEADER
- 06 11 00.L6 4X8 BEAM
- 06 11 00.L7 4X10 BEAM
- 06 16 00.D10 5/8" EXTERIOR GRADE PLYWOOD
- 06 18 13.A10 4X10 LAMINATEVENEER LUMBER
- 06 18 13.A12 6X10 LAMINATEVENEER LUMBER



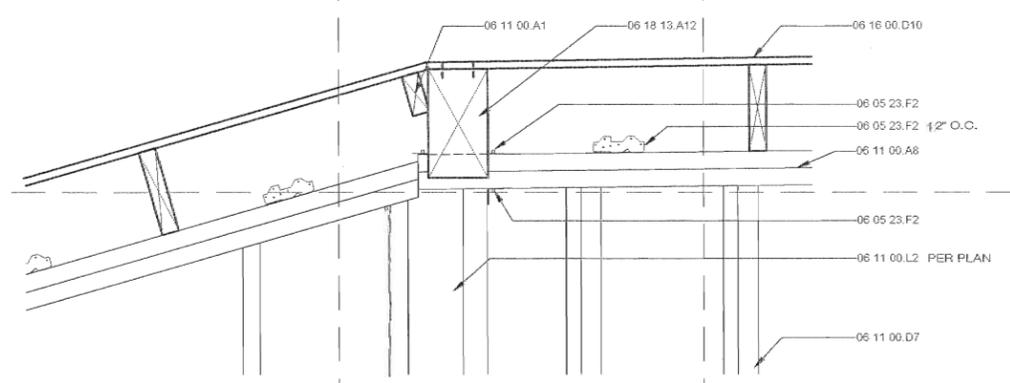
### B SOUTH FACE MODULE CONNECTION



### C MODULE CONNECTION ROOF BEAM TYP.



### F WOOD BEAM TO STUDWALL CONNECTION



### G WOOD BEAM TO STUDWALL CONNECTION



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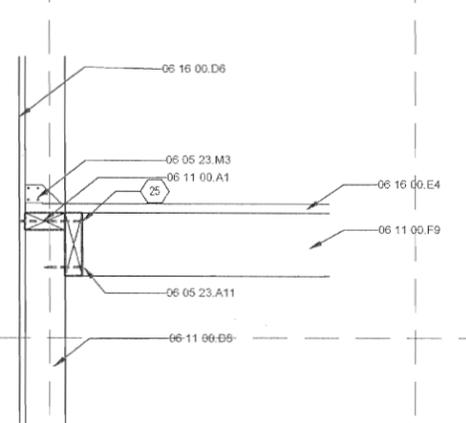
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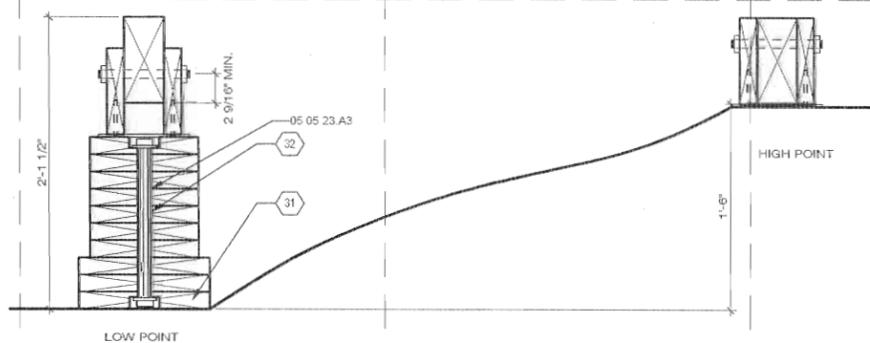
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STRUCTURAL  
DETAILS

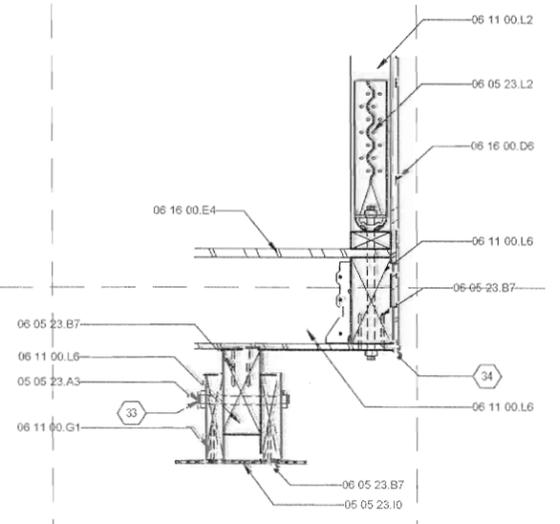
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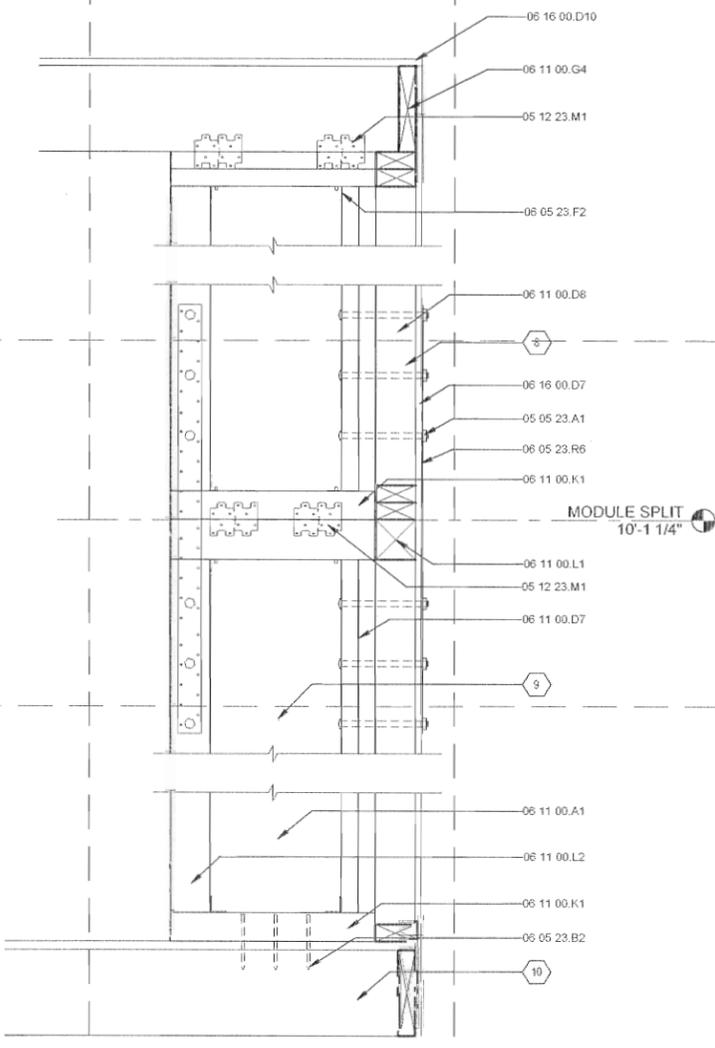
**J SHEAR WALL FLOOR**  
1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"



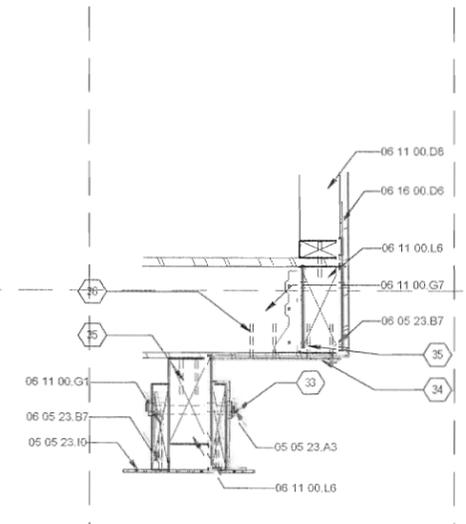
**Q FOOTING TRAVEL DETAIL**  
1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"



**N FOOTING DETAIL SHEAR WALL SPECIAL**  
1 1/2" = 1'-0" 1/2" 1' 1 1/2"



**K SHEAR WALL DETAIL**  
1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"



**P FOOTING DETAIL**  
1 1/2" = 1'-0" 1/2" 1' 1 1/2"

### GENERAL SHEET NOTES

VIEW NAMING CONVENTION PER STRUCTURAL CALCULATIONS IN PROJECT MANUAL

### SHEET NOTES

- 8 4X4 @ SLENDER WALL (PER PLAN)
- 9 10D @ 3" O.C. STAGGERED W/ 15/32" OSB STR
- 10 WOOD BEAM (PER PLAN)
- 25 BLOCK NAILING
- 31 PRESSURE TREATED SILL PLATE
- 32 24" O.C.
- 33 16" O.C.
- 34 15x25.5" 18 GA. STEEL PLT @ 48" O.C.
- 35 2-10d @ 6" O.C.
- 36 2-10d TO EACH JOIST

### REFERENCE KEYNOTES

- 05 05 23.A1 1/2" A307 BOLT
- 05 05 23.A3 3/4" A307 BOLT
- 05 05 23.I0 1/4" STEEL PLATE
- 05 12 23.M1 LPT4
- 06 05 23.A11 16 PENNY NAIL
- 06 05 23.B2 1/2" LAG SCREW
- 06 05 23.B7 1/4" LAG SCREW
- 06 05 23.F2 A35
- 06 05 23.L2 HDU5
- 06 05 23.M3 H2.5
- 06 05 23.R6 MST37
- 06 11 00.A1 BLOCKING
- 06 11 00.D7 2X4 STUDS
- 06 11 00.D8 2X4 STUDS @ 16" O.C.
- 06 11 00.F9 2X6 JOISTS
- 06 11 00.G1 2X8
- 06 11 00.G4 2X8 JOISTS
- 06 11 00.G7 2X8 JOISTS @ 24" O.C.
- 06 11 00.K1 3X4
- 06 11 00.L1 4X4
- 06 11 00.L2 4X4 POST
- 06 11 00.L6 4X8 BEAM
- 06 16 00.D6 1/2" PLYWOOD
- 06 16 00.D7 1/2" EXTERIOR PLYWOOD
- 06 16 00.D10 5/8" EXTERIOR PLYWOOD
- 06 16 00.E4 3/4" OSB



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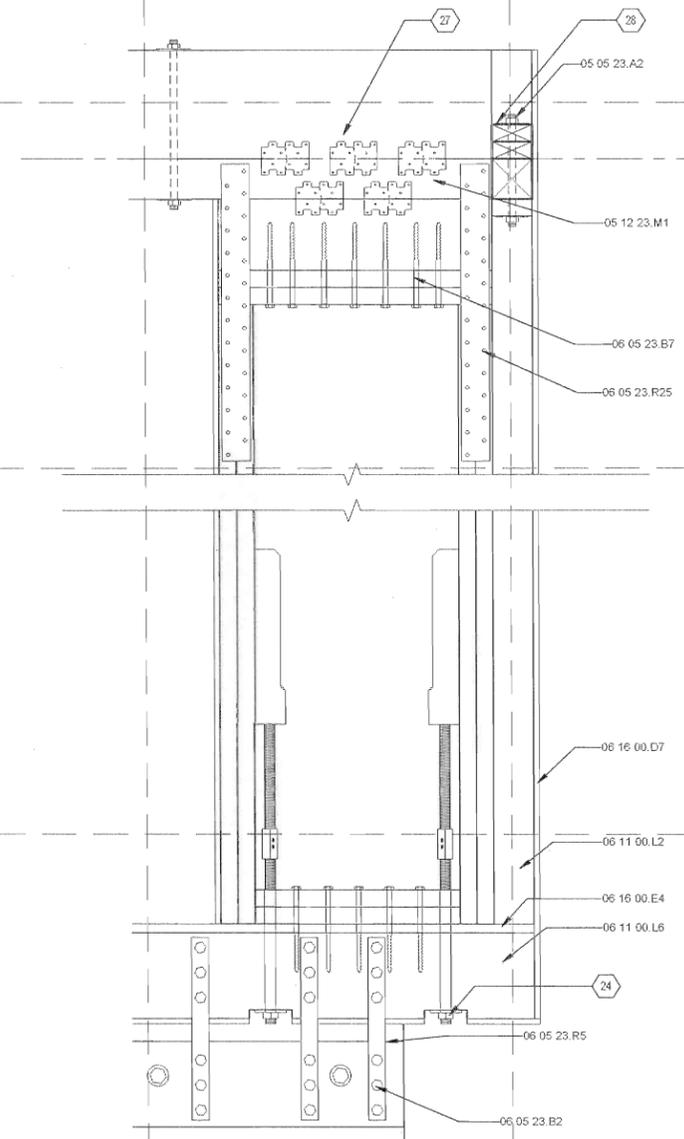
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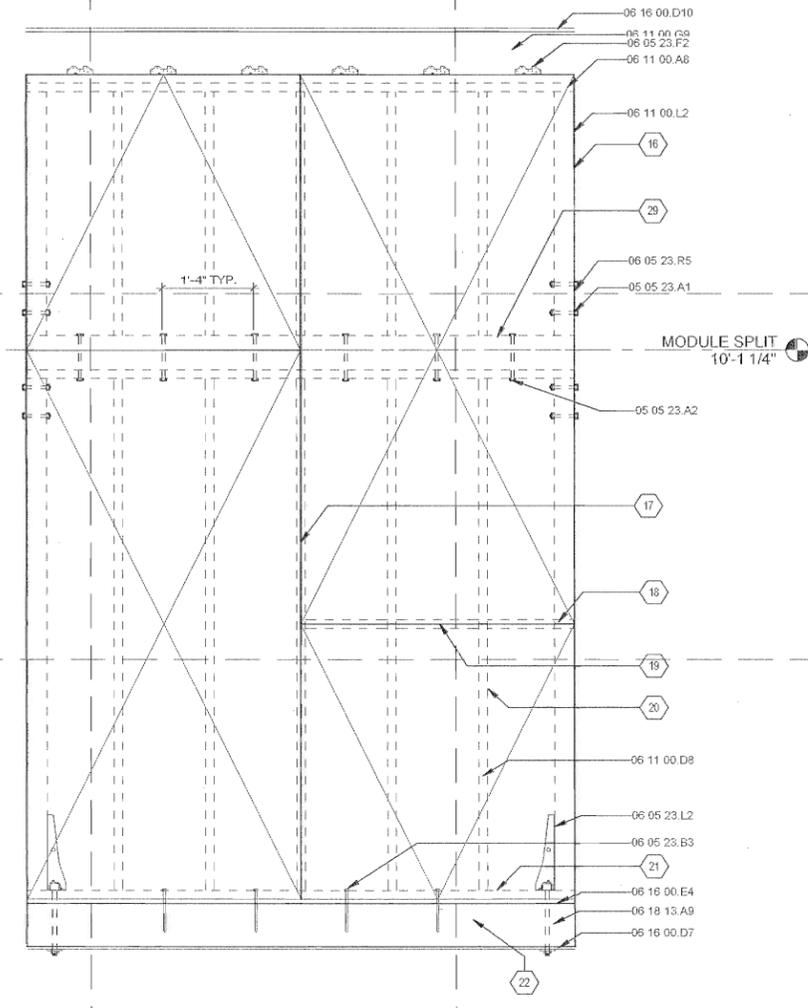
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## SHEAR WALL DETAILS AND NAILING SCHEDULES

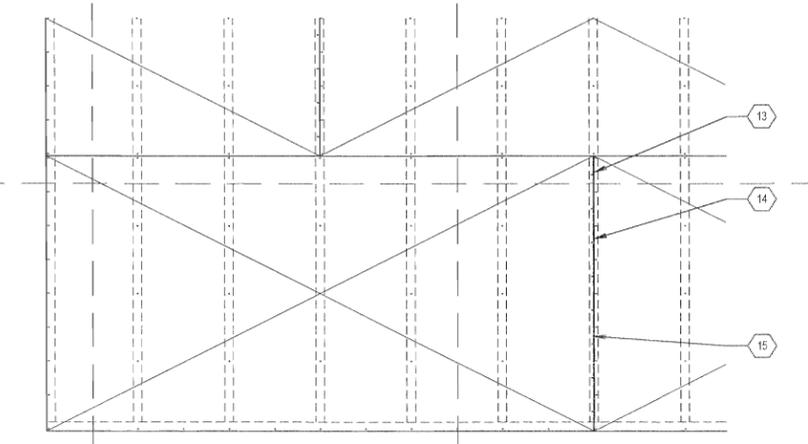
# S-503



**(H) SIMPSON 24" STRONG WALL**  
1 1/2" = 1'-0"



**(M) SHEAR WALL PLYWOOD SHEATHING**  
3/4" = 1'-0"



**(L) FLOOR & ROOF PLYWOOD TYP.**  
3/4" = 1'-0"

### GENERAL SHEET NOTES

1. BLOCK ALL PANEL EDGES PER SCHEDULE
2. SHEET MIN WIDTH IS 2'-0"
3. 4' SIDE OF PLYWOOD SHEETS TO BE SPLICED JOISTS
4. HOLD DOWN CONNECTORS SHALL BE RETIGHTENED JUST PRIOR TO ENCLOSURE
5. SHEATH ENTIRE WALL BETWEEN CROSS WALLS TO PROVIDE FLUSH SURFACE
6. ALL ANCHOR BOLTS SHALL HAVE 3" SQ PLATE WASHERS
7. ALL PLYWOOD NAILING TO BE COMMON NAILS
8. OSB STR I MAY BE REPLACED WITH CDX STR I PLYWOOD
9. MIN EDGE DISTANCE FOR NAILS SHALL BE 3/8"
10. PLYWOOD FACE GRAIN MAY BE VERTICAL OR HORIZONTAL
11. SEE PLAN FOR LOCATION OF PLYWOOD SHEATHING
12. FLOOR INDEX 32/16
13. ROOF INDEX 24/0
14. VIEW NAMING CONVENTION PER STRUCTURAL CALCULATIONS IN PROJECT MANUAL

### SHEET NOTES

13. STAGGERED END NAILING AT SUPPORTED PANELS EDGES
14. BOUNDARY NAILING 8D @ 6" @ ROOF BOUNDARY NAILING 10D @ 6" @ FLOOR INTERMEDIATE NAILS 8D @ 12" O.C. @ ROOF INTERMEDIATE NAILS 10D @ 10" O.C. @ FLOOR
16. BOUNDARY WALL B.N.
17. 2X OR 3X STUDS PER SHEAR WALL SCHEDULE
18. 2X OR 3X BLOCKING PER SCHEDULE
19. EDGE NAILING PER SCHEDULE
20. INTERMEDIATE NAILING @ 12"
21. 2X OR 3X SILL PLATE (PER SCHEDULE)
22. (CONTINUOUS W/ HUS HANGERS AT EACH END)
24. COUNTERSUNK 2.75"x2.75" 1/4" PLT
27. 5 ON EACH SIDE
28. 3"x3" 1/8" PLT
29. 3 X PLATE

### REFERENCE KEYNOTES

- |              |                               |
|--------------|-------------------------------|
| 05 05 23.A1  | 1/2" A307 BOLT                |
| 05 05 23.A2  | 5/8" A307 BOLT                |
| 05 12 23.M1  | LPT4                          |
| 06 05 23.B2  | 1/2" LAG SCREW                |
| 06 05 23.B3  | 5/8" LAG SCREW                |
| 06 05 23.B7  | 1/4" LAG SCREW                |
| 06 05 23.F2  | A35                           |
| 06 05 23.L2  | HDU5                          |
| 06 05 23.R5  | MST27                         |
| 06 05 23.R25 | MST126                        |
| 06 11 00.A8  | DOUBLE TOP PLATE              |
| 06 11 00.D8  | 2X4 STUDS @ 16" O.C.          |
| 06 11 00.G9  | 2X8 CEILING JOISTS @ 16" O.C. |
| 06 11 00.L2  | 4X4 POST                      |
| 06 11 00.L6  | 4X8 BEAM                      |
| 06 16 00.D7  | 1/2" EXTERIOR GRADE PLYWOOD   |
| 06 16 00.D10 | 5/8" EXTERIOR GRADE PLYWOOD   |
| 06 16 00.E4  | 3/4" T&G STRANDBOARD DECKING  |
| 06 18 13.A9  | 4X8 LAMINATE VENEER LUMBER    |

PLYWOOD SHEAR WALL						
MARK	PLYWOOD PANEL		SILL	SILL PLATE ANCHOR TO WOOD BEAM		SHEAR TRANSFER
	THK	TYPE		THK.	SIZE AND SPACING	
1	15/32"	OSB STRUCT I	2x	5/8" DIAM LAG SCREW @ 16 O.C.	340	A35 @ 16" O.C.
2	19/32"	OSB STRUCT I w/ 3x BLKG & 3x STUDS AT PANEL JOINTS	3x	5/8" DIAM LAG SCREW @ 16 O.C.	510	A35 @ 16" O.C.

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TYPICAL  
STRUCTURAL  
DETAILS

# S-504

### GENERAL SHEET NOTES

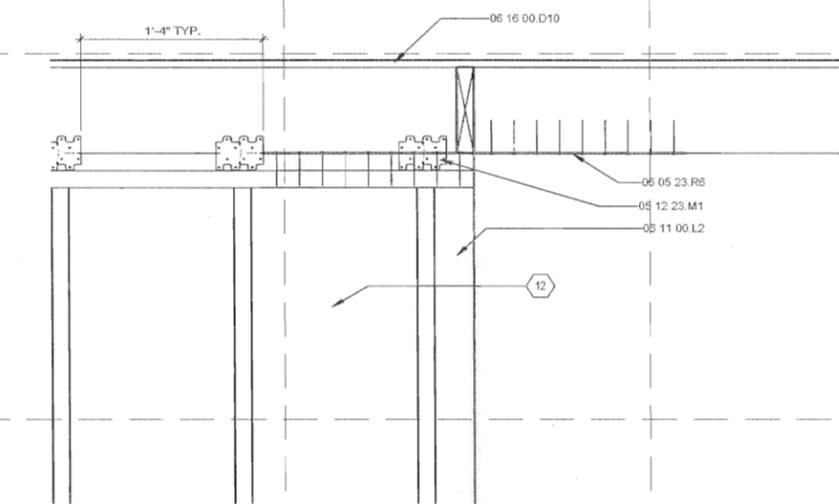
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### SHEET NOTES

- 12 TYP. SHEAR WALL PER PLAN
- 25 BLOCK NAILING
- 26 2 3/4" sq. 1/4" STEEL WASHER PL.

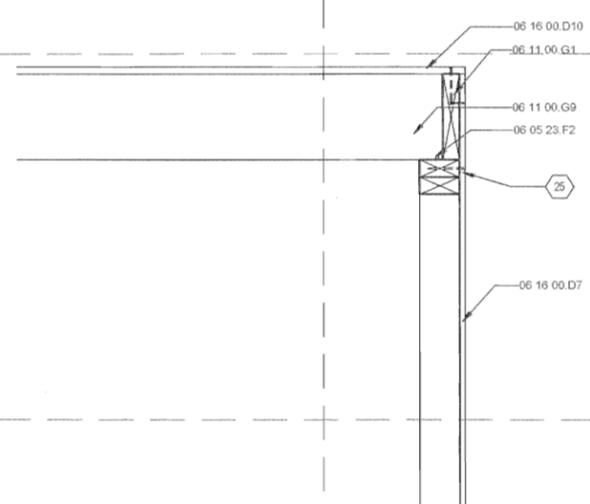
### REFERENCE KEYNOTES

- 05 12 23.M1 LPT4
- 06 05 23.F2 A35
- 06 05 23.L2 HDU5
- 06 05 23.R6 MST37
- 06 11 00.D1 2X4
- 06 11 00.G1 2X8
- 06 11 00.G9 2X8 CEILING JOISTS @ 16" O.C.
- 06 11 00.L2 4X4 POST
- 06 16 00.D6 1/2" PLYWOOD
- 06 16 00.D7 1/2" EXTERIOR GRADE PLYWOOD
- 06 16 00.D10 5/8" EXTERIOR GRADE PLYWOOD
- 06 16 00.E4 3/4" T&G STRANDBOARD DECKING



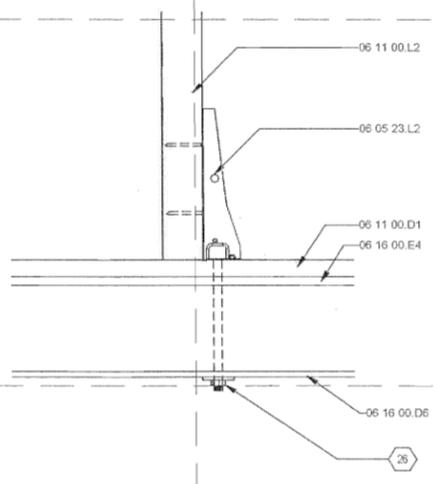
**D DRAG DETAIL TYP.**

1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"



**E WALL STUD TO RAFTER CONNECTION TYP.**

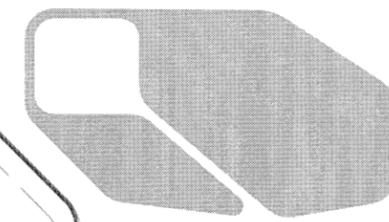
1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"



**I HDU5 CONNECTION TYP.**

1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"

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### FLOOR DETAILS

# S-505

### GENERAL SHEET NOTES

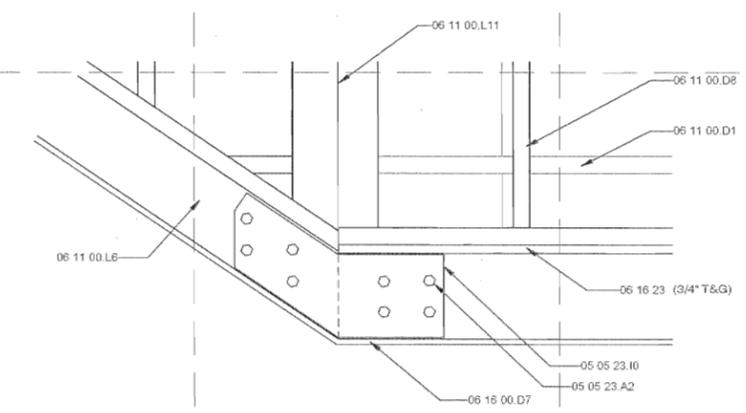
VIEW NAMING CONVENTION PER STRUCTURAL CALCULATIONS IN PROJECT MANUAL

### SHEET NOTES

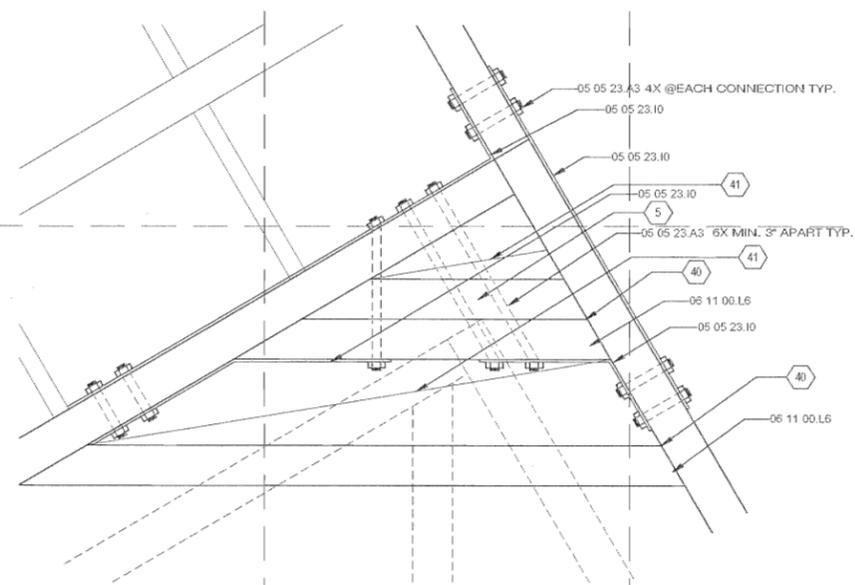
- 5 TWIN MEMBERS
- 40 TYP HUS HANGER @ EACH END
- 41 BLOCKING

### REFERENCE KEYNOTES

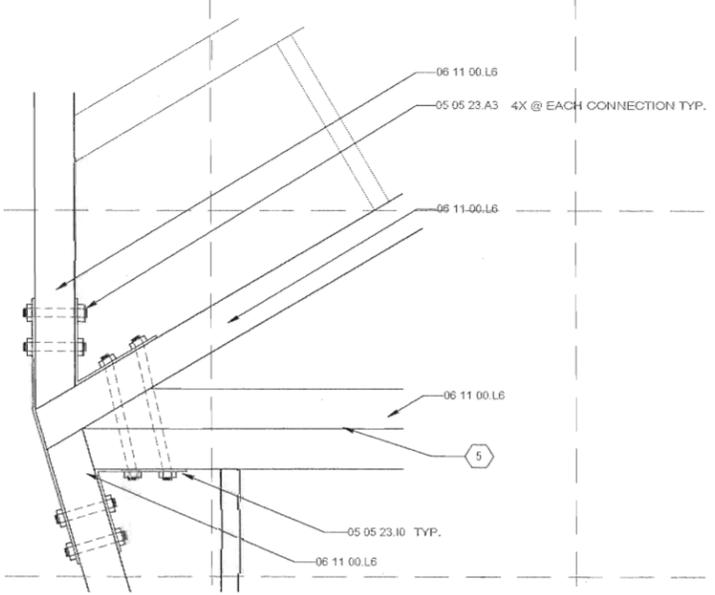
- 05 05 23.A2 5/8" A307 BOLT
- 05 05 23.A3 3/4" A307 BOLT
- 05 05 23.I0 1/4" STEEL PLATE
- 05 11 00.D1 2X4
- 05 11 00.D8 2X4 STUDS @ 16" O.C.
- 05 11 00.L6 4X8 BEAM
- 05 11 00.L11 4X8 POST
- 05 16 00.D7 1/2" EXTERIOR GRADE PLYWOOD
- 05 16 23 SUBFLOORING



**R WEST WALL CANTILEVER CONNECTION**  
1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"



**S FLOOR DETAIL EAST WALL**  
1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"



**T FLOOR DETAIL WEST WALL**  
1 1/2" = 1'-0" 0 1/2" 1' 1 1/2"

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## REINFORCING AND FRAMING SCHEDULES

# S-601

## MATERIALS BY DISCRETE LENGTH

MEMBER TYPE	QUANTITY	LENGTH (LF)
2x4	97	8
	123	10
	24	12
	10	14
	8	16
	7	20
	11	22
2x6	35	8
	4	10
	3	16
3x4	6	10
2x8	44	8
	62	10
	47	12
	7	14
	2	20
	2	24
	2	26
2x12	15	12
	3	14
	46	8
	23	10
4x4	1	12
	1	14
	1	22
	1	24
4x6	1	26
	4	16
	1	18
	2	20
	2	8
	2	12
4x8	2	14
	3	16
	3	18
	1	20
	1	24
	3	26
4x10	2	16
LVL 3.5x9.5	1	14
	2	18
LVL 3.5x7.5	2	26
	1	14
LVL 5.25x9.5	5	10
	1	26

### GENERAL SHEET NOTES

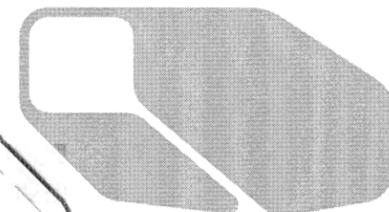
### SHEET NOTES

### REFERENCE KEYNOTES

## SHEATING SCHEDULE

TYPE	LOCATION	NUMBER OF SHEETS
5/8 CDX	ROOF, CANTILEVER	35
1/2 CDX	UNDER MODULE	20
1/2 BCX	PERIMETER WALL	78
1/2 OSB	PLATFORM FAGE	10
3/4 T&G	SUBFLOOR	52





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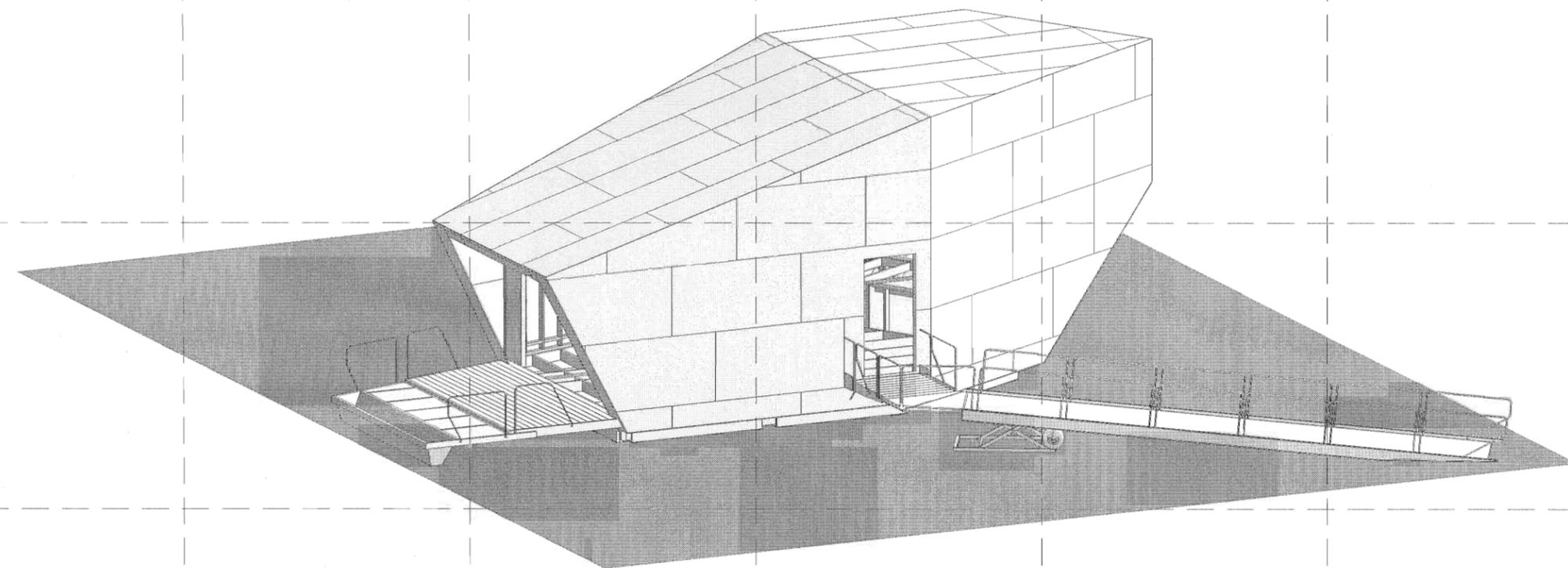
FRAMING ISOMETRICS

# S-901

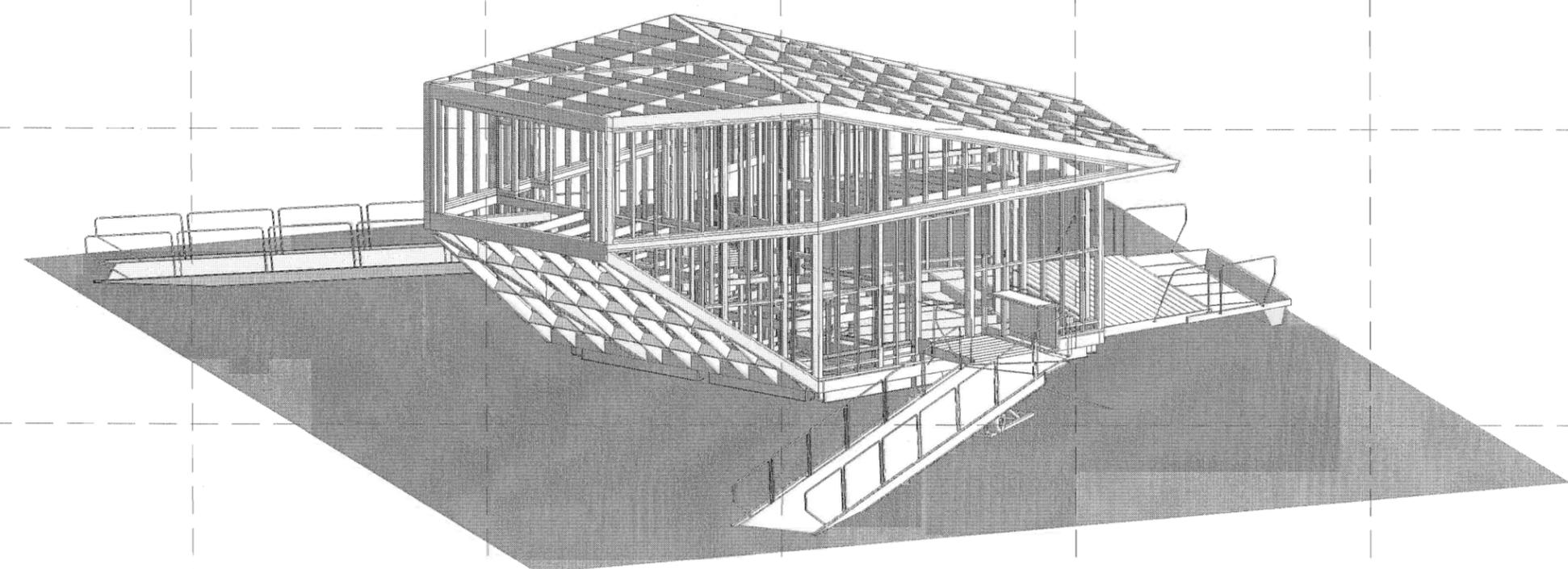
### GENERAL SHEET NOTES

### SHEET NOTES

### REFERENCE KEYNOTES



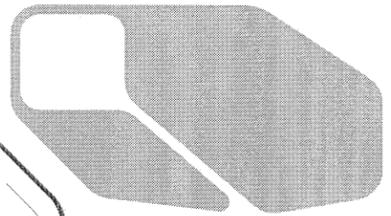
**C1** SHEATHING ISOMETRIC



**A1** FRAMING ISOMETRIC



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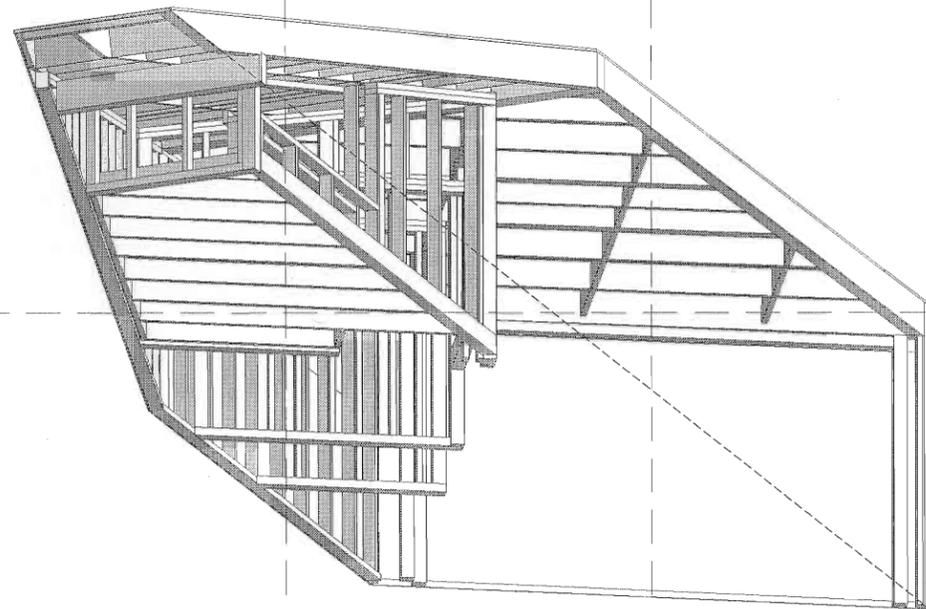
MODULE ISOMETRICS

# S-902

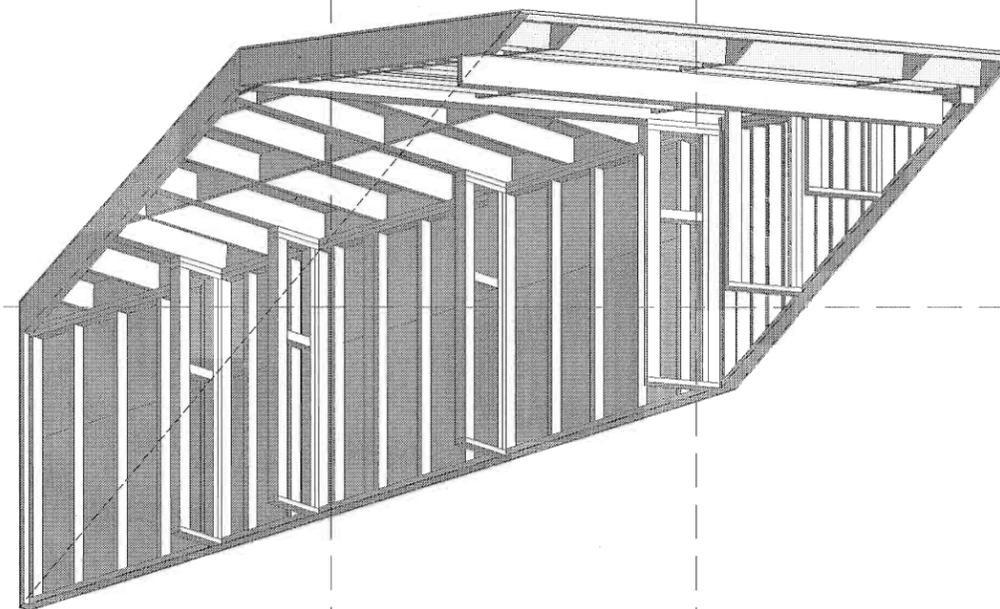
### GENERAL SHEET NOTES

### SHEET NOTES

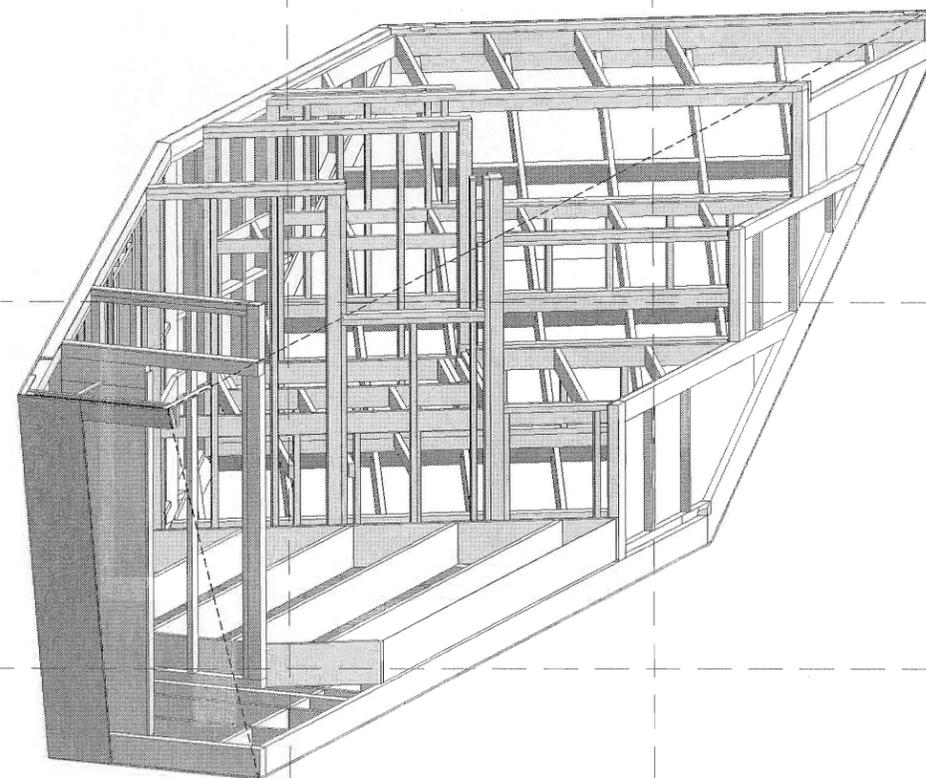
### REFERENCE KEYNOTES



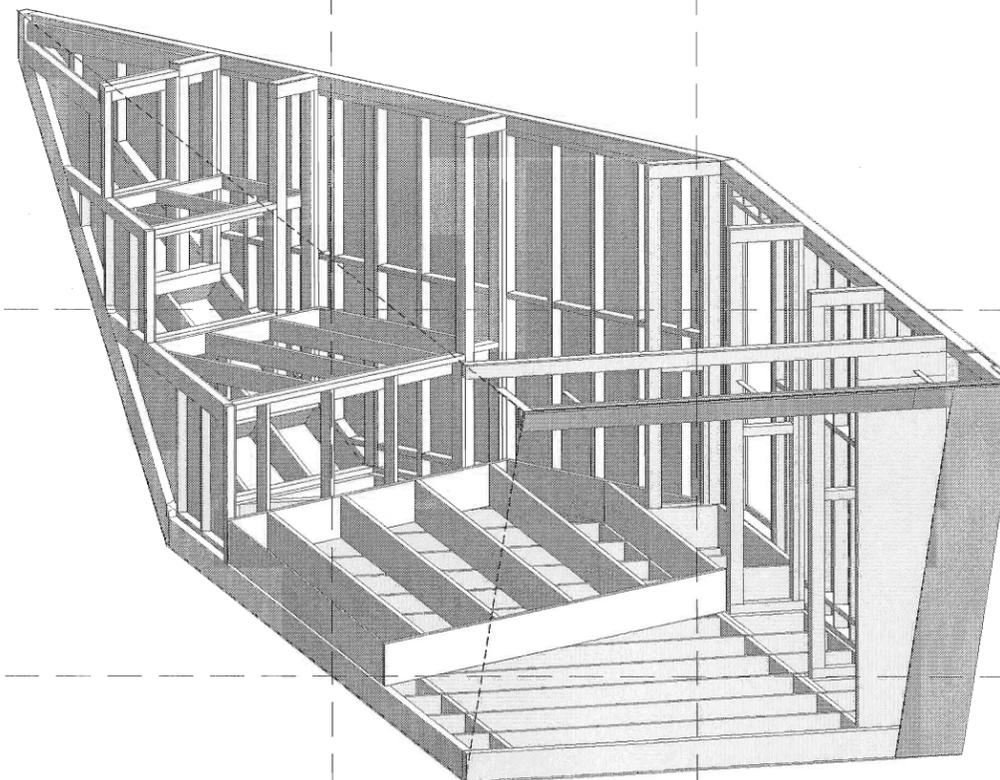
C1 WEST TOP MODULE



C4 EAST TOP MODULE



A1 WEST BOTTOM MODULE



A4 EAST BOTTOM MODULE