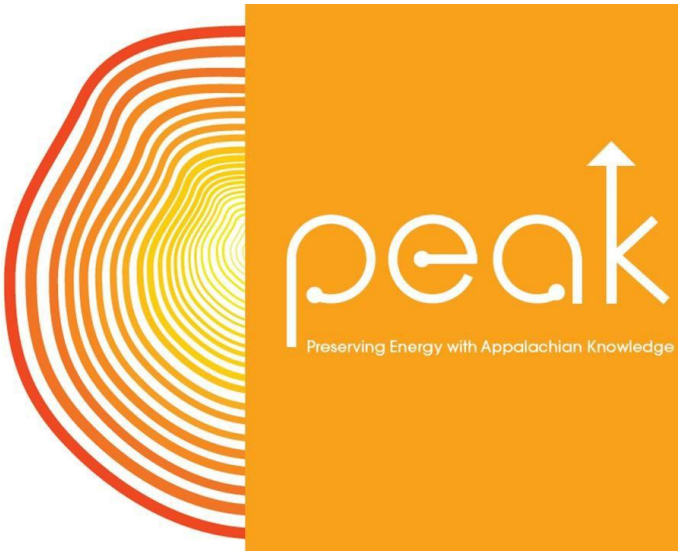

WVU SOLAR HOUSE

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February 14th, 2013

U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON 2013

Project Manual

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Rules Compliance Checklist

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 4-2	Construction Equipment	Drawing(s)showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site	01 54 23
Rule 4-2	Construction Equipment	Specifications for heavy machinery	01 54 19
Rule 4-3	Ground Penetration	Drawing(s) showing the locations and depths of all ground penetrations on the competition site	A-503
Rule 4-4	Impact within the Solar Envelope	Drawing(s) showing the location, contact area, and bearing pressure of every component resting directly within the solar envelope	C-201, C-202
Rule 4-5	Generators	Specifications for generators(including sound rating)	26 32 00
Rule 4-6	Spill Containment	Drawing(s) showing the locations of all equipment, containers, and pipes that will contain liquids at any point during the event	H-101
Rule 4-6	Spill Containment	Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event	H-101
Rule 4-7	Lot Conditions	Calculations showing that the structural design remains compliant even if 18 in. (45.7 cm) of vertical elevation change exists	A-503
Rule 4-7	Lot Conditions	Drawing(s) showing shimming methods and materials to be used if 18 in. (45.7 cm) of vertical elevation change exists on the lot	A-503
Rule 5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	A-102
Rule 5-2	Solar Envelope Dimensions	List of solar envelope exemption requests accompanied by justifications and drawing references	N/A
Rule 6-1	Structural Design Approval	List of, or marking on, all drawing and project manual sheets that have been or will be stamped by the qualified, licensed design professional in the stamped structural submission; the stamped submission shall consist entirely of sheets that also appear in the drawings and project manual	Appendix B
Rule 6-2	Finished Square Footage	Drawing(s) showing all info needed by the officials to measure the finished square footage electronically	G-101
Rule 6-2	Finished Square Footage	Drawing(s) showing all movable components that may increase the finished square footage if operated during contest week	N/A
Rule 6-3	Entrance and Exit Routes	Route through house and entire solar envelope.	Appendix A

Rule 7-1	Placement	Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation etc.	L-101
Rule 7-2	Watering Restrictions	Drawing(s) showing the layout and operation of greywater irrigation systems	N/A
Rule 8-1	PV Limitations	Specifications for photovoltaic components	48 31 00
Rule 8-3	Batteries	Standard primary and secondary batteries, used only for appliances, all under 9 volts.	N/A
Rule 8-3	Batteries	Specifications for all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-5	Village Grid	Completed interconnection application form	P. 9
Rule 8-5	Village Grid	Drawing(s) showing the locations of the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	E-101
Rule 8-5	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	E-101
Rule 8-5	Village Grid	One-line electrical diagram	E-101
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Rule 8-5	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	A-101
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Rule 9-1	Container Locations	Tanks located under deck and under roof, receiving no sun during 9 - 5	H-101
Rule 9-2	Team-Provided Liquids	Quantity, specifications, and delivery date(s) of all team-provided liquids for irrigation, thermal mass, hydronic system pressure test, and thermodynamics.	P. 7
Rule 9-3	Greywater Reuse	Drawing(s)showing the layout and operation of greywater reuse systems	P-101
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Rule 9-6	Thermal Mass	Drawing(s) that show the locations of liquid-based thermal mass systems.	P-107
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Rule 9-7	Greywater Heat Recovery	Drawing(s) showing the layout and operation of greywater heat recovery systems	N/A

Rule 9-8	Water Delivery	Drawing(s) showing the complete of water delivery and distribution events	P-101
Rule 9-8	Water Delivery	Specifications for the water delivery containers	P-601
Rule 9-9	Water Removal	Drawing(s) showing the complete sequence of water consolidation and removal events	P-101
Rule 9-9	Water Removal	Specifications for the containers from which water will be removed	P-601
Rule 11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	Appendix A

Structural Calculations

See Appendix B.

Reconfigurable Components

Our project house has no reconfigurable options.

Detailed Water Budget

Function	Gallons Used	Gal	Events	Notes
Hot Water Shower Draws	320	20	16	
Dishwasher	25	5	5	
Clothes Washer	116	16	8	
Sink	10	0.5	20	
Testing	10	2	5	
Vegetation	160	40	4	Drawn from Fresh Water Supply
Fire Suppression	200	200	1	Held on reserve in Fresh Water Supply
Water System Fill	150	150	1	100 gallons for water tank fill, 50 gallons for piping fill
Safety Factor and Misc. Usage(hot water overflow, etc.	169			
Water Required	**1150 gallons**			

Summary of Unlisted Electrical Components

Special Photovoltaic Panel

N/A

To ensure safe operation during the public event, the team will complete the following minimum testing on the "Special Photovoltaic Panel" and submit the results to the Organizers:

1) N/A

Interconnection Application Form

PV Systems

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
SolarWorld	33 SolarWorld Sunmodule SW 260 Mono Panels	260 W per panel

Total DC power of all arrays is 8.5KW under ideal circumstances.

INVERTERS

Each solar panel has their own Enphase M215 micro-inverter to convert the DC power to AC.

Maximum input is 270W @240V

REQUIRED INFORMATION

The following information must be included in the project manual or construction documents. If located in the construction documents, list the drawing locations in this section of the project manual.

MAIN PANEL LOAD CALCULATIONS			
GENERAL LIGHTING AND RECEPTACLES (NEC 210.11 (C))			
SMALL APPLIANCES	2 CKT X 1500 VA/CKT	3000	VA
WASHER	1 CKT X 1500VA/CKT	1500	VA
LIGHTING (NEC 220.61 (A))	939 SQFT X 3VA/SQFT	2817	VA
SUBTOTAL (NEC 220.40)	3000 VA + 4317 VA AT 35%	**4511**	**VA**
COOKING			
RANGE	14400 VA AT 100%	14400	VA
SUBTOTAL (NEC 220.55 NOTE (1) AND NOTE (4), COLUMN (C))	5%/1KW X 3KW = 15%	**9200**	**VA**
FIXED APPLIANCES			
WATER HEATER (NEC 220.53)	4500 VA AT 75%	3375	VA
WATER TANK PUMP (NEC 430.24)	373 VA AT 100%	373	VA
SPRINKLER PUMP (NEC 430.24)	373 VA AT 100%	373	VA
DISHWASHER (NEC 220.53)	1500 VA AT 75%	1125	VA
RANGE HOOD (NEC 220.53)	492 VA AT 75%	369	VA
SUBTOTAL		**5615**	**A**
DRYER (NEC 220.54)	5600 VA AT 100%	**5600**	**A**
HVAC COMPRESSOR AND UNITS	1780 VA AT 100%	**1780**	**VA**
TOTAL LOAD		**26706**	**VA**
TOTAL CURRENT		**112**	**A**
MAIN PANEL BREAKER		**150**	**A**
NEUTRAL CONDUCTOR			
GENERAL LIGHTING AND RECEPTACLES (NEC 220.61 (A))	4511 VA AT 100%	4511	VA
COOKING (NEC 220.61 (B))	9200 VA AT 70%	6440	VA
FIXED APPLIANCES (NEC 220.61 (A))	5246 VA AT 100%	5246	VA
DRYER (NEC 220.61 (B))	5600 VA AT 70%	3920	VA
TOTAL LOAD		**20117**	**VA**
TOTAL CURRENT		**84**	**A**

SUB PANEL 1 LOAD CALCULATIONS			
GENERAL RECEPTACLES (NEC 210.11(C))			
WASHER	1 CKT X 1500VA/CKT	1500	VA
SMALL APPLIANCE CIRCUITS	2 CKT X 1500VA/CKT	3000	VA
SUBTOTAL (NEC 220.40 AND NEC 220.55)	3000VA AT 100% + 1500 AT 35%	**3525**	**VA**
FIXED APPLIANCES			
DISHWASHER (NEC 220.53)	1500 VA AT 100%	1500	VA
RANGE HOOD (NEC 220.53)	492 VA AT 100%	492	VA
SUBTOTAL		**1992**	**VA**
HVAC COMPRESSOR AND UNITS	1780 VA AT 100%	**1780**	**VA**
TOTAL LOAD		**7297**	**VA**
TOTAL CURRENT		**31**	**A**
SUB PANEL 1 BREAKER		**125**	**A**
NEUTRAL CONDUCTOR			
GENERAL RECEPTACLES (NEC 220.61 (A))	3525 VA AT 100%	3525	VA
FIXED APPLIANCES (NEC 220.53)	1500 VA AT 75%	1125	VA
TOTAL LOAD		**4650**	**VA**
TOTAL CURRENT		**20**	**A**

SUB PANEL 2 LOAD CALCULATIONS			
GENERAL LIGHTING (NEC 210.11)			
LIGHTING (NEC 220.61 (A))	939 SQFT X 3VA/SQFT	2817	VA
SUBTOTAL (NEC 220.40)	2817 AT 35%	**986**	**VA**
COOKING			
RANGE	14400VA AT 100%	14400	VA
SUBTOTAL (NEC 220.55 NOTE (1) AND NOTE (4), COLUMN C)	5%/1KW X 3KW = 15%	**9200**	**VA**
FIXED APPLIANCES			
WATER HEATER (NEC 220.53)	4500 VA AT 100%	4500	VA
WATER TANK PUMP (NEC 430.24)	373 AT 100%	373	VA
SPRINKLER PUMP (NEC 430.24)	373 AT 100%	373	VA
SUBTOTAL		**5246**	**VA**
DRYER (NEC 220.54)	5600 VA AT 100%	**5600**	**VA**
TOTAL LOAD		**21032**	**VA**
TOTAL CURRENT		**88**	**A**
SUB PANEL 2 BREAKER		**125**	**A**
NEUTRAL CONDUCTOR			
GENERAL LIGHTING (NEC 220.61 (A))	986 VA AT 100%	986	VA
COOKING (NEC 220.61 (B))	9200 VA AT 70%	6440	VA
FIXED APPLIANCES (NEC 220.61 (A))	5246 AT 75%	3945	VA
DRYER (NEC 220.61 (B))	5600 AT 70%	3920	VA
TOTAL LOAD		**15291**	**A**
TOTAL CURRENT		**64**	**A**

Energy Analysis Results and Discussion

OBJECTIVES

This report analyzes the meteorological situations that may occur during the Solar Decathlon contest period and sets tentative values of devices performance in order to maximize overall energy efficiency.

Meteorological data from Orange County, CA taken from 1998 and 2005 are used to estimate weather conditions for the contest period (October 3-13).

A realistic forecast of energy consumption of the house is also presented for design purposes.

METEOROLOGICAL DATA

Solar decathlon 2013 will take place in a different period of time and in a different location with respect to the previous edition. It is therefore necessary to compare those two different meteorological conditions in order to have realistic comparisons with the teams competing in 2011.

Solar Decathlon 2013 will be in October 3rd to 13th, differently from the 2011 edition which was in the September 20th to 30th time period.Temperature, relative humidity, and radiation have rather different behaviors that have to be considered in order to maximize energy efficiency performances.

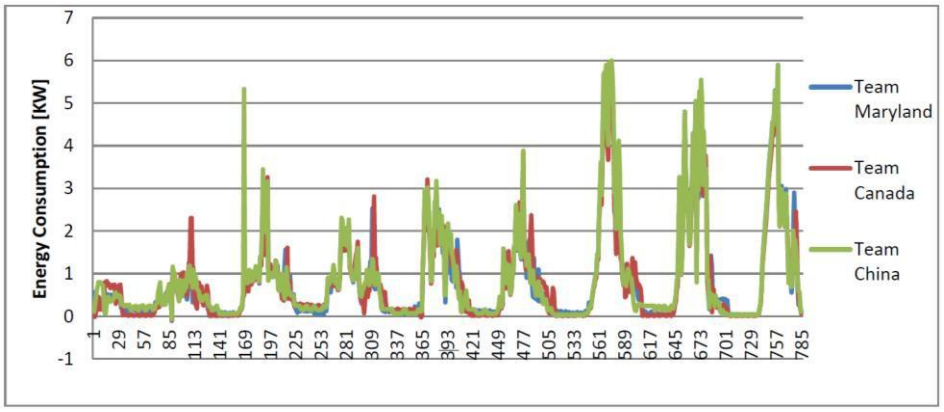
ENERGY CONSUMPTION

Good understanding of the energetic behavior of the house is crucial to discerning an estimation of electrical consumption.

Data have been collected from studies of the government and from the previous edition of the Solar Decathlon. First, it has to be considered that Solar Decathlon contest is not exemplary from the energetic point of view (and thus not immediately comparable with average domestic data) as the period of time is rather short, and the weather rather warm – thus, remarkably reducing costs to heat or cool the building.

Another important aspect regards the behavior of living people as, due to the ongoing contest, they will really take care of energy saving. Thus their effort will be considerably greater than the that of a normal family during daily life. Moreover, all the appliances and energy driven systems of the house are supposed to work in the most efficient way. Due to this reason, the average consumption of a team should be lower than the consumption of a normal family. Charts below show these differences.

U.S. Per Capita Electricity Use By State In 2010				
Ranking	State	Population (thousands)	kWh (millions)	kWh per capita
1	Wyoming	564	15,475	27,457
2	Kentucky	4,339	93,686	21,590
3	District of Columbia	602	11,972	19,896
4	North Dakota	673	13,100	19,477
5	Louisiana	4,533	85,461	18,852
6	South Carolina	4,625	82,809	17,903
7	Alabama	4,780	82,654	17,293
8	West Virginia	1,853	32,039	17,290
9	Mississippi	2,967	49,829	16,793
10	Arkansas	2,916	48,167	16,519
11	Indiana	6,484	105,782	16,315
12	Nebraska	1,826	29,757	16,293
13	Tennessee	6,346	102,281	16,117
14	Oklahoma	3,751	58,399	15,568
15	Iowa	3,046	45,841	15,048
16	Georgia	9,688	141,226	14,578
17	Virginia	8,001	115,928	14,489
18	Idaho	1,568	22,690	14,475
19	Missouri	5,989	85,913	14,345
20	North Carolina	9,535	136,595	14,325
21	Kansas	2,853	40,695	14,263
22	Texas	25,146	356,536	14,179
23	Montana	989	13,844	13,992
24	South Dakota	814	11,330	13,916
25	Washington	6,725	91,166	13,557
26	Ohio	11,537	154,445	13,388
27	Delaware	898	11,587	12,904
28	Minnesota	5,304	68,126	12,845
29	Nevada	2,701	33,748	12,497
30	Florida	18,801	232,735	12,379
	United States	308,746	3,749,985	12,146
31	Wisconsin	5,687	69,147	12,159
32	Oregon	3,831	46,269	12,077
33	Pennsylvania	12,702	149,368	11,759
34	Arizona	6,392	72,836	11,395
35	Maryland	5,774	65,489	11,343
36	Illinois	12,831	144,378	11,253
37	New Mexico	2,059	22,113	10,739
38	Michigan	9,884	103,941	10,516
39	Colorado	5,029	52,099	10,359
40	Utah	2,764	27,932	10,106
41	New Jersey	8,792	78,999	8,985
42	Vermont	626	5,620	8,982
43	Maine	1,328	11,552	8,696
44	Massachusetts	6,548	56,252	8,591
45	Connecticut	3,574	30,432	8,514
46	New Hampshire	1,316	10,909	8,286
47	Alaska	710	5,648	7,952
48	New York	19,378	144,693	7,467
49	Rhode Island	1,053	7,825	7,434
50	Hawaii	1,360	10,016	7,363
51	California	37,254	250,384	6,721



From these charts, it can be seen that the amount of electrical energy consumption per year is even lower than consumption per capita in California.

RADIATION

Sun provides, through radiation, an important source for the house. Radiation, in fact, strongly affects the energy balance of a building not only because of its heating power, but also because the radiated energy can be converted into electrical energy. Sun radiation has, in fact, three different effects:

1) Wall heating: during the day, heat transmitted by radiation affects temperature inside the house depending on its exposure and orientation.

2) Water heating: by means of solar panels, solar radiation can be used to heat water, thus reducing costs due to the request of hot water.

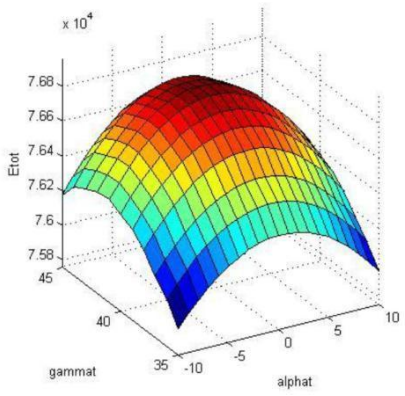
3) Electricity production: photovoltaic panels allow for the conversion of energy from radiation to electricity, with rather low efficiency (in the order of 10% and slightly more).

For the reasons above, it is important to estimate radiated energy on a surface. This is known to change depending on the angle in which the rays impact against that surface, and therefore, on the surface tilt.

A code was then developed by the team to estimate total radiation per square meter during a chosen period of time of the year by selecting the time period, the duration of the analysis, and tilt/orientation of the surface. Furthermore the optimum angle of inclinations both for solar panels and photovoltaic panels in the selected period can then be evaluated. This allows for a specific optimization for the contest period.

So for example, with the meteorological data collected, an attempt to predict a possible behavior during the contest week was made, as was done in the first part of the report for temperature, humidity, and global horizontal irradiation. By means of the program, it is possible to evaluate the total energy irradiated on a surface for different angles and estimate the best tilt for gathering as much radiation as possible.

The amount of global irradiance in the period of the future competition related to the azimuth angle (alphat) and the tilt of the surface (gammat) can be seen below.



The maximum value of irradiation is:76.8 [KWh/m^2]

And best angles are:

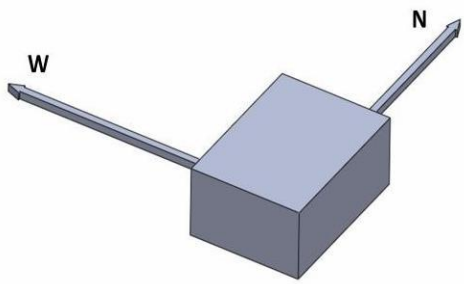
Azimuth (alphat)= 0°

Tilt (gammat)= 42°

In the same way, with knowledge of the house design, it is possible to evaluate its best orientation in order to exploit radiation most efficiently.

Example

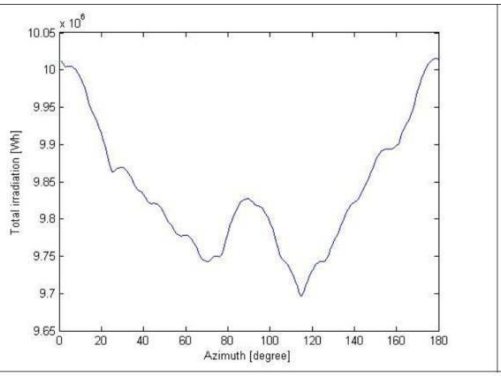
Introducing a parallelepiped house with of dimensions 7x10 m and 4.5 m high, it is possible to evaluate the total radiation incident to the house for different orientations. Starting from the initial position shown below, the house has been rotated 180° counter-clockwise, and radiation has been calculated for each angle.



Initial Orientation

The total irradiance on the building as a function of its orientation is shown below.

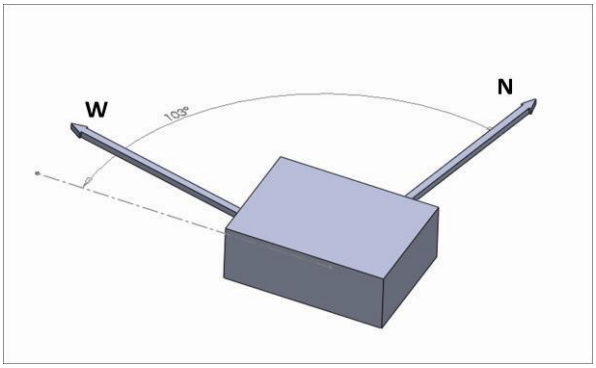
(0° refers to the position in which the 10 m wall is parallel to the north-south axis.)



the angle in which the lest amount of energy is collected is 103°.
Irradiation on

Wall 1 =1.13 MWh
Wall 2 =2.5 MWh
Wall 3 =1.44 MWh
Wall 4=5.73 MWh
Roof=0.417 MWh

The least radiation is collected on the side of the house which is 103° from the north axis as shown in the following picture. The method is applicable for the entire structure once the exterior design has been completed. In this way, it is possible to optimize its orientation in terms of energy radiated.



Orientation with the Least Radiated Energy Collected

Simulation of Thermal Behavior of the House

The thermal behavior of the house has been implemented in EnergyPlus, a software capable of predicting the evolution of temperature in the different zones of the house by assuming the methereological data.

Geometries have been considered in partnership with the design team (figure 1), and mainly to underline the effect of a fulcrum on the passive ventilation of the house.

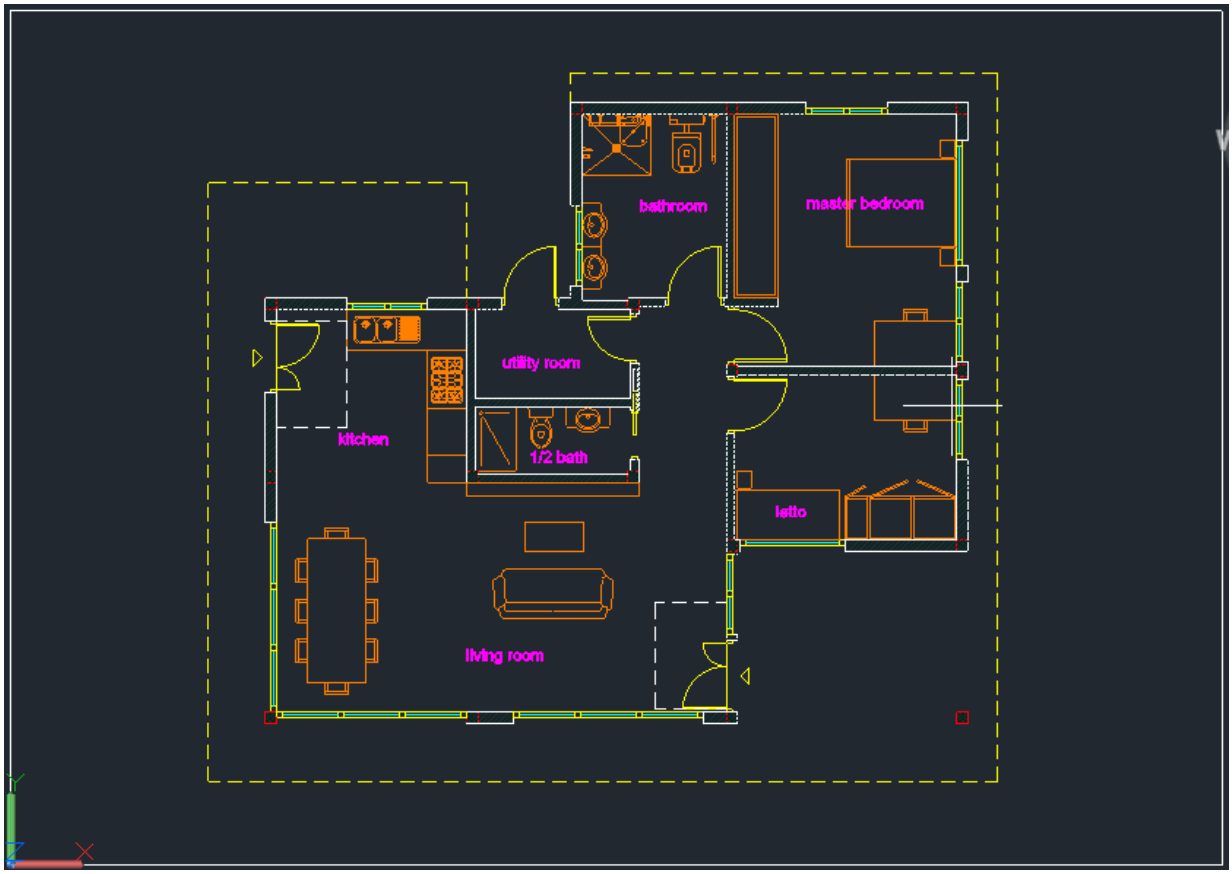


Figure 1. Floor Plan – July '12 Version

Weather conditions have been referred to Santa Ana, simulating a period of the days (October 3 to October 12) with a timestep of 15 minutes.

Table 1. Input Data

Input data	
Location	Santa Ana, CA
Weather data	Santa Ana, CA
Time step	15 min
Evaluation Period	3 October – 12 October
Geometric data	Measured on the floor plan

As a preliminary simplifying assumption, no thermal or electric loads have been taken into account. Therefore the temperature evolution of the different zones mainly depends on the equilibrium among sun radiation, heat conduction, wind convection, and exchange among the different zones of the house.

The five simulations have been implemented as intermediate steps of feedback procedures with the Design Team to take into account the effects of the natural chimney, window surface, and overhangs.

This lead to a comparison of the simulations keeping the variations that increase the performance of the house (except for increase of fenestration).

Table 2. Continuation of Data

# simulation	Floor plan	Shading surface	Windows
# 1	Basic	None	All closed
# 2	Basic with natural chimney	None	All closed
# 3	Last floor plan version and natural chimney	None	All closed
# 4	Last floor plan version and natural chimney	All surfaces	All closed
# 5	Last floor plan version and natural chimney	All surfaces	Only air vents opened

Case #1: small bathroom with full ceiling, no internal openings, no external openings

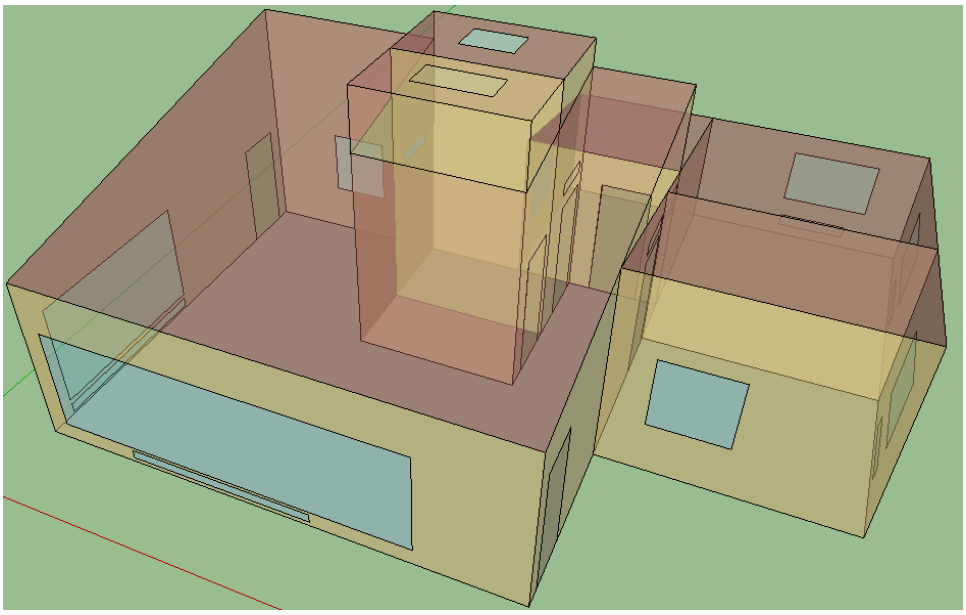


Figure 2. Case # 1

Case #2: small bathroom with 9 ft ceiling, separated by the chimney via a false ceiling

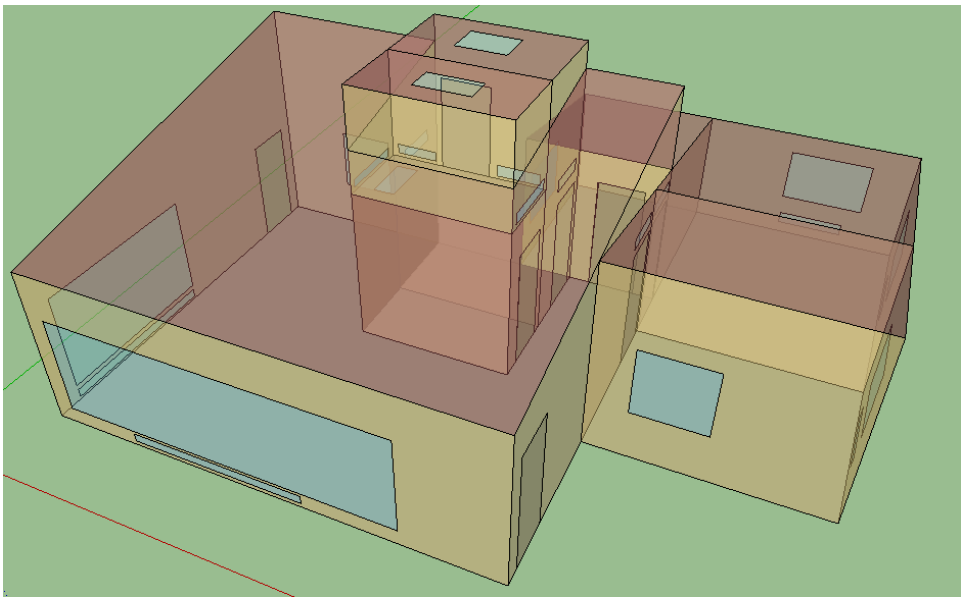


Figure 3. Case # 2

Case #3: with increased window surface

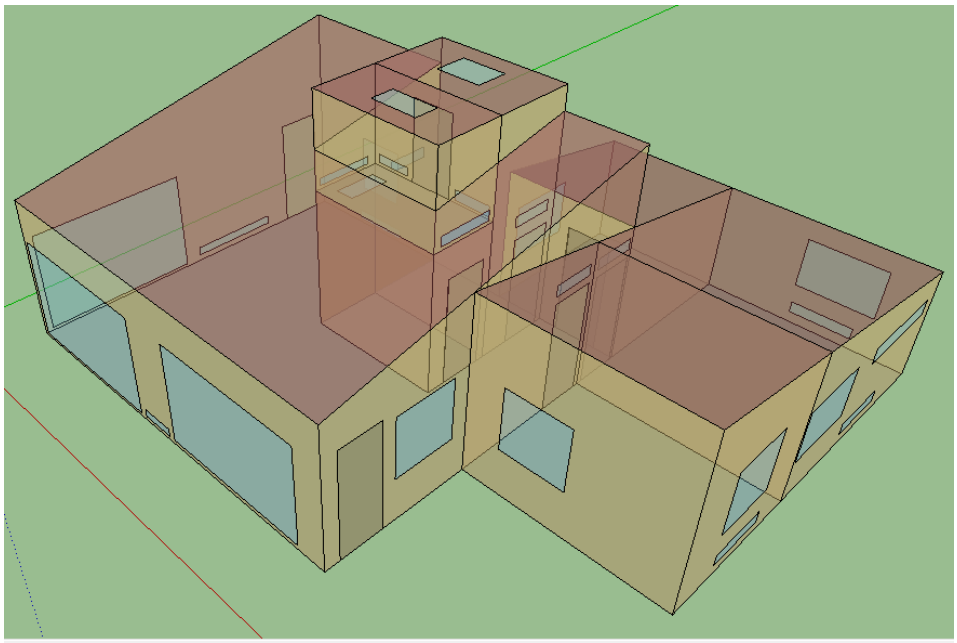


Figure 4. Case # 3

Case #4: Case #3 with higher overhanging

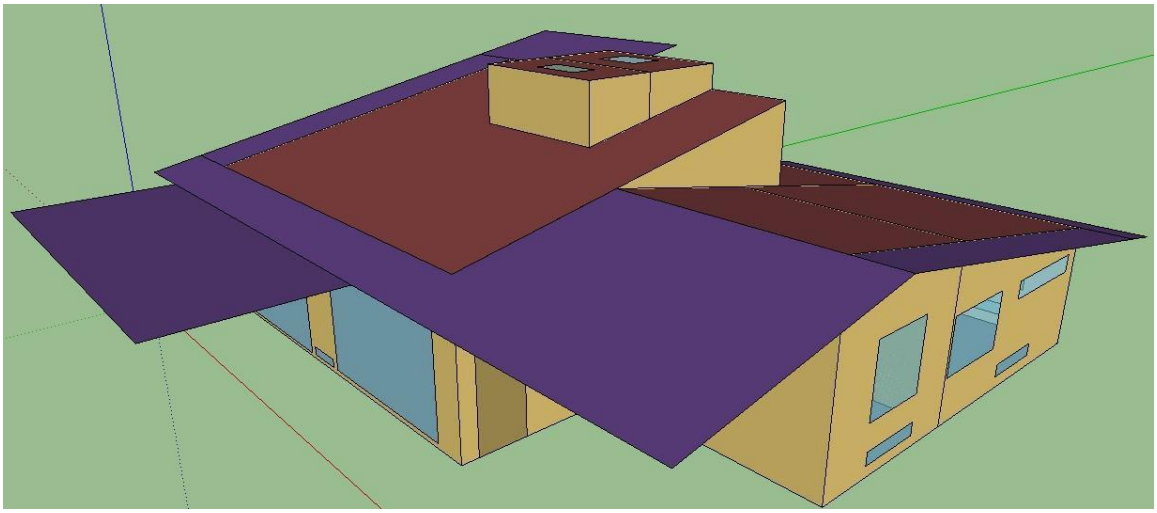


Figure 5. Case # 4

Results of Simulations

To highlight the points of strength and weakness of the house, the initial thought was to treat the house as composed of separated rooms (without air exchange) and to analyze the internal temperatures of the various rooms throughout the day.

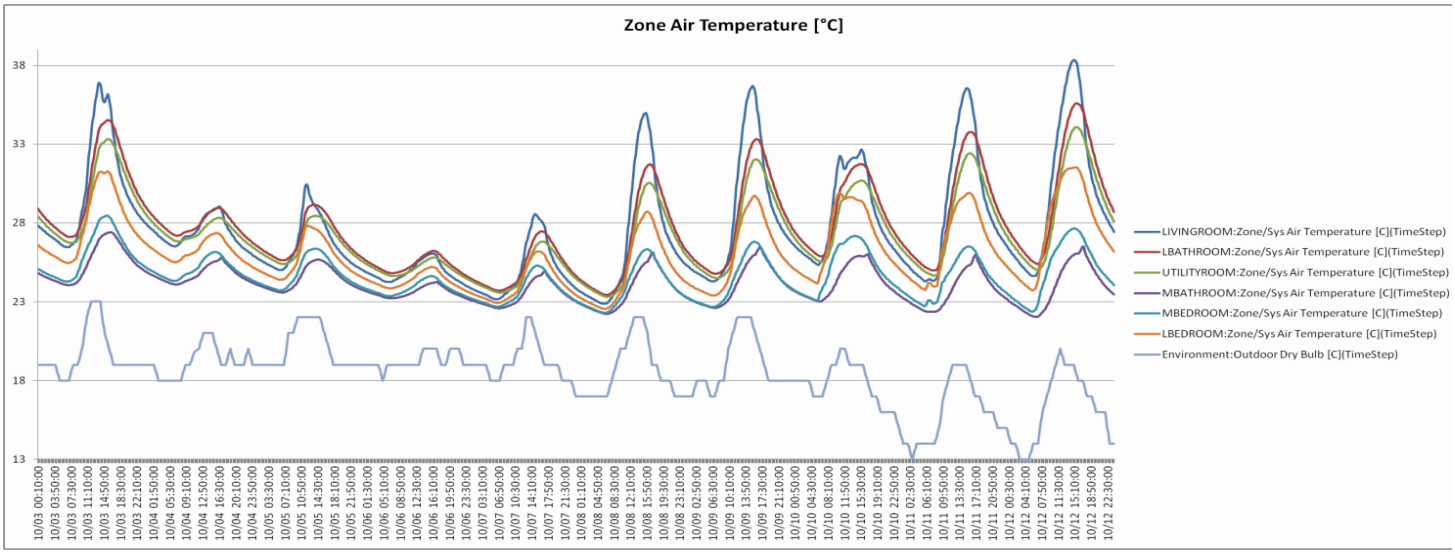


Figure 6. Zone Air Temperature in Case # 1

The results of the first simulation (figure 6) show that the highest temperatures of the house are reached in the living room and in the small bathroom. The high temperature of the bathroom is due to the higher part of his room that is more exposed to direct sun radiation. As a first step, then, the ceiling of the small bathroom has been closed to create a new zone (natural chimney) supporting the natural airflow, while at the same time keeping the small bathroom a little cooler.

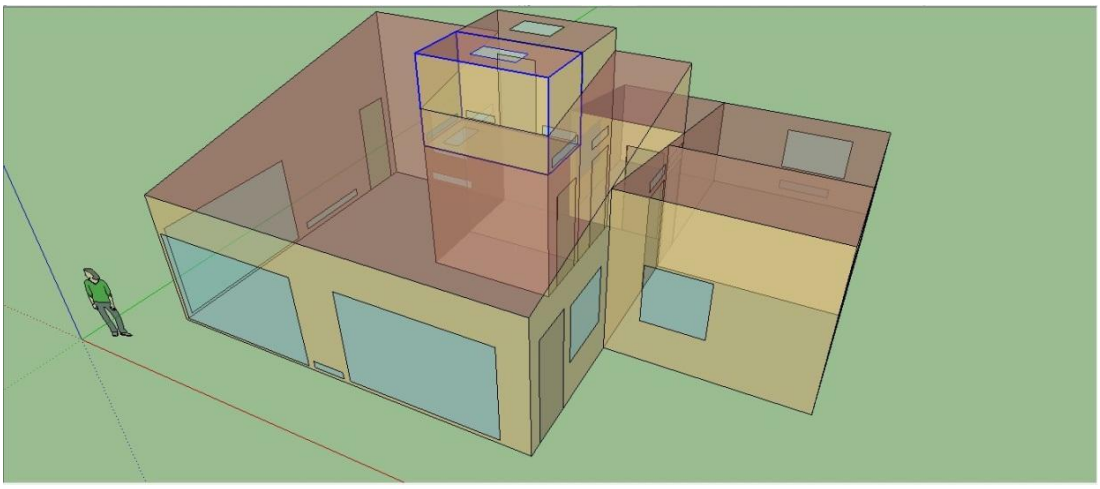


Figure 7. Particular of Natural Chimney

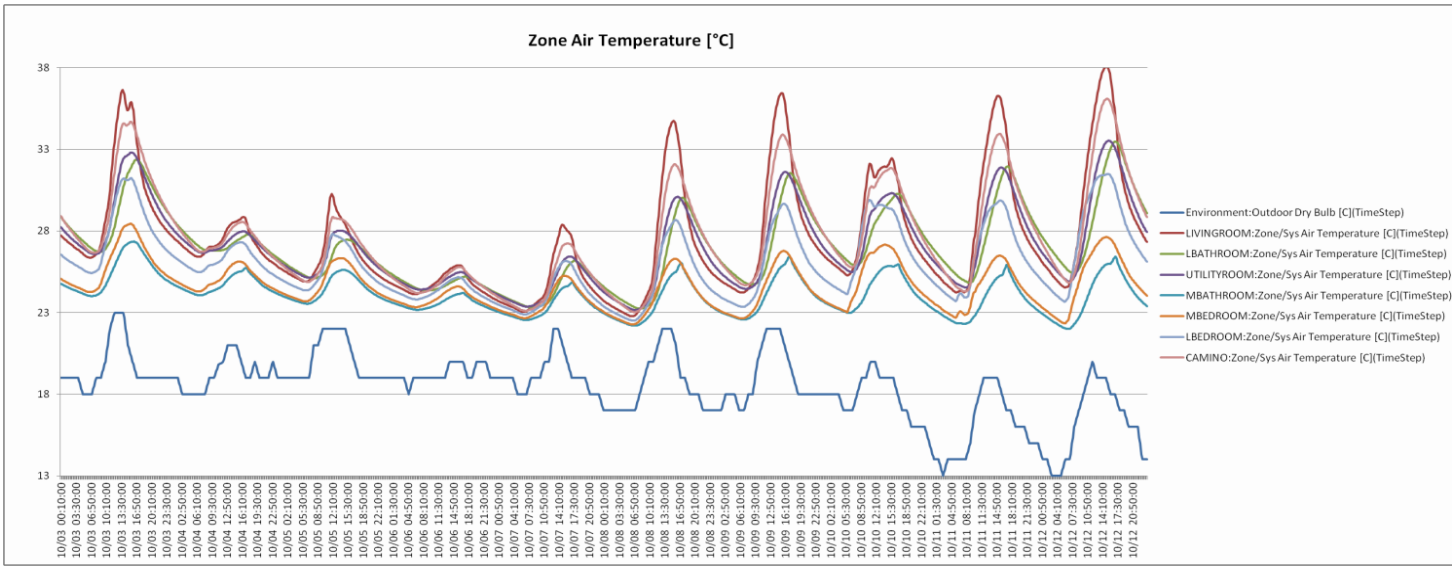


Figure 8. Zone Air Temperature Case # 2

The previous and following graphs show a comparison between case #1 and case#2. It can be seen that the introduction of a separation between the small bathroom and natural chimney gives a lower temperature in the small bathroom and a high temperature in chimney, which is, in fact, the desired effect (figure 8-9).

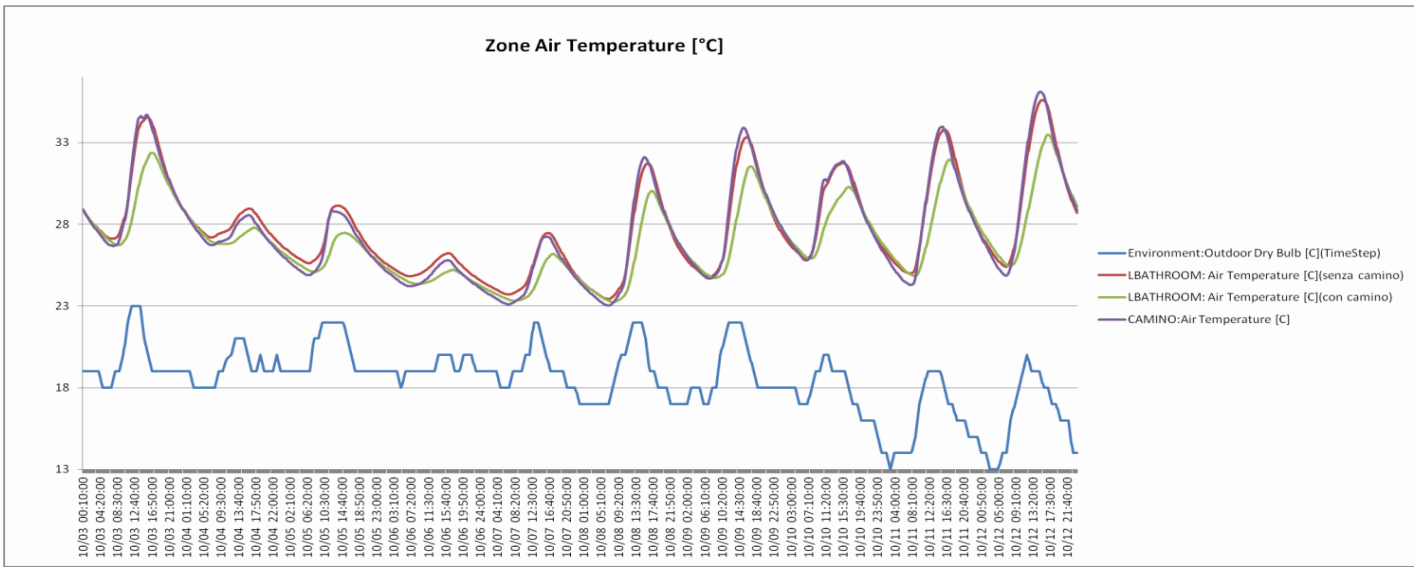


Figure 9. Comparison of Small Bathroom's Temperature in Case # 1 and in Case # 2

New changes have then been done in terms of increasing of window total surface. The change in temperature is observable in figure 10.

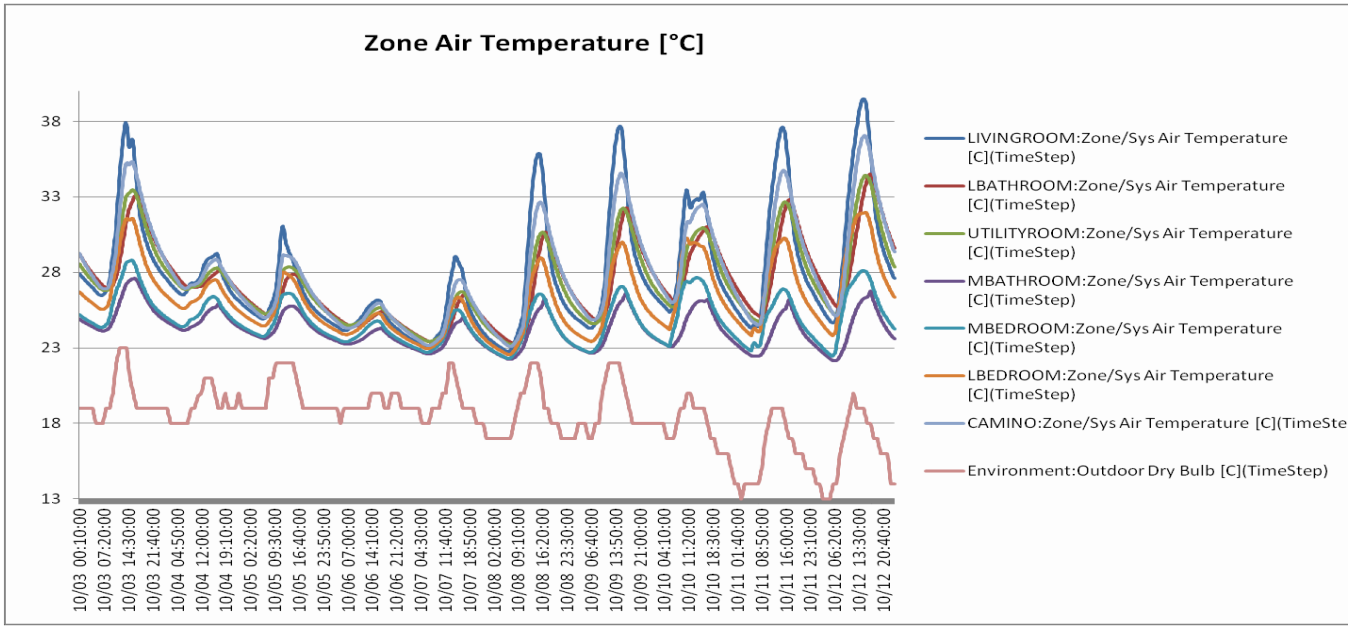


Figure 10. Zone Air Temperature in Case # 3

The change in temperature is quite high – the trends being qualitatively the same as in previous cases. The air temperature inside the living room still remains the highest of the house. In fact, the living room is characterized by the highest peak in the central hours of the day.

To reduce this peak, a solution has been implemented using overhangs to better shield the windows from solar radiation, especially for the living room.

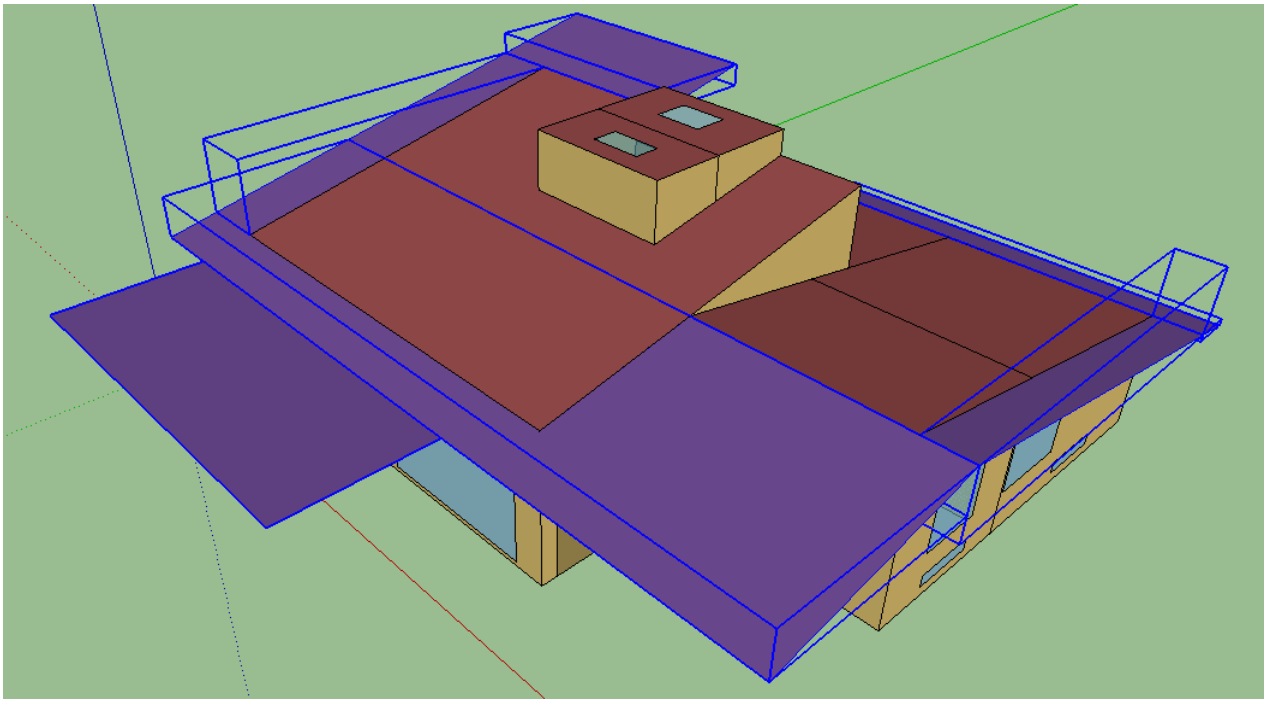


Figure 11. Roof with Overhang Surfaces

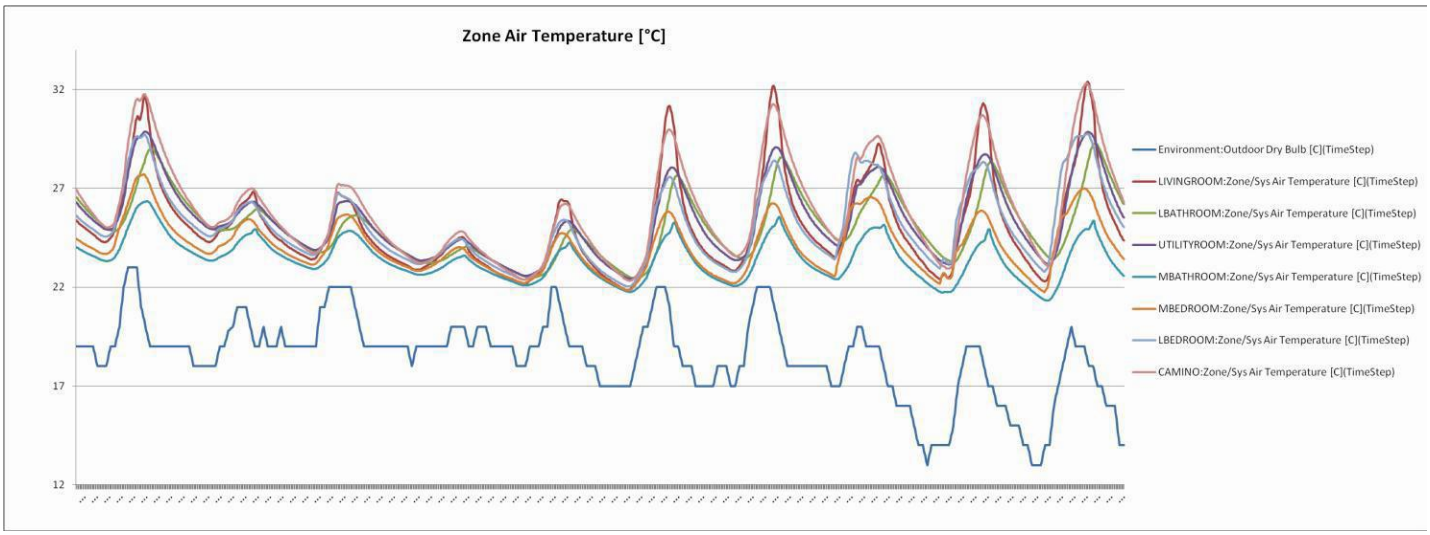


Figure 12. Zone Air Temperature in Case # 4

Such variation (see figure 12), considerably reduces the temperature of the living room in particular, as well as the temperature of the other rooms of the house. Furthermore, although the living room still has a higher peak during the middle of the day, the temperature profile of the natural chimney is higher during the rest of the day, reaching the team's target: a temperature gradient from the living room and the rest of the house to the natural chimney.

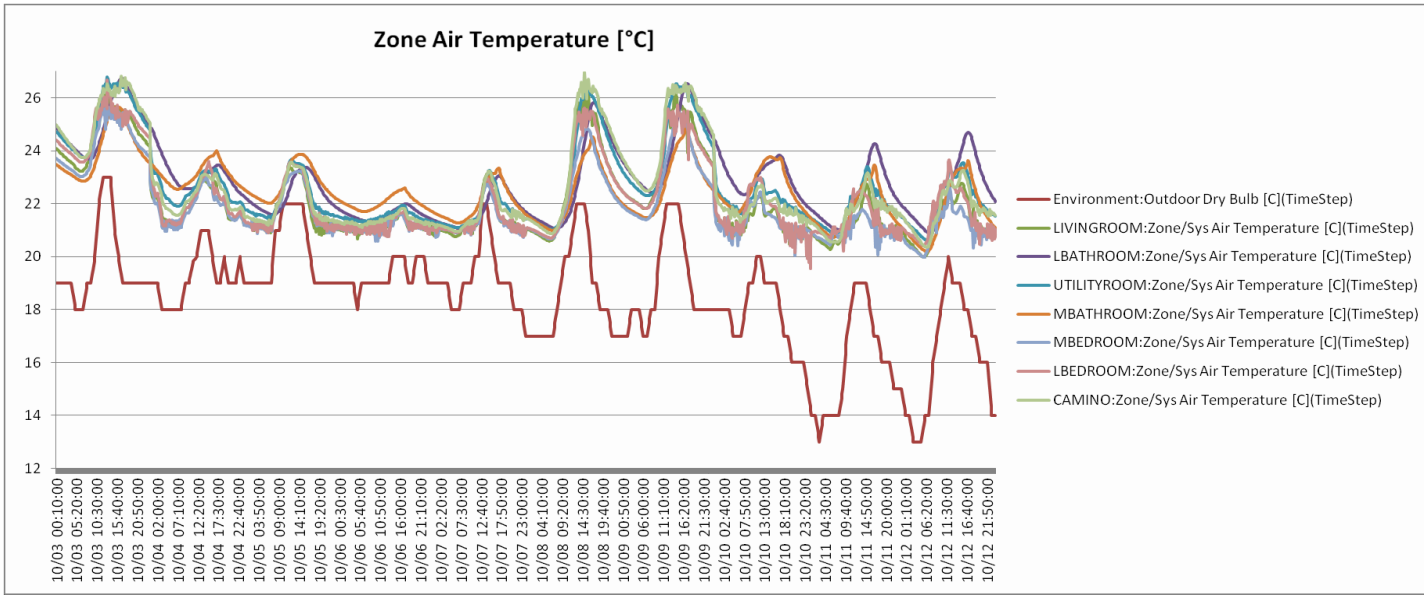


Figura 13. Zone Air Temperature in Case # 5

In case # 5, external openings (air vents) have been added, both internal and external. This situation simulates the natural (or passive) air flow inside the house. The designed path of the air is as follows: Air enters through air vents located on external wall of the house and, through appropriate channels of internal circulation, flows from the rooms, bathrooms, the utility and the living room to the natural chimney. It is then sent out through the chimney.

This entails a reduction of the temperatures for the various rooms of the house (about three or four degrees) and will significantly reduce the energy consumption and allow for downsizing of the HVAC system.

SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING PRIVACY SPACE" "Intense Lighting" "Paint - Intense Lighting - White - Semi Gloss" "17608-000" "" "TRACK LIGHTING PRIVACY SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING PRIVACY SPACE" "Intense Lighting" "Glass - Intense Lighting" "17608-000" "" "TRACK LIGHTING PRIVACY SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING PRIVACY SPACE" "Intense Lighting" "Paint - Intense Lighting - Black - Satin" "17608-000" "" "TRACK LIGHTING PRIVACY SPACE"

Quantity Takeoff of Competition Prototype House

"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING PRIVACY SPACE" "Intense Lighting" "Metal - Intense Lighting" "17608-000" "" "TRACK LIGHTING PRIVACY SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING PRIVACY SPACE" "Intense Lighting" "Paint - Intense Lighting - White - Semi Gloss" "17608-000" "" "TRACK LIGHTING PRIVACY SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING PRIVACY SPACE" "Intense Lighting" "Glass - Intense Lighting" "17608-000" "" "TRACK LIGHTING PRIVACY SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING PRIVACY SPACE" "Intense Lighting" "Paint - Intense Lighting - Black - Satin" "17608-000" "" "TRACK LIGHTING PRIVACY SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING PRIVACY SPACE" "Intense Lighting" "Metal - Intense Lighting" "17608-000" "" "TRACK LIGHTING PRIVACY SPACE"
"Lighting Fixtures" "1" "Chandelier_12713: CHANDELIER" "NUVO" "Default Light Source" "60-2762" "" "CHANDELIER"
"Lighting Fixtures" "1" "Chandelier_12713: CHANDELIER" "NUVO" "crystals" "60-2762" "" "CHANDELIER"
"Lighting Fixtures" "1" "Chandelier_12713: CHANDELIER" "NUVO" "crystals frame" "60-2762" "" "CHANDELIER"
"Lighting Fixtures" "1" "PENDANT LIGHT - HEMISPHERE: PENDANT LIGHT - HEMISPHERE" "LITEX INDUSTRIES" "Metal - Chrome" "CPH2-1HRB""" "PENDANT LIGHT - HEMISPHERE"
"Lighting Fixtures" "1" "PENDANT LIGHT - HEMISPHERE: PENDANT LIGHT - HEMISPHERE" "LITEX INDUSTRIES" "Glass - Frosted" "CPH2-1HRB""" "PENDANT LIGHT - HEMISPHERE"
"Lighting Fixtures" "1" "Sconce Light - Sphere: SCONCE CLOSET LIGHT" "ELLA""Glass - Frosted" "81636" "" "SCONCE CLOSET LIGHT"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING OPEN SPACE" "Intense Lighting" "Paint - Intense Lighting - White - Semi Gloss" "52223-BRZ" "" "TRACK LIGHTING OPEN SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING OPEN SPACE" "Intense Lighting" "Glass - Intense Lighting" "52223-BRZ" "" "TRACK LIGHTING OPEN SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING OPEN SPACE" "Intense Lighting" "Paint - Intense Lighting - Black - Satin" "52223-BRZ" "" "TRACK LIGHTING OPEN SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING OPEN SPACE" "Intense Lighting" "Metal - Intense Lighting" "52223-BRZ" "" "TRACK LIGHTING OPEN SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING OPEN SPACE" "Intense Lighting" "Paint - Intense Lighting - White - Semi Gloss" "52223-BRZ" "" "TRACK LIGHTING OPEN SPACE"
"Lighting Fixtures" "1" "TRACK LIGHTING: TRACK LIGHTING OPEN SPACE" "Intense Lighting" "Glass - Intense Lighting" "52223-BRZ" "" "TRACK LIGHTING OPEN SPACE"

Multi-Category Material Takeoff				
Family and Type	Material: Name	Category	Assembly Description	Count
Base Cabinet-4 Drawers: 12"		Casework	Cabinets	2
Base Cabinet-Corner Unit-Square: 36"		Casework	Cabinets	4
Base Cabinet-Double Door Sink Unit: 48"		Casework	Cabinets	2
Basic Roof: bioclimatic_greenhouse_roof		Roofs		2
Basic Roof: Pitched - Warm Timber - Ins Over		Roofs		3
Basic Roof: SIP roof panel		Roofs	Roof Construction	18
Basic Wall: panelwrights exterior		Walls		48
Basic Wall: panelwrights exterior fulcrum		Walls		6
Basic Wall: panelwrights interior		Walls		30
Basic Wall: panelwrights interior 3"		Walls		9
Bed-Box: Double 53" x 74"		Furniture	Furniture & Accessories	2
Bed-Bunk: 82" x 36"		Furniture	Furniture & Accessories	2
Cabinet - Storage: 1200 x 550 x 2100mm		Furniture		4
Compound Ceiling: Plain		Ceilings		10
Compound Ceiling: strange		Ceilings		2
Concept - Plain Dbl: 48 x 48 casement out		Windows		10
Concept - Plain Dbl: greenhouse 75 x 75 sliding		Windows		8
Counter Top w Sink: 24" Depth	Counter Top	Casework	Fabricated Cabinets & Counters	1
Counter Top-L Shaped: 24" Depth	Counter Top	Casework	Fabricated Cabinets & Counters	2
Dbl Plain: 83 x 60 sliding		Windows		12
Dimension Lumber: 2x4	Wood - Dimensional Lumber	Structural Framing		16
Dimension Lumber: 2x10	Wood - Dimensional Lumber	Structural Framing		126
Dimension Lumber: 6x12	Wood - Dimensional Lumber	Structural Framing		5
Dishwashers_GE-Monogram_ZBD9900RII: Dishwashers_GE-Monogram_ZBD9900RII		Specialty Equipment	Residential Equipment	5
Door-Bifold_9052: Fechada		Doors		2
Dresser: 1220 x 1830 x 0610mm		Furniture		3
ExtSgl (17): Exeternal 1010 x 2110 mm		Doors		12
Filing Cabinet (3): 380 x 457mm		Furniture		2
Floor: deck		Floors		2
Floor: flooring_bathroom	Porcelain - Linen	Floors		2
Floor: flooring_kitchen	Porcelain - Wheat	Floors		1
Floor: flooring_living	Wood - Pine	Floors		1
Floor: SIP floor living		Floors		2
Floor: utility	Vinyl Sheet Flooring	Floors		1
IntSgl (1): 36"		Doors		8
Mdrn Uplighter: 150 W Uplight		Lighting Fixtures		9
Mirror - Ellipse: 600 x 1200mm		Generic Models		2
Outlet-Duplex: Single	Plastic - White	Electrical Fixtures		23
Outlet-GFI: Single	Plastic - White	Electrical Fixtures		21
Outlet-Triplex: Triplex	Plastic - White	Electrical Fixtures		2
Pad Foundation-Rectangular: 8x8x5	Concrete - Cast-in-Place Concrete	Structural Foundations		102
Pad Foundation-Rectangular: 20x20x10	Concrete - Cast-in-Place Concrete	Structural Foundations		18

Construction Specifications

Division 01 –General Requirements

SECTION 01 54 19 - TEMPORARY CRANES

PART 1 - GENERAL

1.1 SUMMARY

A. Structural Performance: Temporary cranes will be able to withstand structural loads and lifts incurred in the handling of all modular components.

B. Submittals: Product Data, and structural analysis data signed and sealed by a qualified professional engineer registered in the state of West Virginia and eligible to be registered in the state of CA.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers

1. Grove

2.2 TEMPORARY CRANES

A. Type: 130 ton, Telescopic Crane.

1. Boom extension: 100 ft.

2. Lattice Jib: 50 ft.

3. Carrier Engine/Output: 6-cylinder, Turbo-Diesel 500 hp

4. Crane Engine/Output: 4-cylinder, Turbo-Diesel, 145 kW

5. Operational Weight: 60,000 kg

6. Total Counterweight: 20 ton

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ground will be prepared by cleaning, removing projections, clearing obstructions, and zoning off safe working area, and as otherwise recommended in temporary crane manufacturer's written instructions.

B. Crane will be grounded securely in place, per operational specifications.

C. Only licensed operators allowed to operate machinery, manage lifts, and issue signals.

D. Placement of modular components will closely monitored so they may comply with foundational spacing and requirements.

E. Operations will be coordinated with structural requirements per specifications of structural engineer and crane operator.

END OF SECTION 01 54 19

SECTION 01 54 23 – TEMPORARY SCAFFOLDING AND PLATFORMS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and install staging aids and fall protection equipment to withstand structural loads required by OSHA and ANSI Z359.1.

B. Submittals: Product Data. Structural analysis data signed and sealed by a qualified professional engineer registered in the state where Project is located.

C. Structural and Accessory Components shall conform to the following Standards:

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

2. Steel Tubing: Cold-formed steel tubing, ASTM A 500.

3. Aluminum Extrusions: ASTM B 221.

PART 2 - PRODUCTS

2.1 FALL PROTECTION EQUIPMENT – STANDING SEAM ROOF

A. Manufacturers

1. Guardian Fall Protection

B. Models

1. Standing Seam Roof Clamp, Model# 00250

C. Operation

1. Portable and reusable anchor for use on standing seam roofs

2. Seam spacing range: 24” – 36”

3. Retractable Rotation: 360 degrees

4. Self-retracting lifeline adaptable

5. Meets or exceeds all applicable industry standards, including OSHA and ANSI Z359.1.

2.2 FALL PROTECTION EQUIPMENT - THERMOPLASTIC POLYOLEFIN ROOF

A. Manufacturers

1. Guardian Fall Protection

B. Models

1. CB-12 Roof Anchor, Model# 00485

C. Operation

1. Deck mounted anchor post

2. Load rating: 5000 lbs

3. Base and mount plates flashed into TPO membrane per manufacturer specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in fall protection and deck eye manufacturer's written instructions.

B. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place, for permanent installation or duration of use.

C. Fasten fall protection securely in place, with provisions for thermal and structural movement.

D. Correct deficiencies in or remove and reinstall fall protection anchors that do not comply with requirements.

E. Repair, refinish, or replace fall protection anchors and deck eyes damaged during installation, as directed by Architect.

END OF SECTION 01 54 23

Division 04 –Masonry

SECTION 04 70 00 - TILE FLOORING

PART 1 - GENERAL

1.01

A. PERFORMANCE – performs normally in moderate to heavy traffic areas

B. PRODUCT DATA – 12”x12” greyish porcelain floor tile

C. STANDARDS – ADA compliant

PART 2 - PRODUCTS

2.01

A. MANUFACTURER –Style Selections

B. MODEL - 0209459

C. OPERATION – operates normally under standard conditions

PART 3 - EXECUTION

3.1 INSTALLATION normal installation

A. PROCESSES – N/A

B. QUANTITY -145

SECTION 04 70 00

SECTION 04 05 13 - THINSET

PART 1 - GENERAL

1.01

A. PERFORMANCE – Once mixed with water, acts as a set up for tile

B. PRODUCT DATA – 50 pound Bag of powder thinset mortar mix

C. STANDARDS – Complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER -Mapei

B. MODEL –0050050L

C. OPERATION – Set up for tile

PART 3 - EXECUTION

3.1 INSTALLATION mix with water. Normal installation

A. PROCESSES – N/A

B. QUANTITY – 4 bags

END OF SECTION 04 05 13

SECTION 04 05 16 - GROUT

PART 1 - GENERAL

1.01

A. PERFORMANCE – fills in spaces between tiles

B. PRODUCT DATA - 10 pound bag powder grout

C. STANDARDS - Complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER –TEC Skill

B. MODEL – 3304455321

C. OPERATION – seals spaces between tiles

PART 3 - EXECUTION

3.01 INSTALLATION - When mixed with water seals in areas between tiles. Normal installation

A. PROCESSES – N/A

B. QUANTITY – 1 bag

END OF SECTION 04 05 16

KITCHEN TILE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Dimensions: Width: 9”, Height: 12”, Thickness: 5/16” Website:

http://shawfloors.com/ceramicflooringDetails/Porcelain_Tile/Domus_12x12_CS82F-Wheat

C. STANDARDS - Glaze Hardness: 5.000, Frost Resistant, PEI Rating

PART 2 - PRODUCTS

2.1 Porcelain Tile

A. MANUFACTURER - Shaw Floors

B. MODEL - Porcelain Tile

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

END OF SECTION

BATHROOM TILE

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Dimensions: Width: 9”, Height: 12”, Thickness: 5/16, Website:

http://shawfloors.com/ceramic-flooringDetails/Porcelain_Tile/Domus_12x12_CS82F-Brownstone

C. STANDARDS - Glaze Hardness: 5.000, Frost Resistant, PEI Rating

PART 2 - PRODUCTS

2.1 Porcelain Tile

A. MANUFACTURER - Shaw Floors

B. MODEL - Porcelain Tile

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

END OF SECTION

Division 05 – Metals

SECTION 05 52 13 – PIPE AND TUBING

PART 1 - GENERAL

1.1 Furnish and install prefabricated steel canopies, walkway covers, carports or structures.

A. Performance: Installers, minimum of 10 years experience in manufacture and supplying.

B. Installer shall be in accordance with manufacturers shop drawings.

C. Specifications

1. ASTM A-500 - Spec for Structural Tubing for construction of bridges and buildings.
2. ASTM A-653 - Spec for Steel Sheet, zinc coated by the hot-dip process for structure.
3. ASTM A-924 - General reqs for Steel Sheet, metallic coated by the hot-dip process.
4. AISI - Specification for the Design of cold-formed steel structural members.

PART 2 - PRODUCTS

2.1 Childers Carports & Structures, Inc.

A. MATERIALS

1. Roof deck and trim shall be pre-painted, hot-dip galvanizes steel meeting ASTM Specification A-653, Grade 50, 50,000 psi yield.

Galvanizing shall meet ASTM Specification A-924, G-90 Class. Paint shall be factory applied baked polyester with a full coat on color side and a uniform wash coat on reverse.

2. Roof beams are met ASTM Specification A-653 Grade 50, 50,000 psi yield. Galvanizing shall meet ASTM Specification A-924, G-90 Class.

3. Columns shall be square tubes meeting ASTM Specifications A-500, Grade B. Columns shall be hot-dip galvanized after fabrication with a minimum zinc coating of 2 oz/ sq ft.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that canopies are installed straight and true.

3.2 INSTALLATION

A. Install canopy in accordance with manufacturer's drawings and specifications.

3.3 TOLERANCES

A. Max Variation From Plan or Location Indicated on Drawings: None.

B. Max Offset - True Alignment between Adjacent Members Butting or In Line: None.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed.

3.5 ADJUSTING AND CLEANING

A. Clean up site and remove excess material.

3.6 PROTECTION

Protect finished installation.

END OF SECTION 05 52 13

DOOR HARDWARE

PART 1 - DOOR HARDWARE AND ACCESSORY MATERIALS

1.01 FOR INTERIOR WOODWORK

PART 2 - EXECUTION

2.1 PRODUCTS

A. MANUFACTURER SUPPLIED

B. MODEL - SUPPLIED BY MANUFACTURER

1. Fabrication shall be completed to maximum extent possible before shipment to site.
2. All woodwork shall comply with Custom grade, per AWI section 400.
3. Wood to be conditioned to ambient level of humidity in installation area before time of fabrication, for no less than 24 hours. Moisture content of wood to meet manufacturer's recommendations for finish carpentry.

4. Woodwork to comply with quality standard for Grade 1 as specified above. Walls and other substrata to be inspected for plumb and rigidity before installation.

5. Woodwork shall be installed level, plumb, true and straight, with use of shims as required. Level and plumb shall be inspected for a tolerance of 1/8 inch in 8 feet.

6. Carpentry shall be scribed and cut to fit adjoining framing. Nails to be countersunk, then surfaces filled, sanded and refinished to match adjoining work. Blind nailing used where possible, as in interior shelving.

7. Shelves to be offset from cabinetry no more than maximum of 1/16".

8. Cabinets: door hinges shall be installed with a maximums of 1/16" tolerance of vertical and horizontal alignment. Adjust hardware to true doors after installation and to provide for ease of operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

END OF SECTION

FASCIA AND FLASHING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Specifications are common with no notable differences.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 Aluminum Fascia and Flashing

A. MANUFACTURER - Lowes

B. MODEL - Standard

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

END OF SECTION

SECTION 05 52 13 - METAL ROOFING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - These panels are grade 80 full hard 27 gauge tin, 96” X 11”

C. STANDARDS - 25 year warranty, Complies with SMACNA.

PART 2 - PRODUCTS

2.1 Sheet metal roofing

A. MANUFACTURER - Fabral

B. MODEL - Ribbed steel roof panel

C. FINISH - Brick red

D. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. RELATED - Caulk sealant.

END OF SECTION 05 52 13

Division 06 – Wood, Plastics, and Composites

SECTION 06 12 00 - STRUCTURAL INSULATED PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Structural Insulated Panels (SIPs).

B. Related Sections: Section(s) related to this section include:

1. Section 06 10 00 Rough Carpentry

2. Section 06 09 00 Wood and Plastics Fastenings

1.2 SYSTEM DESCRIPTION

Structural Insulated Panels (SIPs) consist of oriented strand board (OSB) laminated with structural adhesives to a termite resistant EPS insulation core, a EPA registered treatment for mold, mildew, and termites. SIP Manufacturer supplied connecting splines, sealants, and SIP screws.

1.3 REFERENCES

A. ACSE 7 - Minimum Loads for Buildings and other Structures.

B. ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

C. DOC PS2 – Performance Standard for Wood-based Structural-Use Panels.

D. ICC ES AC04 – Acceptance Criteria for Sandwich Panels.

ICC ES AC05 – Acceptance Criteria for Sandwich Panel Adhesives.

E. ICC ES AC12 – Acceptance Criteria for Foam Plastic Insulation.

F. ICC ES AC239 – Acceptance Criteria for Termite-Resistant Foam Plastics.

G. AWPA E1 - Standard Laboratory Evaluation to Determine Resistance to Subterranean Termites.

H. AWPA E12- Standard Method of Determining Corrosion of Metal in Contact with Treated Wood.

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

J. EPA - Registered products listing.

1.4 DESIGN REQUIREMENTS

A. Provide SIPs which have been manufactured, fabricated and installed to withstand loads [Specify code/standard reference.] and to maintain [Specify performance criteria.] performance criteria stated by SIP manufacturer without defects, damage or failure.

1.5 SUBMITTALS

A. Product Data: Submit product data for specified products.

1. SIP Code Compliance: Provide ICC ES code report for SIP with evidence of compliance with code requirements as an alternate method of construction. Submit current compliance report number from ICC ES showing conformance to the 2012 International Building Code (IBC) and International Residential Code (IRC). Code report shall include compliance with ICC ES AC04 (Sandwich Panels) dated February 2012.

2. EPS Code Compliance: Provide ICC ES code report for EPS foam with evidence of compliance with code. Submit current compliance report numbers from ICC ES with conformance to the 2012 International Building Code (IBC) and International Residential Code (IRC). Code report shall include compliance with ICC ES AC12 (Foam Plastic) dated February 2011 and ICC ES AC239 (Termite-Resistance) dated October 2008.

3. Manufacturer's Instructions: SIP Manufacturer's Construction Manual and load design charts.

B. Calculations: Provide structural calculations by a registered architect or professional engineer [in the state of] qualified to perform such work.

C. Shop Drawings: Submit shop drawings for SIPs showing layout, elevations, product components and accessories.

D. Quality Assurance Submittals: Submit the following:

1. Certificate: Product compliance to Third Party Quality Control program of PFS Corp.

E. Fire Resistant Assemblies: PFS construction number for each fire-rated assembly

F. Warranty: Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.

B. Source Limitations: Obtain all SIPs through one source. All accessories to be as furnished or recommended by the SIP manufacturer.

1.7 Regulatory Requirements:

A. SIPs shall be recognized for compliance with [International Building Code, International Residential Code, or specify] in a current ICC ES evaluation report

B. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, foundation/structural system/substrate conditions, SIP manufacturer installation instructions and SIP manufacturer warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

1.8 DELIVERY, STORAGE & HANDLING

A. Ordering: Comply with SIP manufacturer ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver materials from SIP manufacturer with identification labels or markings intact.

C. Off-load SIPs from truck and handle using fork lift or other means to prevent damage to SIPs.

D. SIPs shall be fully supported in storage and prevented from contact with the ground. Stack SIPs on pallets or a minimum of three stickers for every 8 feet of SIP length.

E. SIPs shall be fully protected from weather. Protect against exposure to rain, water, dirt, mud, and other residue that may affect SIP performance. Cover stored SIPs with breathable protective wraps. SIPs shall be stored in a protected area.

1.9 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit SIP manufacturer's standard warranty document. SIP Manufacturer warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. Warranty Period: [Specify term.] years commencing on Date of Substantial Completion.

PART 2 PRODUCTS

Note to Specifier Select the name and address of the local Licensed R-Control SIP Manufacturers/Suppliers.

2.1 Manufacturers/Suppliers:

A. ACH Foam Technologies, LLC, 5250 North Sherman St., Denver, CO 80216

B. ACH Foam Technologies, LLC, 111 W. Fireclay Ave., Murray, UT 84107

C. ACH Foam Technologies, LLC, 775 Waltham Way, Suite 105, McCarran, NV 89434

D. ACH Foam Technologies, LLC, 90 Trowbridge Drive, Fond du Lac, WI 54936-0660

E. ACH Foam Technologies, LLC, 4001 Kaw Drive, Kansas City, KS 66102

F. ACH Foam Technologies, LLC, 1418 Cow Palace Road, Newton, KS 67114

G. ACH Foam Technologies, LLC, 809 East 15th Street, Washington, IA 52353

H. ACH Foam Technologies, LLC, 2731 White Sulphur Road, Gainesville, GA 30501

I. Big Sky Insulations, Inc., 15 Arden Drive, Belgrade, MT 59714

J. Branch River Plastics, Inc., 15 Thurber Boulevard, Smithfield, RI 02917

K. Energy Systems, Inc. 990 Epco Dr., Dandridge, TN 37725

L. Mid-Atlantic Foam, 326 McGhee Road, Winchester, VA 22603

M. NoArk Enterprises, Inc., 10101 Highway 70 East, North Little Rock, AR 72117

N. Thermal Foams, Inc., 2101 Kenmore Avenue, Buffalo, NY 14207

O. AFM Corporation, 17645 Juniper Path, Suite 260, Lakeville, MN 55044

2.2 Materials

A. SIPs consisting of the following:

1. UL certified EPS core with Perform Guard treatment, minimum of 0.95 pcf (15.2 kg/m^3) complying with ASTM C578 Type I and having ICC ES recognition of termite resistance. Insulation manufacturer shall provide Third Party UL certificate. ICC ES report shall be provided for recognition of termite resistance in compliance with ICC AC239.

2. OSB identified with APA or TECO performance mark with Exposure I durability rating and performance in accordance with DOC PS-2 span rating 24/16 or greater.

3. Adhesives shall be in conformance with ICC ES AC05 – Acceptance Criteria for Sandwich Panel Adhesives

4. FrameGuard treatment for mold, mildew, and termite resistance meeting the following requirements:

    a. Registered with EPA.

    b. Mold growth: 0 rating, tested to ASTM D3273 for 8 weeks at 77 degrees F and 100 percent relative humidity.

    c. Termite resistance: Minimum rating of 7.0, tested to AWPA E-1.

d. Corrosion potential for metals in contact with treated wood: Maximum 2 mils per year, tested to AWPA E12 for minimum of 60 days on aluminum 2024, carbon steel, hot-dip galvanized steel, and G90 galvanized steel.

e. Equivalent lateral resistance and tooth holding capacity as untreated wood.

2.3 Accessories

A. Splines: OSB, block splines, or I-beam for use in joining SIPs shall be supplied by SIPs manufacturer.

B. Fasteners: corrosion resistant SIP screws compatible with SIP system shall be provided by the SIPs manufacturer.

1. Wood Screws for attachment to wood members

2. Heavy Duty Metal Screws for attachment to metal members (16 gauge to 3/16")

3. Light Duty Metal Screws for attachment to metal decks (18 gauge or thinner)

C. SIP Sealant: Shall be specifically designed for use with SIPs. Sealant must be compatible with all components of the SIP. Sealant shall be provided by the SIP manufacturer. VOC content of SIP sealant shall be less than 10 g/L.

D. Dimensional Lumber: SPF, #2 or better, or engineered equivalent unless otherwise required by structural drawings.

E. Vapor Barrier SIP Tape: 40 mil thick, butyl adhesive suitable for indoor use, min. 6 inch wide for use on SIP joints as specified by designer. SIP Tape shall be supplied by the SIP manufacturer.

2.4 Fabrication

A. Sizes: SIPs shall be fabricated in accordance with approved Shop Drawings

B. Thermal Resistance, R-value

Note to Specifier Select the R-value as required for each area of construction.

1. 4 1/2" (114 mm) thick SIP with R-value of 15 at 75°F (16 at 40°F)
2. 6 1/2" (165 mm) thick SIP with R-value of 23 at 75°F (24 at 40°F)
3. 8 1/4" (210 mm) thick SIP with R-value of 29 at 75°F (32 at 40°F)
4. 10 1/4" (260 mm) thick SIP with R-value of 37 at 75°F (40 at 40°F)
5. 12 1/4" (311 mm) thick SIP with R-value of 45 at 75°F (48 at 40°F)

Note to Specifier SIPs can be designed for use as 1 hour fire resistant assemblies. See technical information publications from SIP manufacturer.

C. Fire Performance Rating: [Specify fire performance rating.].

Note to Specifier Edit article below to suit project requirements. If substitutions are permitted, edit text below. Add text to refer to Division 1 Project Requirements (Product Substitutions Procedures) Section.

2.5 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted without fourteen day (14) prior approval.

2.6 RELATED MATERIALS

A. Related Materials: Refer to other sections for related materials as follows:

1. Dimensional Lumber: SPF #2 or better or pre-engineered equivalent: Refer to Division 6 Carpentry Sections.

2.7 SOURCE QUALITY

A. Source Quality Assurance: Each SIP component required shall be supplied by SIP manufacturer and shall be obtained from selected SIP manufacturer or its approved supplier.

1. Each SIP shall be labeled indicating PFS Third Party certification.
2. Provide evidence of UL Third Party inspection and labeling of all insulation used in manufacture of SIPs.
3. SIP manufacturer shall provide Lamination, R-Value and mold/mildew/termite resistance warranty documents for building owner acceptance. Manufacturer standard forms will be submitted.
4. Provide SIPs with Foam-Control EPS with Perform Guard for termite resistance. Treatment shall be EPA registered with treatment efficacy substantiated by ICC ES report.
5. Provide SIPs with FrameGuard treatment for mold, mildew, and termite resistance. Treatment shall be EPA registered with treatment efficacy substantiated by independent research.
6. Dimensional Tolerance - shall comply with values listed in the manufacturer's Quality Control Manual.

B. Source Quality: Obtain SIPs from a single manufacturer.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's ICC ES report, Load Design Charts, Construction Manual, Shop Drawings, and product data, including product technical bulletins, for installation.

B. Plans shall be reviewed by a qualified architect/engineer and shall be signed and/or sealed. Deviations from standard detail and load design values shall be calculated and signed and/or sealed by a qualified architect/engineer.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

1. Verify conditions of foundation/structural system/substrate and other conditions which affect installation of SIPs. Any adverse conditions shall be reported in writing. Do not proceed with installation until adverse conditions are corrected.

3.3 INSTALLATION

A. SIP Installation:

Note to Specifier Complete installation recommendations are available from the manufacturer. SIP weight and contractor preference will dictate the erection method used. The use of a crane or lift truck may be required for SIP placement. Consult with SIP manufacturer for recommended handling methods. Supplementary lifting clamps and attachments to be provided by the contractor.

1. SIP Supports: Provide level and square foundation/structural system/substrate that support wall and/or roof SIPs. For wall SIPs, hold sill plate back from edge of rim board 7/16" (11 mm) to allow full bearing of OSB skins. Provide 1 1/2" (38 mm) diameter access holes in plating to align with electrical wire chases in SIPs. Provide adequate bracing of SIPs during erection. Remove debris from plate area prior to SIP placement.

2. SIP Fastening: Connect SIPs by nails as shown on drawings. SIP sealant must be used together with each fastening techniques. Where SIP Screw Fasteners are used, provide a minimum of 1" (25.4 mm) penetration into support. Join SIPs using plates and splines. Secure attachment with nails, staples, or screws, and SIP sealant. Apply SIP sealant following SIP manufacturer recommendations.

3. SIP Tape: Provide SIP Tape at joints between SIP panels and at intersection of SIP roof and wall.

4. Vapor Retarders: Provide vapor retarders mandated by building code or climate conditions.

5. Thermal Barriers: Interior surfaces of SIPs shall be finished with a minimum 15-minute thermal barrier, such as 1/2" (13 mm) gypsum wallboard, nominal 1" (25 mm) wood paneling, or other approved materials. Apply code approved thermal barriers according to SIP manufacturer's recommendations.

6. Restrictions: Do not install SIPs directly on concrete. Do not put plumbing in SIPs without consulting SIP manufacturer. Do not overcut skins for field-cut openings and do not cut skins for electrical chases. SIPs shall be protected from exposure to solvents and their vapors that damage the EPS foam core.

7. Remove and replace insulated wall or roof SIPs which have become excessively wet or damaged before proceeding with installation of additional SIPs or other work.

3.4 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: [Specify number and duration of periodic site visits.].

3.5 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

1. Roof SIPs: Protect roof SIPs from weather. Provide temporary protection at the end of the day or when rain or snow is imminent.

AFTER INSTALLATION, COVER SIPS TO PREVENT CONTACT WITH WATER ON EACH EXPOSED SIP EDGES AND FACES.

END OF SECTION 06 12 00

SECTION 06 16 26 - BAMBOO FLOORING UNDERLAY

PART 1 – GENERAL

1.01

A. PERFORMANCE – Underlayment that silences and protects from moisture

B. PRODUCT DATA – 200 sq ft roll of flooring underlayment

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Ambient Bamboo

B. MODEL - 3-in-1 Silencer Underlayment

C. OPERATION – 3 in 1 silencer reduces sound, protects from moisture, and acts as underlayment

PART 3 – EXECUTION

3.1 INSTALLATION Roll onto subfloor before flooring installation

A. PROCESSES – N/A

B. QUANTITY – 4

END OF SECTION 06 16 26

SECTION 06 20 13 - LOG SIDING

PART 1 – GENERAL

1.01

A. PERFORMANCE – Performs normally under standard conditions. External siding

B. PRODUCT DATA – 8’-10’ length of 6 ½ “ high pine siding

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Twin Creeks Log Home Supply

B. MODEL – 2x8 Southern Yellow Pine “D” Log Siding

C. OPERATION – operates normally understandard conditions. External siding

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 1800 sq ft

END OF SECTION 06 20 13

SECTION 06 20 23 - KITCHEN CABINETS

PART 1 – GENERAL

1.01

A. PERFORMANCE – storage for kitchen, base for counter

B. PRODUCT DATA – raw unfinished wooden cabinets

C. STANDARDS – compliant with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Baker Cabinets

B. MODEL – custom cabinets

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 15

END OF SECTION 06 20 23

SECTION 06 40 16 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Specifications are common with no notable differences.

C. STANDARDS - Complies with all federal regulations. AWI 100. FSC (for reclaimed oak)

PART 2 - PRODUCTS

2.1 Lumber (solid stock):

A. A mixture of domestic red and white American Oaks. Widths 3 - 12 inches, thicknesses from ½ to ¾ inch, lengths from 2 - 12 feet, and profiles of Tongue & Groove, Shiplap or Square Edge.

Website: http://www.elmwoodreclaimedtimber.com/wood.aspx?pgID=2196

B. Wood Species and Grade: Reclaimed Antique Oak.

A mixture of domestic red and white American Oaks. Widths 3 - 12 inches, thicknesses from ½ to ¾ inch, lengths from 2 - 12 feet, and profiles of Tongue & Groove, Shiplap or Square Edge.

Website: http://www.elmwoodreclaimedtimber.com/wood.aspx?pgID=2196

C. OSB (Oriented Strand Board):

1. ANSI A208.1, Grade M-2.

D. Hardwood plywood and face veneers

1. Type HPVA HP-10, using adhesive with no urea formaldehyde.

2. Species: Birch

E. Bamboo Panels

1. Installed in cabinetry.

Website: http://www.mrbamboocabinets.com/index.html

F. Flooring--Living Area/Bedroom

Company: Elmwood Reclaimed Timber Antique Wide Plank Flooring

Website: http://www.elmwoodreclaimedtimber.com/wood.aspx?pgID=2196

G. Deck and Ramping

GeoDeck: Mixture, compound, and extrusion of cellulose fiber with minerals and a thermoplastic material, using an approx mix ratio wt of thermoplastic material to other ingredients of 1:1.3.

a. Profiles in 12', 16', and 20' lengths and 5/4" x 6" Traditional board, 5/4"x 6" Groove board, and 2" x 8" Heavy-Duty Commercial plank widths.

b. GeoDeck 2 x 2 Balusters (profile ID number 1004) are manufactured in nominal 1-3/4" x 1 3/4" (44 x 44 mm) engineered profiles in minimum lengths of 32" (813 mm), and the max lengths of 38.125" (968 mm). The wall thickness of component is 0.25"

c. GeoDeck 4 x 4 Post Sleeves (profile ID number 1007) are manufactured in 4.315" X 4.315" (109.6 x 109.6 mm) engineered profiles in minimum lengths of 37" (940 mm), and the maximum lengths of 96" (2438 mm). The composite wall thickness of the component is 0.26" (6.6 mm).

d. GeoDeck Hand Rail Collar fits over and restrain the GeoDeck 2 x 4 Hand Rails using four #10 diameter screws. It has O. D. of 3-11/16" x 3" x 1-1/4" (94 x 76 x 32 mm).

e. GeoDeck Post Caps, which are installed on the top of GeoDeck 4 x 4 and 6 x 6 Post Sleeves, are manufactured in nominal 5" x 5" (127 x 127 mm) for the 4 x 4 sleeves and 7" x 7" (178 x 178 mm) for the 6 x 6 sleeves.

f. Connections: GeoDeck Post Sleeves, post-rail brackets, and wood screws. The post sleeve is installed over a conventional, pressure-treated wood, nominal 4" x 4" (102 x 102 mm) or 6" x 6" (152 x 152 mm) posts. The top and bottom 2 x 4 Hand Rail is secured between the supporting Post Sleeves with the inserted post-rail brackets.

g. Pergola - Treated materials for outdoor use, to provide shade.

1. Manufacturer: Lowes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

END OF SECTION 06 40 16

SECTION 06 41 00 - T-MOLDING

PART 1 – GENERAL

1.01

A. PERFORMANCE – acts as a transition between different styles of flooring

B. PRODUCT DATA – 6’ strip of bamboo t molding

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Ambient Bamboo

B. MODEL – T-Molding. Natural strandwoven

C. OPERATION – acts as a transition between different styles of flooring

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 3

END OF SECTION 06 41 00

SECTION 06 42 16 - ENTERTAINMENT CENTER WAINSCOTING

PART 1 – GENERAL

1.01

A. PERFORMANCE – operates normally under standard conditions

B. PRODUCT DATA- 2-11/16-ft Stain Grade Knotty Pine Edge and Center Bead Wainscot

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - EverTrue

B. MODEL - #: PECBW32

C. OPERATION – product functions normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION nails and adhesive

A. PROCESSES – N/A

B. QUANTITY – 4

END OF SECTION 06 42 16

SECTION 06 46 00 - TRIM/BASEBOARD

PART 1 – GENERAL

1.01

A. PERFORMANCE – Performs normally under standard conditions

B. PRODUCT DATA – ¾" x 3 ½" molding in different lengths

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Country Moldings

B. MODEL – MV206 Baseboard in Red Oak

C. OPERATION – Baseboard, trim, molding

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 581.75 ft

END OF SECTION 06 46 00

SECTION 06 48 00 - PLANTER BOX

PART 1 – GENERAL

1.01

A. PERFORMANCE – Performs normally under standard conditions

B. PRODUCT DATA – ¾" Thick. Dimensions: 36" X 18" X 18, 34" X 16" X 16"

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Forever Redwood

B. MODEL – Napa Planters. Dimensions: 36" X 18" X 18, 34" X 16" X 16"

C. OPERATION – Baseboard, trim, molding

PART 3 – EXECUTION

3.1 INSTALLATION- Installation provided by Forever Redwood.

A. PROCESSES – N/A

B. QUANTITY – 12

END OF SECTION 06 48 00

Division 07 – Thermal and Moisture Protection

SECTION 07 21 16 - BLANKET INSULATION

ROLL INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Fiberglass roll insulation.

C. STANDARDS - R-Value - 30, 31.25 sq. ft.

PART 2 - PRODUCTS

2.1 Fiberglass Insulation

A. MANUFACTURER - Johns Manville

B. MODEL - B-390

C. OPERATION - Operates normally under standard conditions.

2.2 Caulk sealant

A. MANUFACTURER - Nova-Green

B. MODEL - NOVAFLEX

C. OPERATION - Operates normally under standard conditions.

2.3 Vapor Barrier

A. MANUFACTURER - Lowes

B. MODEL - Bruce

C. OPERATION - Operates normally under standard conditions.

2.4 Latex Primer

A. MANUFACTURER - Olympic

B. MODEL - Premium Latex Primer (Zero VOC)

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

END OF SECTION 07 21 16

SECTION 07 72 36 - BATHROOM EXHAUST FAN

PART 1 - GENERAL

1.01

A. PERFORMANCE – uses 50CFM fan to ventilate bathroom area

B. PRODUCT DATA – White ceiling exhaust fan

C. STANDARDS – HVI certified, energy star qualified

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - NuTone

B. MODEL - QTXEN050

C. OPERATION - uses 50CFM fan to ventilate bathroom area

PART 3 - EXECUTION

3.1 INSTALLATION ceiling recessed, needs GFCI circuit, 6 inch duct

A. PROCESSES – N/A

B. QUANTITY - 2

END OF SECTION 07 72 36

SECTION 07 92 00 - INTERIOR CAULK

PART 1 – GENERAL

1.01

A. PERFORMANCE – this low VOC and low odor caulk has a mold and mildew resistant finish, is 100% waterproof and provides soundproofing

B. PRODUCT DATA – 10.1 oz Kitchen/Bath adhesive 4 pack

C. STANDARDS – meets ASTM standards

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - EcoBond

B. MODEL – KBT100-4 pk

C. OPERATION – sealant for kitchen and bathrooms

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 07 92 00

SECTION 07 92 00 - EXTERIOR CAULK

PART 1 – GENERAL

1.01

A. PERFORMANCE – This fast tacking adhesive is Low VOC and low odor as well as mold and mildew resistant

B. PRODUCT DATA – 10.1 oz heavy duty adhesive 4 pack

C. STANDARDS – meets ASTM standards

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - EcoBond

B. MODEL – HD150-4 pk

C. OPERATION – All purpose adhesive for exteriors

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 07 92 00

Division 08 – Openings

SECTION 08 14 00 – WOOD DOORS

ETERIOR DOORS

PART 1 - Exterior doors

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Entrance style door

B. PRODUCT DATA - 36” X 80” Decorative Entry Door (Pine, Oak, or Meranti)

C. STANDARDS - Forest Stewardship Council (FSC) Certified

PART 2 - PRODUCTS

2.1 Wooden doors

A. MANUFACTURER - Zola

B. MODEL - Entrance Door

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - Two

END OF SECTION 08 14 00

SECTION 08 14 00 - EXTERIOR DOOR

PART 1 – GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – door with clear glass and wood panels

C. STANDARDS – Complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Reliabilt

B. MODEL – 36” Douglas Fir Wood Door

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 3

END OF SECTION 08 14 00

SECTION 08 14 00 - INTERIOR CLAD DOOR

PART 1 - GENERAL

1.01

A. PERFORMANCE- performs normally under standard conditions

B. PRODUCT DATA - hardwood interior slab clad door, unstained

C. STANDARDS - complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - Reliabilt

B. MODEL - 10505

C. OPERATION – Complies with all laws and regulations

PART 3 - EXECUTION

3.1 INSTALLATION Normal installation

A. PROCESSES – N/A

B. QUANTITY – 1

END OF SECTION 08 14 00

SECTION 08 14 00 INTERIOR DOORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Sliding door

B. PRODUCT DATA - 36” X 80” Woodframe insulated glass door.

C. STANDARDS - Measures beyond Energy Star standards. Overall U values as low as 0.123. Triple argon-filled seals that provide airtight barrier (European Level 4). U=0.14; R-7; Glass SHGT=0.5; Visible light transmission=71%

PART 2 - PRODUCTS

2.1 Interior doors

A. MANUFACTURER - Zola

B. MODEL - Classic Patio Door

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - Four

END OF SECTION 08 14 00

SECTION 08 14 73 - BATHROOM DOOR

PART 1 - GENERAL

1.01

A. PERFORMANCE – sliding door for bathroom

B. PRODUCT DATA – barn door kit and barn door hardware combo all in one

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER – Barndoors and Hardware

B. MODEL – Barn door kit and barn door combo all in one

C. OPERATION – functions normally under standard conditions

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - http://www.barndoorshardware.com/barn-door-installation-help/

B. QUANTITY - 1

END OF SECTION 08 14 73

SECTION 08 14 23 - CLOSET DOOR

PART 1 – GENERAL

1.01

A. PERFORMANCE – bifold opening for closet

B. PRODUCT DATA – 36” x79” 6- panel wooden bifold door

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Reliabilt

B. MODEL – 364374

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation. Installed on tracks

A. PROCESSES – N/A

B. QUANTITY – 1

END OF SECTION 08 14 23

SECTION 08 14 73 - POCKET DOOR

PART 1 – GENERAL

1.01

A. PERFORMANCE – pocket door. Slides into wall and out of view

B. PRODUCT DATA – raised panel

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Interior Doors

B. MODEL – 5512

C. OPERATION – Door slides into wall instead of swinging open like a normal door

PART 3 – EXECUTION

3.1 INSTALLATION- needs tracks. Hanging door. Hidden in wall

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 08 14 73

SECTION 08 50 00 – WINDOWS

WOOD FRAMED WINDOWS

PART 1 - 40” X 40” and 40” X 48” windows

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - WOOD-FRAMED WINDOWS

B. PRODUCT DATA - 36” X 80” Woodframe insulated glass window.

C. STANDARDS - Measures beyond Energy Star standards. Overall U values as low as 0.123. Triple argon-filled seals that provide airtight barrier (European Level 4). U=0.14; R-7; Glass SHGT=0.5; Visible light transmission=71%.

Passive House Alliance US (PHAUS) Sponsor.

Acoustic Insulation Coefficient of 31 dB.

PART 2 - PRODUCTS

2.1 Interior doors

A. MANUFACTURER - Zola

B. MODEL - Tilt and turn windows

C. OPERATION - Hinges, pivots, and operates normally under standard conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. PROCESSES - Structural Zola or equivalent 7.5 mm window insulation screws through jam, 12 inch OC or equivalent. Liquid applied air and weather resistive barrier under sill, attach SIGA tape or equivalent to routed cavity face.

B. QUANTITY - Four

60” X 82” and 70” X 80” 60” X 16” windows

PART 1

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - WOOD-FRAMED WINDOWS

B. PRODUCT DATA - 36” X 80” Woodframe insulated glass window.

C. STANDARDS - Measures beyond Energy Star standards. Overall U values as low as 0.123. Triple argon-filled seals that provide airtight barrier (European Level 4). U=0.14; R-7; Glass SHGT=0.5; Visible light transmission=71%

Passive House Alliance US (PHAUS) Sponsor.

Acoustic Insulation Coefficient of 31 dB.

PART 2 - PRODUCTS

2.1 Interior doors

A. MANUFACTURER - Zola

B. MODEL - Casement windows

C. OPERATION - Slides and operates normally under standard conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. PROCESSES - Structural Zola or equivalent 7.5 mm window insulation screws through jam, 12 inch OC or equivalent. Liquid applied air and weather resistive barrier under sill, attach SIGA tape or equivalent to routed cavity face.

B. QUANTITY - 20

END OF SECTION 08 50 00

Division 09 – Finishes

SECTION 09 21 16 - CORNER BEADING

PART 1 - GENERAL

1.01

A. PERFORMANCE – reinforces drywall corners

B. PRODUCT DATA – 1 ¼”Wx 8’’L metal corner beading

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - Dietrich

B. MODEL - 036008-9144

C. OPERATION – helps to reinforce drywall corners

PART 3 - EXECUTION

3.1 INSTALLATION normal installation

A. PROCESSES – N/A

B. QUANTITY – 40

END OF SECTION 09 21 16

SECTION 09 21 16 - SHEETROCK COMPOUND

PART 1 – GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – 61.75 pound tub of joint compound

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Proform

B. MODEL – JT0070

C. OPERATION – finishing of gypsum board. Patch work, tape application

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 10

END OF SECTION 09 21 16

SECTION 09 21 16 - SHEETROCK JOINT TAPE

PART 1 – GENERAL

1.01

A. PERFORMANCE – Used alongside joint compound to seam and finish drywall together

B. PRODUCT DATA – 500 ft roll of 2 1/16” white joint tape

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Proform

B. MODEL – JT4482

C. OPERATION – Conceals and reinforces wallboard joints

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation. use with joint compound

A. PROCESSES – N/A

B. QUANTITY – 8

END OF SECTION 09 21 16

SECTION 09 28 13 - CEMENTOUS BACKER BOARD

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiber cement backer board panels.

1.2 RELATED SECTIONS

A. Section 05400 - Light Gage Metal Framing: wall framing and bracing.

B. Section 06100 - Rough Carpentry: wood framing and bracing.

C. Section 09260 - Gypsum Board: Vapor barrier material and installation requirements.

1.3 REFERENCES

A. ANSI 108/A118/A136 - American National Standards for the Installation of Ceramic Tile.

B. ANSI A108.11 - Installation of Cementitious Backer Units.

C. ANSl A118.4 - Specifications for Latex Portland Cement Mortar

D. ANSI A118.9- Cementitous Baker Units.

E. ANSl A136.1 - Organic Adhesives for Installation of Ceramic Tile

F. ASTM C1288 - Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Store boards flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

1.7 PROJECT CONDITIONS

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

1.8 WARRANTY

A. Product Warranty: limited product warranty against manufacturing defects:

1. HardieBacker 1/2 inch (13 mm) nominal cement board for 20 years.

2. HardieBacker 1/4 inch (6 mm) nominal cement board for 20 years.

B. Workmanship Warranty: application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: James Hardie Building Products, Inc., which is located at: 26300 La Alameda Suite 400 ; Mission Viejo, CA 92691; Toll Free Tel: 866-274-3464; Tel: 949-367-4980; Fax: 949-367-4981; Email: request info (info@jameshardie.com); Web: www.jameshardiecommercial.com

B. Substitutions: Not permitted.

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

2.2 BACKERBOARD

A. Type: HardieBacker 1/2 inch (13 mm) nominal cement board as manufactured by James Hardie Building Products, Inc.

B. Type: HardieBacker 1/4 inch (6 mm) nominal cement board as manufactured by James Hardie Building Products, Inc.

C. Material shall meet the following building code compliance:

1. Non-asbestos fiber-cement board to comply with ASTM C1288 and ANSl A118.9.
2. Board shall meet the building code compliance National Evaluation Report No. NER 405.
3. US Department of Housing and Urban Development Materials Release 1268C.
4. California DSA PA-019.
5. City of Los Angeles, Research Report No. 24862.

2.3 FASTENERS

A. Wood Framing fasteners

1. Wood framing: 1-1/2 inches (32 mm) corrosion resistant (galvanized or stainless steel) roofing nails.
2. Wood framing: 1-1/2 inches (32 mm) No. 8 by 0.375 inch (9.5 mm) HD self-drilling, corrosion resistant ribbed wafer head screws.

B. Metal Framing:

1. Metal framing: 1-1/2 inches (32 mm) No. 8 by 0.375 inch (9.5 mm) HD self-drilling, corrosion resistant ribbed wafer head screws.

PART 3 EXECUTION

3.1 EXAMINATION

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

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

3.2 WALL FRAMING

A. Either vertical or horizontal, nominal 2 inches by 4 inches (51 mm by 102 mm) wood framing spaced a maximum of 24 inches (610 mm) on center with end joints staggered from adjacent courses in both vertical and horizontal applications.

B. To comply with ANSI A108.11, either vertical or horizontal, nominal 2 inches by 4 inches (51 mm by 102 mm) wood framing spaced a maximum of 16 inches (406 mm) on center with end joints staggered from adjacent courses in both vertical and horizontal applications.

C. Either vertical or horizontal, minimum 20 gauge 3-5/8 inches (92 mm) C-Stud 24 inches (610 mm) maximum on center metal framing complying with local building codes with end joints staggered from adjacent courses in both vertical and horizontal applications.

D. comply with ANSI A108.11, either vertical or horizontal, minimum 20 gauge 3-5/8 inches (92 mm) C-Stud 16 inches (406 mm) maximum on center metal framing complying with local building codes with end joints staggered from adjacent courses in both vertical and horizontal applications.

E. Install a vapor barrier. Refer to Section 09260 for material and installation requirements.

1. Comply with building code regarding vapor barrier requirements.

2. Repair any punctures or tears in vapor barrier prior to the installation of the board.

3.3 FLOOR FRAMING

A. Design: Maximum deflection (dead and live load combined) for floor framing shall not exceed the following:

1. Typical: L/360.

2. Natural stone: L/270.

3.4 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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

3.5 INSTALLATION

A. Install in accordance with manufacturer's instructions. Install sheets with 1/8 inch (3 mm) gap between sheets.

B. Place fasteners 8 inches (152 mm) on center no closer than 3/8 inch (9.5 mm) from board edges and 2 inches (51 mm) from board corners.

C. Boards shall be placed with a minimum 1/4 inch (6 mm) clearance from the floor surfaces and other horizontal tile termination locations, including above tub edges. This gap shall be free of adhesive and grout and filled with a flexible sealant.

D. Boards shall be placed with a minimum 1/8 inch (3 mm) clearance from wall and cabinet bases, and other horizontal tile termination locations, including above

tub edges. This gap shall be free of adhesive and grout and filled with a flexible sealant.

E. Joints shall be reinforced with 2 inches (51 mm) wide, high-strength, coated, alkali-resistant, glass fiber reinforcing tape embedded into the wet mastic or modified thinset mortar and allowed to dry thoroughly.

F. For large tiled areas, movement/control joints shall be provided in accordance with ANSI A108, Section AN-3.7 or as indicated on drawings.

G. Wall tiles complying with ANSI A137.1 are attached to the board with flexible Type I mastic adhesives complying with ANSI A136.1, or acrylic or latex-modified thinset mortars complying with ANSI A118.4, in accordance with ANSI A108.

END OF SECTION 09 28 13

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Product Certificate for GREENGUARD Indoor Air Quality for products and materials required to comply with requirements for minimum chemical emission.

C. ASTM C 1396 standards applicable.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD (Not for backer board, see backer board below)

A. STANDARD GYPSUM BOARD

1. Core: Regular

2. Surface Paper: 100% recycled content paper on front, back and long edges.

3. Long Edges: Square.

4. Overall thickness: 1/2 inch.

B. MOLD AND MOISTURE RESISTANT GYPSUM BOARD

1. Core: Mold and moisture resistant gypsum core

2. Surface paper: 100% recycled content moisture/mold/mildew resistant paper on front, back, and long edges. Long Edges: square. Overall thickness: 5/8 inch

3. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

4. Environmental Requirements: Provide products that comply with testing and product requirements for low emitting materials

PART 3 - EXECUTION

3.1 INSTALLATION: GYPSUM BOARD

A. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in gypsum board manufacturer's written instructions.

1. Single Layer - 5-1/2 inch wood stud construction.

a. Apply 1/2 inch, Gypsum Panel to wood studs.

b. Space screws 16” (400 mm) o.c. in field and along abutting end joints. Parallel application, space screws 16” (400 mm) o.c. in field of panels and along vertical abutting edges.

B. ACCESSORY PRODUCTS

1. Tape:

a. Paper Tape: 2-1/16 inches wide

b. Paper Tape: 2 inches wide with metal strips laminated along the center crease to form inside and outside corners

c. Fiberglass Tape: Nominal 2 inches wide self-adhering tape

2. Trims and Beads: Material: Zinc-coated steel; 26 gauge min, ASTM C10472

a. Corner Bead: Use at outside corners

b. Control Joint: Use where indicated and specified

c. J-Bead: Use where indicated and specified

3. Drying Type Compound:

a. Ready Mix vinyl base compound.

b. Ready Mix vinyl base for enhanced mold and mildew resistance.

c. Ready Mix vinyl base to reduce airborne dust during sanding.

d. Ready Mix vinyl base topping compound for finish coating.

e. Ready Mix vinyl base for embedding joint tape, cornerbeads, etc.

f. Field Mix vinyl base compound.

4. Setting Compound:

a. Field mixed hardening compound.

b. Field mixed for fire resistance rated construction and penetrations.

END OF SECTION 0929 00

SECTION 09 91 23 - INTERIOR PAINT (LATEX)

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Sustainable raw materials, like soy and sunflower oil in their formulation to keep solvent content low and VOCs in the zero-VOC range, mildew and bacteria resistant.

C. STANDARDS - Complies with all federal regulations, Good Housekeeping choice.

D. WEBSITE: http://www.sherwin-williams.com/homeowners/products/catalog/

PART 2 - PRODUCTS

2.1 Latex Paint

A. MANUFACTURER - Harmony

B. MODEL - Interior Latex

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

END OF SECTION 09 91 23

SECTION 09 91 23 - INTERIOR PAINT

PART 1 – GENERAL

1.01

A. PERFORMANCE – Aesthetics

B. PRODUCT DATA – 1 gallon bucket of paint

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – YOLO Colorhouse

B. MODEL – Yolo Colorhouse

C. OPERATION – paint, operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation. Painting supplies needed

A. PROCESSES – N/A

B. QUANTITY – 15

END ON SECTION 09 91 23

SECTION 09 91 23 - PAINT PRIMER

PART 1 – GENERAL

1.01

A. PERFORMANCE – Acts as a base for paint

B. PRODUCT DATA – 5 gallon bucket of paint primer

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – YOLO Colorhouse

B. MODEL – 120457

C. OPERATION – to create a nice base for the paint

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation. Put on walls before paint

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 09 91 23

SECTION 09 93 13.13 - LOG SIDING STAIN

PART 1 – GENERAL

1.01

A. PERFORMANCE –Low VOC wood finish brings out natural highlights of wood as well as inhibiting mold and mildew

B. PRODUCT DATA – 5 gal bucket of cowhide leather colored stain

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Nature's Edge

B. MODEL – Transparent Cowhide Leather

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- apply two coats stain then one coat clear as a topcoat. To get pigments, mix pigments in clear pail with hand held power drill. Can be applied with an airless sprayer, brush, or roller.

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 09 93 13.13

Division 10 – Specialties

SECTION 10 28 00 - BATHROOM ACCESSORY KIT

PART 1 - GENERAL

1.01

A. PERFORMANCE – operates normally under standard conditions

B. PRODUCT DATA – 3 piece bronze bath accessory kit including towel ring, towel bar, and toilet tissue holder.

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER -Delta

B. MODEL -138296

C. OPERATION – for the purpose of holding towels and toilet tissue

PART 3 - EXECUTION

3.1 INSTALLATION wall mounted items

A. PROCESSES – N/A

B. QUANTITY -1

END OF SECTION 10 28 00

SECTION 10 28 00 - BATHROOM TOWEL RING

PART 1 - GENERAL

1.01

A. PERFORMANCE – operates normally under standard conditions

B. PRODUCT DATA – oil rubbed bronze towel ring

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER -Moen

B. MODEL - YB2286ORB

C. OPERATION – used to hold hand towel

PART 3 - EXECUTION

3.1 INSTALLATION wall mount

A. PROCESSES – N/A

B. QUANTITY -1

END OF SECTION 10 28 00

SECTION 10 28 00 - BATHROOM MIRROR

PART 1 - GENERAL

1.01

A. PERFORMANCE – Helps view oneself

B. PRODUCT DATA – 31”x24” rectangular mirror in wooden frame

C. STANDARDS – Complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER – Style Selections

B. MODEL - 45139

C. OPERATION - operates normally under standard conditions

PART 3 - EXECUTION

3.1 INSTALLATION wall mount

A. PROCESSES –N/A

B. QUANTITY – 2

END OF SECTION 10 28 00

SECTION 10 28 13 - TOILET TISSUE BAR

PART 1 – GENERAL

1.01

A. PERFORMANCE – holds 2 rolls of toilet tissue

B. PRODUCT DATA – oil rubbed bronze double toilet paper roll

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER -Moen

B. MODEL – YB5408ORB

C. OPERATION – holds toilet tissue

PART 3 - EXECUTION

3.1 INSTALLATION normal installation

A. PROCESSES – N/A

B. QUANTITY - 1

END OF SECTION 10 28 13

SECTION 10 28 13 - ADA TOILET GRAB BAR

PART 1 – GENERAL

1.01

A. PERFORMANCE – Wall mounted bar for those requiring ADA assistance

B. PRODUCT DATA – 24 inch Bronze ADA wall grab bar

C. STANDARDS – ADA Compliant

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - Delta

B. MODEL – 40024-RB

C. OPERATION – Wall mounted to assist with ADA bathroom requirements

PART 3 - EXECUTION

3.1 INSTALLATION Wall mount

A. PROCESSES – N/A

B. QUANTITY - 1

END OF SECTION 10 28 13

SECTION 10 56 13 - CLOSET ORGANIZER

PART 1 - GENERAL

1.01

A. PERFORMANCE – fits in closet to maximize space

B. PRODUCT DATA – bronze colored wire racks and bars. Closet organizer kit

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - ClosetMaid

B. MODEL - 32875

C. OPERATION – maximizes closet space by providing multiple levels of shelving and racks

PART 3 - EXECUTION

3.1 INSTALLATION wall mount

A. PROCESSES – N/A

B. QUANTITY - 1

END OF SECTION 10 56 13

MOTION-ACTION CAMERA

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - The Kinect for Windows sensor will provide a software environment which we can develop a facial detection and recognition system to track users within the house.

B. PRODUCT DATA - 15.8 x 6.5 x 5.2 inches, 2.4 lbs.,

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 Kinect camera

A. MANUFACTURER - Microsoft

B. MODEL - Kinect

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. Quantity - two.

USB CABLE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Cable which extends the connection of the Kinect to server.

B. PRODUCT DATA - 82 ft.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 USB Cable Extenders

A. MANUFACTURER - Monoprice

B. MODEL - USB 2.0 Cable Extenders

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. Quantity - two.

WATER QUALITY MONITORING SYSTEM

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - System takes information from mulitple different sensors to evaluate the condition of the water. The information is then sent and stored to an online server where the user could get graph and information readouts.

B. PRODUCT DATA - 6.5” X 8.5” X 4.75”, 1.8 LBS.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 WATER SENSOR

A. MANUFACTURER - YSI

B. MODEL - 5200A

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

TEMP/HUMID/BAROM PRESSURE AND LIGHT SENSOR

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - 80 mm X 80 mm X 21 mm, .5 LBS., The EDS Environmental Sensor Line, OW-ENV, offers an innovative way to easily monitor and control temperature, humidity, barometric pressure, and/or light in indoor environments. The wall mount sensor features high accuracy temperature, humidity, and barometric pressure sensors. The product also contains a light sensor, an LED, conditional search support, and a pass-through 1-Wire connection. Together these features offer an efficient and flexible system for monitoring the temperature, humidity, barometric pressure, and light levels at one or more locations within a building. The sensor was specifically designed for easy communications. Any general-purpose 1-Wire host adapter* should be capable of reading data from the sensor. The LED and optional relay response times are extremely fast; the sensors are able to respond appropriately (activate fan/alarm siren/etc.) even before the monit app is aware an alarm has been triggered. Since, the EDS Environmental Sensor line's alarm functions can operate independently of the 1-Wire host adapter, sensor may be used as standalone sensor.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 MULTI-SENSOR FOR SMART HOME

A. MANUFACTURER - EMBEDDED DATA SYSTEMS

B. MODEL - OW-ENV-THPL

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - three.

TEMPERATURE/LIGHT SENSOR

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - 80 mm X 80 mm X 21 mm, .5 LBS., The EDS Environmental Sensor Line, OW-ENV, offers an innovative way to easily monitor and control temperature, humidity, barometric pressure, and/or light in indoor environments. The wall mount sensor features high accuracy temperature, humidity, and barometric pressure sensors. The product also contains a light sensor, an LED, conditional search support, and a pass-through 1-Wire connection. Together these features offer an efficient and flexible

system for monitoring the temperature, humidity, barometric pressure, and light levels at one or more locations within a building. The sensor was specifically designed for easy communications. Any general-purpose 1-Wire host adapter* should be capable of reading data from the sensor. The LED and optional relay response times are extremely fast; the sensors are able to respond appropriately (activate fan/alarm siren/etc.) even before the monit app is aware an alarm has been triggered. Since, the EDS Environmental Sensor line's alarm functions can operate independently of the 1-Wire host adapter, sensor may be used as standalone sensor.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 DUAL-SENSOR FOR SMART HOME

A. MANUFACTURER - EMBEDDED DATA SYSTEMS

B. MODEL - OW-ENV-TL

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - seven.

END OF SECTION

SECTION 10 40 00 - CO2/CO DETECTOR

PART 1 – GENERAL

1.01

A. PERFORMANCE – interconnectable with other detectors, carbon monoxide and smoke detector, battery backup

B. PRODUCT DATA – round, white, smoke and co detector

C. STANDARDS – complies with ANSI/UL 217, ANSI/UL 2034, NFPA72, NFPA720

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Gentex

B. MODEL – GN-503

C. OPERATION – Operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- hardwired with battery backup

A. PROCESSES – N/A

B. QUANTITY – 5

END OF SECTION 10 40 00

SECTION 10 44 16 - FIRE EXTINGUISHER

PART 1 – GENERAL

1.01

A. PERFORMANCE – Multi use fire extinguisher works in garages, restaurants, and storage areas. Good for fires with electrical equipment, trash, and flammable liquid

B. PRODUCT DATA – A 15” tall red cylinder with black tube and white label

C. STANDARDS – 3-A:40-BC rating. Complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Kidde

B. MODEL – 21005782

C. OPERATION – remove pin, squeeze, spray

PART 3 – EXECUTION

3.1 INSTALLATION- N/A

A. PROCESSES – N/A

B. QUANTITY – 3

END OF SECTION 10 44 16

Division 11 – Equipment

SECTION 11 31 13 - RESIDENTIAL KITCHEN APPLIANCES

SECTION 11 31 00 - WASHING MACHINE

PART 1 - GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – stainless steel drum, transparent glass

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER -LG

B. MODEL – WT6001HV

C. OPERATION – Washes Clothing

PART 3 - EXECUTION

3.1 INSTALLATION Normal installation

A. PROCESSES – N/A

B. QUANTITY -1

END OF SECTION 11 31 00

SECTION 11 31 00 - REFRIGERATOR

PART 1 - GENERAL

1.01

A. PERFORMANCE – operates normally under standard conditions

B. PRODUCT DATA – stainless steel french door, bottom freezer refrigerator

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - LG

B. MODEL – LFC31995ST

C. OPERATION – operates normally under standard conditions

PART 3 - EXECUTION

3.01 INSTALLATION normal installation

A. PROCESSES – N/A

B. QUANTITY - 1

END OF SECTION 11 31 00

SECTION 11 31 00 - STOVE

PART 1 - GENERAL

1.01

A. PERFORMANCE – has infrared heating element to preheat in 20% less time. Able to set things remotely via smartthinq technology

B. PRODUCT DATA – Stainless steel, black ceramic, 6.3 cubic feet range

C. STANDARDS –complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - LG

B. MODEL – LRE3027ST

C. OPERATION – Infrared cooking elements cut cooking time

PART 3 - EXECUTION

3.1 INSTALLATION normal installation

A. PROCESSES – N/A

B. QUANTITY - 1

END OF SECTION 11 31 00

SECTION 11 31 00 - DISHWASHER

PART 1 - GENERAL

1.01

A. PERFORMANCE – six cycles,sanitization options, and variable spray pressure allow for a clean wash while being one of the quietest dishwashers

B. PRODUCT DATA – panel front, undercabinet

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER -Bosch

B. MODEL – SHV68R53UC

C. OPERATION – operates normally under standard conditions

PART 3 - EXECUTION

3.1 INSTALLATION normal installation

A. PROCESSES – N/A

B. QUANTITY - 1

END OF SECTION 11 31 00

SECTION 11 31 00 - RANGE HOOD

PART 1 - GENERAL

1.01

A. PERFORMANCE – control ventilation with performance and efficiency

B. PRODUCT DATA – touchpad, stainless steel, chimney hood

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - Dacor

B. MODEL – Discovery DHW301

C. OPERATION – 4 speed fan allows for controlled ventilation with performance and efficiency

PART 3 - EXECUTION

3.1 INSTALLATION wall mount

A. PROCESSES – N/A

B. QUANTITY -1

END OF SECTION 11 31 00

DRYER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components, 7.0 cu. ft.

B. PRODUCT DATA - Minimum clearances between dryer cabinet and adjacent walls or other surfaces are: 0" either side, 3" front and rear

-Minimum vertical space from floor to overhead cabinets, ceilings, etc. is 52".

-Closet doors must be louvered or otherwise ventilated and must contain a minimum of 60 sq. in. of open area equally distributed. If this closet contains both a washer and a dryer, doors must contain a minimum of 120 sq. in. of open area equally distributed.

C. STANDARDS - Complies with all federal regulations.

D. WEBSITE: http://products.geappliances.com/ApplProducts/Dispatcher?REQUEST=SpecPage&Sku=GFDN240GLWW

PART 2 - PRODUCTS

2.1 STAINLESS STEEL FRONTLOAD DRYER

A. MANUFACTURER - GE

B. MODEL - GFDN240GL

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

END OF SECTION 11 31 23

SECTION 11 31 00 - MICROWAVE

PART 1 – GENERAL

1.01

A. PERFORMANCE – Heats and defrosts foods and beverages

B. PRODUCT DATA – stainless steel, clear touch control

C. STANDARDS – compliant with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Bosch

B. MODEL – HMB5050

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- normal installations

A. PROCESSES – N/A

B. QUANTITY – 1

END OF SECTION 11 31 00

SECTION 11 52 00 - TELEVISION

PART 1 – GENERAL

1.01

A. PERFORMANCE – operates normally under standard conditions. Equipped with Google, LED lights, and a qwerty keypad

B. PRODUCT DATA – 55" LED TV

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Samsung

B. MODEL – UN55F9000AF 9000 Series 4k Ultra HD Smart

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – n/a

B. QUANTITY – 1

END OF SECTION 11 52 00

Division 12 – Furnishings

SECTION 12 36 19 - BATHROOM COUNTER

PART 1 – GENERAL

1.01

A. PERFORMANCE – Performs normally under standard conditions

B. PRODUCT DATA – 1 ½" thick slab of wooden counter top

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Southside Woodshop

B. MODEL – custom counter

C. OPERATION – bathroom counter top

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 7.9 sq ft

END OF SECTION 12 36 19

SECTION 12 36 23 - KITCHEN COUNTER

PART 1 – GENERAL

1.01

A. PERFORMANCE – horizontal decorative/ work surface

B. PRODUCT DATA – slab of greyish brown acrylic pieces made into smooth surface

C. STANDARDS – compliant with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Renewed Materials LLC

B. MODEL – Alkemi Acrylics Clear 500

C. OPERATION – countertop for kitchen

PART 3 – EXECUTION

3.1 INSTALLATION- horizontal applications. Install over substrate of plywood or particle board vertically supported. Use flexible neoprene or silicone adhesive to allow for movement and expansion

A. PROCESSES – N/A

B. QUANTITY – 30 sq ft

END OF SECTION 12 36 23

KITCHEN CABINETRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - ¾" solid bamboo plywood doors, drawers front, shelves and end panels, edge-banded with 1/8"bamboo. 5/8" solid bamboo super-sized lazy susan box with ¼" bamboo bottom with ¾" bamboo fixed shelf, 18" X 34 ½" X 24"

C. STANDARDS - Complies with all federal regulations.

D. WEBSITE: http://www.mrbamboocabinets.com/products.htm

PART 2 - PRODUCTS

2.1 BAMBOO KITCHEN CABINET

A. MANUFACTURER - MR. BAMBOO

B. MODEL - B18 SimplyGreen

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - three.

CORNER BASE CABINETRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - ¾" solid bamboo plywood doors, drawers front, shelves and end panels, edge-banded with 1/8"bamboo. 5/8" solid bamboo super-sized lazy susan box with ¼" bamboo bottom with ¾" bamboo fixed shelf, 18" X 34 ½" X 24"

C. STANDARDS - Complies with all federal regulations.

D. WEBSITE: http://www.mrbamboocabinets.com/products.htm

PART 2 - PRODUCTS

2.1 BAMBOO KITCHEN CABINET

A. MANUFACTURER - MR. BAMBOO

B. MODEL - B18 SimplyGreen

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

KITCHEN COUNTERTOPS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Recycled Walnut Shell Nuxite countertops, 8’ X 1” X 30”

C. STANDARDS - Complies with all federal regulations.

D. WEBSITE: naturalbuilthome.com/images/stories/nuxite/nuxite%20faq%2010-21-10.pdf

PART 2 - PRODUCTS

2.1 BAMBOO KITCHEN CABINET

A. MANUFACTURER - NATURAL BUILT HOMES

B. MODEL - NUXITE

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - two.

BATHROOM CABINETRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - ¾" solid bamboo plywood doors, drawers front, shelves and end panels, edge-banded with 1/8"bamboo. 5/8" solid bamboo super-sized lazy susan box with ¼" bamboo bottom with ¾" bamboo fixed shelf, 18" X 34 ½" X 24"

C. STANDARDS - Complies with all federal regulations.

D. WEBSITE: http://www.mrbamboocabinets.com/products.htm

PART 2 - PRODUCTS

2.1 BAMBOO BATHROOM CABINET

A. MANUFACTURER - MR. BAMBOO

B. MODEL - VA3021 Vanity Sink Base

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - 2

BATHROOM COUNTERTOPS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Recycled Walnut Shell Nuxite countertops, 8’ X 1 3/8” X 56”

C. STANDARDS - Complies with all federal regulations.

D. WEBSITE: http://www.squakmountainstone.com/literature/SLABS.pdf

PART 2 - PRODUCTS

2.1 BATHROOM CABINET

A. MANUFACTURER - NATURAL BUILT HOMES

B. MODEL -

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - 2

Division 21 – Fire Suppression

SMOKE DETECTOR

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Manufacturers: products by one of the following:

1. System Sensor

2. Approved Equal

B: Approving Agencies and Standards by the following:

- U.L. Standard 1626, Standard for Residential sprinkler systems for fire-protection service
- U.L. Standard 268A, Standard for Smoke Detectors for Duct Applications
- NFPA Standard 90A, Installation of Air Conditioning and Ventilating Systems
- NFPA 90A3, “Standard for the Installation of Air Conditioning and Ventilating Systems”
- NFPA 92A, Recommended Practice for Smoke Control Systems
- NFPA Standard 72, National Fire Alarm Code
- NFPA Standard 101, Life Safety Code
- ASHRAE Handbook and Product Directory, “Fire and Smoke Control” or latest standard.

PART 2 - PRODUCTS

2.1 SMOKE DETECTOR

1. Proof of compliance by means of product label indicating at a minimum; manufacturer's name and model number; date of manufacture; UL file number and logo and UL Online Certifications Directory; and NYC MEA number

2. It shall be capable of local testing

PART 3 - EXECUTION

3.1 INSTALLATION

1. Detectors listed for use in open air applications

2. Detector shall be listed for the application, may be mounted interior surface

3. Maintenance:

a. Tested or inspected at least annually to ensure that they sample the air.

b. Tested at least annually causing them to initiate an alarm at their installed location to ensure that they are operative and produce the intended response.

c. Checked within one year after installation and every alternate year thereafter to assure that they are within their listed and marked sensitivity range.

d. Continue log information from closeout procedures.

4. QUANTITY - 8

FIRE EXTINGUISHER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Federal Standard (FED-STD)

FED-STD-795 Uniform Federal Accessibility Standards (UFAS)

B. National Fire Protection Association (NFPA)

NFPA 10 Portable Fire Extinguishers

C. International Building Code (IBC)

D. International Fire Code (IFC)

PART 2 - PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

a. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

b. Product: A 10-lb, multi-purpose, UL listed, dry chemical fire extinguisher with a minimum rating of 4-A:40-B:C..

c. Mounting Brackets: Manufacturer's standard steel bracket, designed to secure extinguisher, of sizes required for types and capacities of fire extinguisher indicated, with plated or baked-enamel finish.

d. Fire extinguishers installed outside shall be located in approved weather-tight cabinets.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRE EXTINGUISHERS

A. Comply with manufacturer's written instructions for installing fire extinguishers and mounting brackets.

B. Mounting Height: Install extinguishers at heights indicated below.

1. Install fire extinguishers mounted on hangers or brackets attached to a wall so that the top of the fire extinguisher is not more than 3½ ft. above the floor.

2. In no case shall the clearance between the bottom of the fire extinguisher and the floor be less than 4 inches.

C. Locations: Install extinguishers at locations indicated below.

1. Install fire extinguishers at locations specified on the drawings or as directed by the authority having jurisdiction.

2. Fire extinguishers shall be conspicuously located, along normal paths of travel, including exits from areas. Extinguishers shall not be obstructed or obscured from view.

D. Install portable fire extinguishers on the hanger or in the bracket supplied, or place in the fire extinguisher cabinets provided. Verify that the extinguisher operating instructions face outward.

QUANTITY - 2

FIRE SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - U/L listed and FM approved, Bronze frame, 5mm glass bulb with glycerin solution, 175 PSI working water pressure, Hydrostatically tested to 500 PSI

B. PRODUCT DATA - Suppression of Type A, B, and C; in accordance with National Fire Protection Association

PART 2 - PRODUCTS

2.1 SPRINKLER HEAD

A. MANUFACTURER - Globe Fire Sprinkler

B. MODEL - GL2810

C. OPERATION - Operates normally under standard conditions.

D. Website: http://www.americanfirehose.com/sprinkler-heads/12-200-white-pendent-sprinkler-head-gl5651

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs by professionals or certified installers.

B. QUANTITY - 14

Division 22 – Plumbing

TANKLESS WATER HEATER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - 99% EFFICIENCY, 6 GPM, TEMP RISE OF 103 DEGREES AT 2.5 GPM

B. PRODUCT DATA - 240 VOLT, 38kW max, 160A, 20 3/16" X 12 1/8" X 4 1/8", 20 LBS.

C. STANDARDS - Complies with all federal regulations.

D. WEBSITE: http://solar.veluxusa.com/solar/products/solar_systems

PART 2 - PRODUCTS

2.1 WATER HEATER

A. MANUFACTURER - Velux

B. MODEL - CLI U12 4000, TFF 080 0205US, EKL U12 0021E, TPK OO1US

C. OPERATION - Combines with solar water heater for entire system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

SECTION 22 41 16 - BATHROOM TOILET

PART 1 – GENERAL

1.01

A. PERFORMANCE – product offers duel flush technology allowing users to use less water

B. PRODUCT DATA – 2-Piece High Efficiency Dual Flush Elongated Toilet in White

C. STANDARDS – ADA compliant. Watersense certified

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Glacier Bay

B. MODEL - N2316

C. OPERATION – duel flush allows user to minimize water usage

PART 3 – EXECUTION-

3.1 INSTALLATION- Standard installation

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 22 41 16

SECTION 22 41 16 - BATHROOM SINK

PART 1 - GENERAL

1.01

A. PERFORMANCE – operates normal under standard conditions

B. PRODUCT DATA - VIGO Brown Glass Topmount Round Bathroom Sink (Drain Included)

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER -Vigo

B. MODEL - VGT152

C. OPERATION – operates normally under standard conditions

PART 3 - EXECUTION

3.1 INSTALLATION- above counter installation.

Items Required for Standard Installation: Adjustable wrench, plumber's putty or caulking, pipe tape, hex keys, drill tape measure, tubing cutter or hacksaw, regular and Phillips screwdriver, caulking gun, caulk

A. PROCESSES – N/A

B. QUANTITY - 1

END OF SECTION 22 41 16

SECTION 22 41 16 - KITCHEN SINK and FAUCETS

PART 1 – GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – All-In-One 30” , apron front, stainless steel, farmhouse sink

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Vigo

B. MODEL – VG15278

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- normal installation

A. PROCESSES – N/A

B. QUANTITY – 1

END OF SECTION 22 41 16

SECTION 22 41 23 - SHOWER

PART 1 – GENERAL

1.01

A. PERFORMANCE - barrier free for ADA compliance

B. PRODUCT DATA – white, 3 walled, barrier free shower

C. STANDARDS - complies with IPC, UPC, ANSI Z124.2 plastic shower standards, ADA accessibility guidelines, ANSI A117.7 accessible and usable facilities, CSA approved, MAS, TAS

PART 2 - PRODUCTS

2.01

A. MANUFACTURER – Freedom Showers

B. MODEL – APFQ3637BF3P

C. OPERATION – barrier free to allow for ADA compliance

PART 3 - EXECUTION

3.1 INSTALLATION standard installation

A. PROCESSES – N/A

B. QUANTITY - 1

END OF SECTION 22 41 23

SECTION 22 41 39 - BATHROOM SINK

PART 1 - GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – Copper glass above counter sink with faucet and drain

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER – Vigo

B. MODEL - VGT007RB

C. OPERATION – operates normally under standard conditions

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Items Required for Standard Installation: Plumber's putty or caulk, tape measure, caulking gun

B. QUANTITY - 1

END OF SECTION 22 41 39

Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC)

HVAC SYSTEM

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - 9,000 BTU / 580 W

B. PRODUCT DATA - W: 31-1/2, D: 11-1/4, H: 21-5/8

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 HVAC

A. MANUFACTURER - Mitsubishi

B. MODEL - MSZ-GE09NA-8, MSZ-GE12NA-8

C. OPERATION - Indoor use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs professionally only.

B. QUANTITY - 4 of Each

HVAC SYSTEM

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - 35,400 BTU / 3,340 W

B. PRODUCT DATA - W: 35-7/16, D: 12-5/8, H: 35-7/16

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 HVAC

A. MANUFACTURER - Mitsubishi

B. MODEL - MXZ-4B36NA-1

C. OPERATION - Outdoor use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs professionally only.

B. QUANTITY - 1

Division 26 – Electrical

SECTION 26 51 13 - DINING ROOM LIGHT

PART 1 – GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – Five light island fixture. Imperial bronze with marble

C. STANDARDS – complies with safety rating CUL

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Quoizel

B. MODEL – KY5401B

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- Installs with standard household tools

A. PROCESSES – N/A

B. QUANTITY – 1

END OF SECTION 26 51 13

SECTION 26 51 13 - BED/LIVING CEILING FAN

PART 1 – GENERAL

1.01

A. PERFORMANCE –Performs normally under standard conditions

B. PRODUCT DATA - 52`` CEILING FAN.

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Fanimation

B. MODEL - BP220OB1

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION – standard or flush mount

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 26 51 13

SECTION 26 51 13 - STONE WALL SCONCES

PART 1 – GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – One light wall fixture. Oil rubbed bronze and marble

C. STANDARDS - complies with CUL safety rating

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Quoizel

B. MODEL - KY8701IB

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION Wall mount

A. PROCESSES – N/A

B. QUANTITY –2

END OF SECTION 26 51 13

SECTION 26 51 13 - BATHROOM VANITY LIGHT

PART 1 – GENERAL

1.01

A. PERFORMANCE – Performs normally under standard conditions

B. PRODUCT DATA – Bronze 3 light wall mount fixture with amber glass

C. STANDARDS – UL safety rating

PART 2 - PRODUCTS

2.01

A. MANUFACTURER – Murry Feiss

B. MODEL – VS18903-RBZ

C. OPERATION – operates normally under standard conditions

PART 3 - EXECUTION

3.1 INSTALLATION Wall mount

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 26 51 13

SECTION 26 51 13 - RECESSED LIGHTING

PART 1 - GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – white 4.5” led recessed light

C. STANDARDS – complies with all laws and regulations

PART 2 - PRODUCTS

2.01

A. MANUFACTURER - Eurofase

B. MODEL – TR-M07-02

C. OPERATION – Operates normally under standard conditions

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES – Ceiling installation, recessed.

B. QUANTITY – 13

END OF SECTION 26 51 13

GFCI Outlet

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - COPPER 20-Amp White GFCI Electrical Outlet

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 COPPER WIRE 20-Amp White Decorateor GFCI Electrical Outlet

A. MANUFACTURER - Pass& Seymour

B. MODEL - Legrand 1595NTLRWCC4

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - 10.

PANEL BOX

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - 40-Circuit 30-Space 200-Amp Main Breaker Load Center Value Pack

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 ELECTRICAL BOX

A. MANUFACTURER - SQUARE D

B. MODEL - HOM3040M200RBVP

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

240V CIRCUIT BREAKER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - 40 Amp circuit breaker for tankless water heater.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 40 AMP CIRCUIT BREAKER

A. MANUFACTURER - SIEMENS

B. MODEL - Q240

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - 4

240V CIRCUIT BREAKER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - 50 Amp breakers for range/stove.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 50 AMP CIRCUIT BREAKER

A. MANUFACTURER - SIEMENS

B. MODEL - Q250

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

240V CIRCUIT BREAKER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - 30 Amp breakers for stove.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 50 AMP CIRCUIT BREAKER

A. MANUFACTURER - SIEMENS

B. MODEL - Q230U

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

120V CIRCUIT BREAKER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - 20 Amp breakers for refrigerator and washing machine.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 40 AMP CIRCUIT BREAKER

A. MANUFACTURER - SIEMENS

B. MODEL - Q120

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - 2

120V CIRCUIT BREAKER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - 15 Amp breakers for dishwasher.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 15 AMP CIRCUIT BREAKER

A. MANUFACTURER - SIEMENS

B. MODEL - Q115

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

B. QUANTITY - 2

SECTION 26 32 00 – GENERATOR Apollo AED6500SR Diesel

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Complies with NFPA 54 and NFPA 70

PART 2 - PRODUCTS

2.1 ASSEMBLY

A. Apollo AED6500SR Diesel

B. 120/240 Single-Phase

C. Maximum AC Output 6500 Watts

D. Operating Noise 40 dBA max at 50 ft.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Operate on level ground, store in weather-safe area.

END OF SECTION 26 32 00

SECTION 26 51 13 - SINK LIGHTING

PART 1 – GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – pendant light Bronze and amber

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Quoizel

B. MODEL – KY1507IB

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- Ceiling mount. Normal installation

A. PROCESSES – N/A

B. QUANTITY – 1

END OF SECTION 26 51 13

SECTION 26 51 13 - TRACK LIGHTING

PART 1 – GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – white track with 3 white light fixtures

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER – Thomas Lighting

B. MODEL – TRR3048

C. OPERATION – operates normally under standard conditions

PART 3 – EXECUTION

3.1 INSTALLATION- Normal installations. Ceiling mount

A. PROCESSES – N/A

B. QUANTITY – 2

END OF SECTION 26 51 13

SECTION 26 56 00 - EXTERIOR LIGHT

PART 1 – GENERAL

1.01

A. PERFORMANCE – performs normally under standard conditions

B. PRODUCT DATA – wall mounted lantern look light fixture

C. STANDARDS – UL listed for wet locations. Complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Kichler

B. MODEL – 9477OB

C. OPERATION – operates normally under standard condition

PART 3 – EXECUTION

3.1 INSTALLATION- wall mount

A. PROCESSES – N /A

B. QUANTITY – 3

END OF SECTION 26 56 00

Division 27 – Communications

COMPUTER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - The server posses a six-core AMD processor running at 3.5GHz, a 10GB DDR3 SDRAM expandable to 32GB, with a 1TB in size hard-drive; 2 USB 3.0 ports and 6 USB 2.0 ports, and is Bluetooth enabled, and runs Microsoft Windows 7 home premium edition 64-bit Operating System.

C. STANDARDS - Complies with all federal regulations.

D. WEBSITE:

http://www.bestbuy.com/site/HP++Pavilion+HPE+Desktop++10GB+Memory+-+1TB+Hard+Drive/5563052.p?id=1218661381249&skuId=5563052#tab=specifications

PART 2 - PRODUCTS

2.1 Desktop

A. MANUFACTURER - Hewlett Packard

B. MODEL - Pavilion H8-1234

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.01 INSTALLATION - Installs with standard domestic tools.

TABLET

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Gyroscope, accelerometer, ambient light sensor, and compass as well as a 3.5mm headphone jack and 30-pin dock connector port.

B. PRODUCT DATA - 10.1” 1280x800 LCD 1080p display with Wi-Fi Direct, Wi-Fi 802.11 a/b/g/n, Dual-Band (2.4GHz, 5GHz), along with Bluetooth, rear-facing HD(720p) video recording camera. Product: Built-in 7000mAh battery

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 TABLET COMPUTER

A. MANUFACTURER - SAMSUNG

B. MODEL - GALAXY

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

SERVER

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Ethernet/WiFi to 1-Wire interface that is designed to efficiently monitor and control 1-Wire devices. The OW-SERVER will allow you to use industry standard Ethernet or WiFi products (switches, hubs, etc.) to build the backbone of your 1-Wire based sensor / control system. C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 WIRE TO ETHERNET SERVER

A. MANUFACTURER - EMBEDDED DATA SYSTEMS

B. MODEL - OW-SERVER-2

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

E-MONITOR

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Sends the data it collects to remote servers, where it is processed and then sends back information on ways to save money and energy

B. PRODUCT DATA - eMonitor system gather data from the circuit breaker of the house and communicates wirelessly to the eMonitor Gateway, connects wirelessly to the Wi-Fi network

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 CIRCUIT BREAKER E-MONITOR

A. MANUFACTURER - POWERHOUSE DYNAMICS

B. MODEL - 12, 24, AND 44

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

E-COMMUNICATIONS GATEWAY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Takes solar information from the PV panels and sends the information into the Envoy gateway which displays part of the data on its main screen. This information is then sent to online enlighten system to be interpreted and stored on the system.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 COMMUNICATIONS SYSTEM

A. MANUFACTURER - ENPHASE ENERGY

B. MODEL - ENVOY COMMUNICATIONS GATEWAY

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools

B. RELATED - CAT-5 (140 FT.) RJ12 (20FT. AND 40 FT.)

Division 28 – Electronic Safety and Security

SMOKE DETECTORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. PERFORMANCE - Performs with standard comparable components.

B. PRODUCT DATA - Specifications are common with no notable differences.

C. STANDARDS - Complies with all federal regulations.

PART 2 - PRODUCTS

2.1 BATTERY OPERATED SMOKE DETECTOR

A. MANUFACTURER - STANDARD

B. MODEL - STANDARD

C. OPERATION - Operates normally under standard conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. PROCESSES - Installs with standard domestic tools.

Division 33 – Utilities

Pending

Division 34 – Transportation

Pending

Division 48 – Electrical Power Generation

SECTION 48 31 00

PHOTOVOLTAIC PANELS

PART 1 – GENERAL

1.01

A. PERFORMANCE – Outputs a maximum 270 W (DC)

B. PRODUCT DATA – 39.41” x 65.94” x 1.22”

C. STANDARDS – complies with all laws and regulations

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Sunmodule

B. MODEL – SW 270 mono / Version 2.5 Frame

C. OPERATION – Collects solar energy and outputs DC Power

PART 3 – EXECUTION

3.1 INSTALLATION - Attaches to two rail mounts

A. PROCESSES – Each panel must attach to its respective microinverter

B. QUANTITY – 28

MICROINVERTERS (one in each panel)

PART 1 – GENERAL

1.01

A. PERFORMANCE – Receives 270W (DC) and outputs 215 W @ 60 Hz (AC)

B. PRODUCT DATA – 6.8” x 6.45” 1.0”

C. STANDARDS – Enclosure environmental rating: Outdoor – NEMA 6

PART 2 – PRODUCTS

2.01

A. MANUFACTURER - Enphase Energy

B. MODEL – M215 Microinverter

C. OPERATION – Inverts DC Power to AC to connect to the house

PART 3 – EXECUTION

3.1 INSTALLATION- Mount below respective PV panels

A. PROCESSES – Receives power from PV panels and outputs AC power in conjunction with all other microinverters

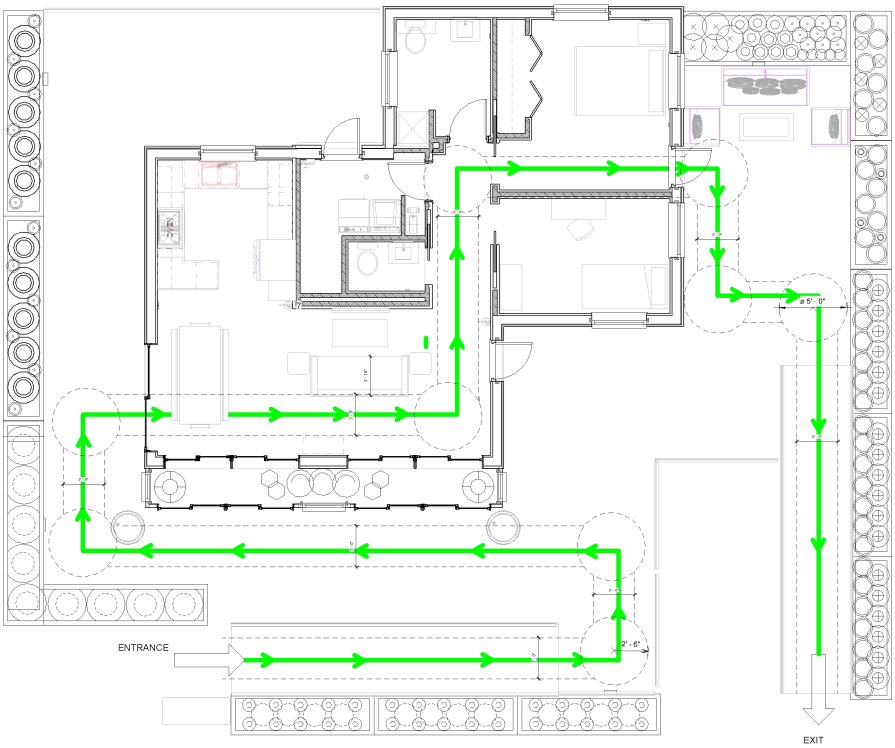
B. QUANTITY –28

END OF SECTION 48 31 00

Appendix A

Full Public Route:

Starting from the east ramp, the tour path takes visitors through the master bedroom of the house and down the night area hallway past the guest bedroom. The route exits and continues through the living area and finally out through the kitchen door. Visitors may then exit via the south ramp. This path highlights the main features of the house in an efficient manner.



WVU Solar House
West Virginia University
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Appendix B

Structural Calculations

Steven Schaefer Associates, Inc.
Consulting Structural Engineers

PEAK
Solar Decathlon 2013

Structural Calculation Package

Prepared For WVU

SSA Project # 1209.38

Cincinnati:
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Cincinnati, OH 45241
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ESG
Entertainment Structures Group
800-542-3302

Project:	**WVU Solar Decathlon SIPs**
Client:	**PEAK Team**
Proj. No.:	**1209.38**
Designer:	**TAM**
Page:	1 of 1
Date:	3/29/2013

SIP Panel Analysis - Roof Panel Checks (Transverse Loading)

StructureDescription: PEAK - WVU Solar Decathlon 2013

Location: Irvine, CA

BuildingCode: 2012 International Residential Code

2.5:12 Pitch Roof:

- Typical Roof Live Load = 20 PSF
  Dead Load = 35 PSF (max)
  Total Load = 55 PSF

- Max Span = 8'-0"

- Allowable Load for 8'-0" span (shortest span listed) = 56.6 PSF > 55 PSF **OK** (from SIPA design charts)

- Check Wind Uplift at the exterior wall (mean roof height = 15')
  C&C Wind Uplift = -16 PSF @ field
  -28 PSF @ perimeter
  -42 PSF @ corner (see ASCE 7 Wind Table Enclosed)

  Uplift Load to SIP Screws at perimeter:
  P = (8')(28 PSF) = 224 PLF
  SIP Screws @ 10"oc
  187# per screw

  Uplift Load to SIP Screws at corners:
  P = (8')(42 PSF) = 336 PLF
  SIP Screws @ 6"oc
  168# per screw

Trufast SIP Screw Capacity (Head Pull Thru Controls):
  Ultimate Capacity = 630#
  Safety Factor = 3
  630# / 3 = 210# allowable > 187# **OK**

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Entertainment Structures Group
800-542-3302

Project:	**WVU Solar Decathlon SIPs**
Client:	**PEAK Team**
Proj. No.:	**1209.38**
Designer:	**TAM**
Page:	1 of 1
Date:	3/29/2013

SIP Panel Analysis - Wall Panel Checks

StructureDescription: PEAK - WVU Solar Decathlon 2013

Location: Irvine, CA

BuildingCode: 2012 International Residential Code

81/4" Wall Panels:

- Maximum span = 12'-0"
  C&C wind load = 17.3 PSF (see Zone 4 - 50 sf on enclosed ASCE 7-05 wind table)
  Allowable wind load per SIPA Code Report = 54 PSF for L/240
  17.3 PSF < 54 PSF **OK**

ChecksForReinforcedSIPWallJoints: (incorporating contribution from 1'-0" strip of SIP panel for deflection)

12'wallheight-10'dooropening-(1)2x8jambstud

$h := 12\cdot ft$ $WL := 17.3\cdot psf$ $W_{trib} := 5\cdot ft$

$w := WL\cdot W_{trib}$ $w = 86.50\cdot plf$

$M := \left(\frac{1}{8}\right)(w)(h)^2$ $M = 1557.00\cdot lbf\cdot ft$

$b_{2x} := 1.5\cdot in$ $F_{b\_2x} := 1200\cdot psi$ $E_{SIP} := 658.8\cdot ksi$

$d_{2x} := 7.25\cdot in$ $E_{2x} := 1600\cdot ksi$ $I_{SIP} := 160.2\cdot in^4$

$C_f := \left(\frac{12\cdot in}{d_{2x}}\right)^{\frac{1}{9}}$ $C_f = 1.06$

$S_{2x} := \left(\frac{1}{6}\right)(b_{2x})(d_{2x})^2$ $S_{2x} = 13.14\cdot in^3$

$M_{allow} := (1.6)(F_{b\_2x})(S_{2x})(C_f)$ $M_{allow} = 2223.58\cdot lbf\cdot ft$ **OK**

Deflection:

$I_{2x} := \left(\frac{1}{12}\right)(b_{2x})(d_{2x})^3$ $I_{2x} = 47.63\cdot in^4$

$w_{defl} := (0.7)(WL)W_{trib}$ $w_{defl} = 0.061\cdot klf$

$Defl := \frac{(5)(w_{defl})(h)^4}{(384)\left[(E_{2x})(I_{2x}) + (E_{SIP})(I_{SIP})\right]}$ $Defl = 0.16\cdot in$

$\frac{h}{240} = 0.60\cdot in$ **OK**

Main Wind-Force Resisting Systems - Walls
ASCE 7-05 - Rigid Buildings of All Heights, Method 2
Figure 6-6 - Walls and Roofs
Section 6.5.12.2.1 & Eqn. 6-17: $p = qGC_p - q_i(GC_{pi})$, PSF
Tables for Wind Load Pressures, PSF

InputData:				
Basic Wind Speed, V =	90	Directionality Factor, K_d =	0.85
Importance Factor, I =	1.00	Gust Effect Factor, G =	0.85
Topographic Factor, K_{zt} =	1.00		

Exposure B — Enclosed Building

Height	Velocity Pressure Coeff.	Velocity Pressure	External Effects Only = qGC_p: Windward Wall Pressure at z	Leeward Wall Pressure at h: L/B= 0 to 1	L/B= 2	$L/B \geq 4$	Sidewall Pressure at h	Internal Effects Only = $q_i(GC_{pi})$: Pos. I.P. GC_{pi}= at h	Neg. I.P. GC_{pi}= at h	Individual Wall Design Pressures External + Worst-Case Internal Effects: Windward	Leeward Wall Pressure: L/B= 0 to 1	L/B= 2.	$L/B \geq 4$	Sidewall	Maximum Lateral Stability Pressure
h	K_h	q_h	C_p = 0.8	C_p = -0.5	Cp = -0.3	C_p = -0.2	C_p = -0.7	0.18	-0.18	Wall Pressure	L/B= 0 to 1	2.	$L/B \geq 4$	Pressure	Pressure
15'	0.57	10.1	6.9	-4.3	-2.6	-1.7	-6.0	1.8	-1.8	8.7	-6.1	-4.4	-3.5	-7.9	11.2
20'	0.62	11.0	7.5	-4.7	-2.8	-1.9	-6.5	2.0	-2.0	9.5	-6.7	-4.8	-3.8	-8.5	12.2
25'	0.67	11.7	8.0	-5.0	-3.0	-2.0	-7.0	2.1	-2.1	10.1	-7.1	-5.1	-4.1	-9.1	13.0
30'	0.70	12.3	8.4	-5.2	-3.1	-2.1	-7.3	2.2	-2.2	10.6	-7.5	-5.4	-4.3	-9.6	13.6
40'	0.76	13.4	9.1	-5.7	-3.4	-2.3	-8.0	2.4	-2.4	11.5	-8.1	-5.8	-4.7	-10.4	14.8
50'	0.81	14.3	9.7	-6.1	-3.6	-2.4	-8.5	2.6	-2.6	12.3	-8.6	-6.2	-5.0	-11.1	15.8
60'	0.85	15.1	10.2	-6.4	-3.8	-2.6	-9.0	2.7	-2.7	12.9	-9.1	-6.5	-5.3	-11.7	16.6
70'	0.89	15.7	10.7	-6.7	-4.0	-2.7	-9.4	2.8	-2.8	13.5	-9.5	-6.8	-5.5	-12.2	17.4
80'	0.93	16.3	11.1	-6.9	-4.2	-2.8	-9.7	2.9	-2.9	14.1	-9.9	-7.1	-5.7	-12.7	18.1
90'	0.96	16.9	11.5	-7.2	-4.3	-2.9	-10.1	3.0	-3.0	14.5	-10.2	-7.4	-5.9	-13.1	18.7
100'	0.99	17.4	11.8	-7.4	-4.4	-3.0	-10.4	3.1	-3.1	15.0	-10.5	-7.6	-6.1	-13.5	19.2

Exposure C — Enclosed Building

Height	Velocity Pressure Coeff.	Velocity Pressure	External Effects Only = qGC_p: Windward Wall Pressure at z	Leeward Wall Pressure at h: L/B= 0 to 1	L/B= 2	$L/B \geq 4$	Sidewall Pressure at h	Internal Effects Only = $q_i(GC_{pi})$: Pos. I.P. GC_{pi}= at h	Neg. I.P. GC_{pi}= at h	Individual Wall Design Pressures External + Worst-Case Internal Effects: Windward	Leeward Wall Pressure: L/B= 0 to 1	L/B= 2.	$L/B \geq 4$	Sidewall	Maximum Lateral Stability Pressure
h	K_h	q_h	C_p = 0.8	C_p = -0.5	Cp = -0.3	C_p = -0.2	C_p = -0.7	0.18	-0.18	Wall Pressure	L/B= 0 to 1	2.	$L/B \geq 4$	Pressure	Pressure
15'	0.85	15.0	10.2	-6.4	-3.8	-2.5	-8.9	2.7	-2.7	12.9	-9.1	-6.5	-5.2	-11.6	16.5
20'	0.90	15.9	10.8	-6.8	-4.1	-2.7	-9.5	2.9	-2.9	13.7	-9.6	-6.9	-5.6	-12.3	17.6
25'	0.95	16.7	11.3	-7.1	-4.2	-2.8	-9.9	3.0	-3.0	14.3	-10.1	-7.2	-5.8	-12.9	18.4
30'	0.98	17.3	11.8	-7.4	-4.4	-2.9	-10.3	3.1	-3.1	14.9	-10.5	-7.5	-6.1	-13.4	19.1
40'	1.04	18.4	12.5	-7.8	-4.7	-3.1	-10.9	3.3	-3.3	15.8	-11.1	-8.0	-6.4	-14.3	20.3
50'	1.09	19.3	13.1	-8.2	-4.9	-3.3	-11.5	3.5	-3.5	16.6	-11.7	-8.4	-6.7	-14.9	21.3
60'	1.14	20.0	13.6	-8.5	-5.1	-3.4	-11.9	3.6	-3.6	17.2	-12.1	-8.7	-7.0	-15.5	22.1
70'	1.17	20.7	14.1	-8.8	-5.3	-3.5	-12.3	3.7	-3.7	17.8	-12.5	-9.0	-7.2	-16.0	22.9
80'	1.21	21.3	14.5	-9.0	-5.4	-3.6	-12.7	3.8	-3.8	18.3	-12.9	-9.3	-7.4	-16.5	23.5
90'	1.24	21.8	14.8	-9.3	-5.6	-3.7	-13.0	3.9	-3.9	18.8	-13.2	-9.5	-7.6	-16.9	24.1
100'	1.27	22.3	15.2	-9.5	-5.7	-3.8	-13.3	4.0	-4.0	19.2	-13.5	-9.7	-7.8	-17.3	24.6

Notes:
1. Positive external pressure is defined as acting towards the exterior wall surface. Negative external pressure is defined as acting away from the exterior wall surface (suction).
2. Positive internal pressure is defined as acting towards the interior wall surface. Negative internal pressure is defined as acting away from the interior wall surface.
3. Maximum Lateral Stability Pressure = Windward Wall Pressure + Maximum Leeward Wall Pressure. This pressure considers the external effects only as the internal effects on each wall cancel out in an enclosed building with equal wall heights on the windward and leeward elevations. The minimum wind load used for the MWFRS for an enclosed or partially enclosed building shall not be less than 10 psf mutiplied by the area of the building projected onto a vertical plane.
4. K_d = 0.85 only when using ASCE 7-05 load combinations or the IBC 2006 basic load combinations. If you are using the IBC 2006 alternative basic load combinations or other load combinations, enter K_d = 1.0 in the project data input table.
5. B is defined as the horizontal building dimension measured normal to the wind direction. L is defined as the horizontal building dimension measured parallel to the wind direction.

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Components & Cladding - Walls
ASCE 7-05 - Buildings w/ h :: 60 ft., Method 2
Section 6.5.12.4.1 & Eqn. 6-22: $p = q_h[(GC_p)-(GC_{pi})]$, PSF
Reference Figure 6-11A: Walls; Roof 8 > 10°
Table for Wind Load Pressures, PSF

InputData:				
Basic Wind Speed, V =	90	Directionality Factor, K_d =	0.85
Importance Factor, I =	1.00		
Topographic Factor, K_{zt} =	1.00		

Enclosed Buildings

Exposure C — Zone 4 (field) Design Pressures - External + Internal Effects

Height, h	Exp. Coeff. K_h	Velocity Pressure, q_h, PSF	- Int. Pressure GCpi -0.18	+ Int. Pressure GCpi 0.18	δ10 sf 1.00 - I.P.	δ10 sf □1.10 + I.P.	50 sf 0.88 - I.P.	50 sf □0.98 + I.P.	100 sf 0.82 - I.P.	100 sf □0.92 + I.P.	200 sf 0.77 - I.P.	200 sf □0.87 + I.P.	500-1000 sf 0.70 - I.P.	500-1000 sf □0.80 + I.P.	Eff. Wind Area GC_p
15'	0.85	15.0	-2.7	2.7	17.7	-19.2	15.8	-17.3	15.0	-16.5	14.2	-15.7	13.2	-14.7	
20'	0.90	15.9	-2.9	2.9	18.8	-20.3	16.8	-18.4	16.0	-17.5	15.1	-16.7	14.0	-15.6	
25'	0.95	16.7	-3.0	3.0	19.7	-21.3	17.6	-19.3	16.7	-18.4	15.8	-17.5	14.7	-16.3	
30'	0.98	17.3	-3.1	3.1	20.4	-22.2	18.3	-20.0	17.4	-19.1	16.5	-18.2	15.2	-17.0	
40'	1.04	18.4	-3.3	3.3	21.7	-23.5	19.4	-21.3	18.5	-20.3	17.5	-19.3	16.2	-18.0	
50'	1.09	19.3	-3.5	3.5	22.7	-24.7	20.4	-22.3	19.3	-21.3	18.3	-20.2	17.0	-18.9	
60'	1.14	20.0	-3.6	3.6	23.6	-25.6	21.2	-23.2	20.1	-22.1	19.0	-21.0	17.6	-19.6	

Exposure C — Zone 5 (end) Design Pressures - External + Internal Effects

Height, h	Exp. Coeff. K_h	Velocity Pressure, q_h, PSF	- Int. Pressure GCpi -0.18	+ Int. Pressure GCpi 0.18	δ10 sf 1.00 - I.P.	δ10 sf □1.40 + I.P.	50 sf 0.88 - I.P.	50 sf □1.15 + I.P.	100 sf 0.82 - I.P.	100 sf □1.05 + I.P.	200 sf 0.77 - I.P.	200 sf □0.94 + I.P.	500-1000 sf 0.70 - I.P.	500-1000 sf □0.80 + I.P.	Eff. Wind Area GC_p
15'	0.85	15.0	-2.7	2.7	17.7	-23.6	15.8	-19.9	15.0	-18.4	14.2	-16.8	13.2	-14.7	
20'	0.90	15.9	-2.9	2.9	18.8	-25.1	16.8	-21.2	16.0	-19.5	15.1	-17.8	14.0	-15.6	
25'	0.95	16.7	-3.0	3.0	19.7	-26.3	17.6	-22.2	16.7	-20.4	15.8	-18.7	14.7	-16.3	
30'	0.98	17.3	-3.1	3.1	20.4	-27.4	18.3	-23.1	17.4	-21.2	16.5	-19.4	15.2	-17.0	
40'	1.04	18.4	-3.3	3.3	21.7	-29.1	19.4	-24.5	18.5	-22.6	17.5	-20.6	16.2	-18.0	
50'	1.09	19.3	-3.5	3.5	22.7	-30.5	20.4	-25.7	19.3	-23.7	18.3	-21.6	17.0	-18.9	
60'	1.14	20.0	-3.6	3.6	23.6	-31.7	21.2	-26.7	20.1	-24.6	19.0	-22.4	17.6	-19.6	

Notes:
1. Use this table only for low-rise buildings and buildings with h no greater than 60 ft.
2. Values of GC_p for walls may be reduced by 10% when 8 is no greater than 10°. See separate table.
3. K_d = 0.85 only when using ASCE 7-05 load combinations or the IBC 2006 basic load combinations. If you are using the IBC 2006 alternative basic load combinations or other load combinations, enter K_d = 1.0 in the project data input table.
4. Positive pressure is defined as acting towards a wall's surface. Negative pressure is defined as acting away from a wall's surface (suction).
5. Edge zone dimension, a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft.
6. Components and cladding elements with tributary area greater than 700 ft2 shall be permitted to be designed using the provisions for MWFRSs.

Components & Cladding - Gable/Hip Roofs w/ 7°<8::27°
ASCE 7-05 - Buildings w/ h :: 60 ft., Method 2
Section 6.5.12.4.1 & Eqn. 6-22: $p = q_h[(GC_p)-(GC_{pi})]$, PSF
Reference Figure 6-11C: Gable/Hip Roofs with 7°<8::27°
Tables for Wind Load Pressures, PSF

Input Data:				
Basic Wind Speed, V =	90	Directionality Factor, K_d =	0.85
Importance Factor, I =	1.00		
Topographic Factor, K_{zt} =	1.00		

Enclosed Buildings

Exposure C — Zone 1 (field) Design Pressures - External + Internal Effects

Height, h	Exp. Coeff. K_h	Velocity Pressure, q_h, PSF	Neg. Int. Pressure GCpi=-0.18	Pos. Int. Pressure GCpi=0.18	δ10 sf		50 sf		100 sf		200 sf		500-1000 sf		Eff. Wind Area
					0.50	□0.90	0.36	□0.83	0.30	□0.80	0.30	□0.80	0.30	□0.80	GC_p
					- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	
15'	0.85	15.0	-2.7	2.7	10.2	-16.2	10.0	-15.1	10.0	-14.7	10.0	-14.7	10.0	-14.7	
20'	0.90	15.9	-2.9	2.9	10.8	-17.2	10.0	-16.1	10.0	-15.6	10.0	-15.6	10.0	-15.6	
25'	0.95	16.7	-3.0	3.0	11.3	-18.0	10.0	-16.8	10.0	-16.3	10.0	-16.3	10.0	-16.3	
30'	0.98	17.3	-3.1	3.1	11.8	-18.7	10.0	-17.5	10.0	-17.0	10.0	-17.0	10.0	-17.0	
40'	1.04	18.4	-3.3	3.3	12.5	-19.9	10.0	-18.6	10.0	-18.0	10.0	-18.0	10.0	-18.0	
50'	1.09	19.3	-3.5	3.5	13.1	-20.8	10.4	-19.5	10.0	-18.9	10.0	-18.9	10.0	-18.9	
60'	1.14	20.0	-3.6	3.6	13.6	-21.6	10.8	-20.2	10.0	-19.6	10.0	-19.6	10.0	-19.6	

Exposure C — Zone 2 (perimeter) Design Pressures - External + Internal Effects

Height, h	Exp. Coeff. K_h	Velocity Pressure, q_h, PSF	Neg. Int. Pressure GCpi=-0.18	Pos. Int. Pressure GCpi=0.18	δ10 sf		50 sf		100 sf		200 sf		500-1000 sf		Eff. Wind Area
					0.50	□1.70	0.36	□1.35	0.30	□1.20	0.30	□1.20	0.30	□1.20	GC_p
					- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	
15'	0.85	15.0	-2.7	2.7	10.2	-28.1	10.0	-22.9	10.0	-20.6	10.0	-20.6	10.0	-20.6	
20'	0.90	15.9	-2.9	2.9	10.8	-29.9	10.0	-24.3	10.0	-21.9	10.0	-21.9	10.0	-21.9	
25'	0.95	16.7	-3.0	3.0	11.3	-31.3	10.0	-25.5	10.0	-23.0	10.0	-23.0	10.0	-23.0	
30'	0.98	17.3	-3.1	3.1	11.8	-32.5	10.0	-26.5	10.0	-23.9	10.0	-23.9	10.0	-23.9	
40'	1.04	18.4	-3.3	3.3	12.5	-34.6	10.0	-28.2	10.0	-25.4	10.0	-25.4	10.0	-25.4	
50'	1.09	19.3	-3.5	3.5	13.1	-36.2	10.4	-29.5	10.0	-26.6	10.0	-26.6	10.0	-26.6	
60'	1.14	20.0	-3.6	3.6	13.6	-37.7	10.8	-30.7	10.0	-27.6	10.0	-27.6	10.0	-27.6	

Exposure C — Zone 3 (corner) Design Pressures - External + Internal Effects

Height, h	Exp. Coeff. K_h	Velocity Pressure, q_h, PSF	Neg. Int. Pressure GCpi=-0.18	Pos. Int. Pressure GCpi=0.18	δ10 sf		50 sf		100 sf		200 sf		500-1000 sf		Eff. Wind Area
					0.50	□2.60	0.36	□2.18	0.30	□2.00	0.30	□2.00	0.30	□2.00	GC_p
					- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	- I.P.	+ I.P.	
15'	0.85	15.0	-2.7	2.7	10.2	-41.6	10.0	-35.3	10.0	-32.6	10.0	-32.6	10.0	-32.6	
20'	0.90	15.9	-2.9	2.9	10.8	-44.2	10.0	-37.5	10.0	-34.7	10.0	-34.7	10.0	-34.7	
25'	0.95	16.7	-3.0	3.0	11.3	-46.3	10.0	-39.3	10.0	-36.3	10.0	-36.3	10.0	-36.3	
30'	0.98	17.3	-3.1	3.1	11.8	-48.1	10.0	-40.9	10.0	-37.7	10.0	-37.7	10.0	-37.7	
40'	1.04	18.4	-3.3	3.3	12.5	-51.1	10.0	-43.4	10.0	-40.1	10.0	-40.1	10.0	-40.1	
50'	1.09	19.3	-3.5	3.5	13.1	-53.6	10.4	-45.5	10.0	-42.0	10.0	-42.0	10.0	-42.0	
60'	1.14	20.0	-3.6	3.6	13.6	-55.7	10.8	-47.3	10.0	-43.7	10.0	-43.7	10.0	-43.7	

Notes:
1. Use this table only for low-rise buildings and buildings with h no greater than 60 ft.
2. K_d = 0.85 only when using ASCE 7-05 load combinations or the IBC 2006 basic load combinations. If you are using the IBC 2006 alternative basic load combinations or other load combinations, enter K_d = 1.0 in the project data input table.
3. For hip roofs with q£25°, Zone 3 shall be treated as Zone 2.
4. Edge zone dimension, a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft.

Main Wind-Force Resisting Systems - Roofs
Wind Normal to Ridge for 8 :2 **10°**
ASCE 7-05 - Rigid Buildings of All Heights, Method 2
Section 6.5.12.2.1, Figure 6-6, & Eqn. 6-17: $p = qGC_p - q_i(GC_{pi})$, PSF
Tables for Wind Load Pressures, PSF

Input Data:				
	Basic Wind Speed, V =	90	Directionality Factor, K_d =	0.85
	Importance Factor, I =	1.00	Gust Effect Factor, G =	0.85
	Topographic Factor, K_{zt} =	1.00		

Exposure B — Enclosed Building

External Effects Only, qGC_p — Internal Effects Only, $q_i(GC_{pi})$ — Individual Roof Design Pressures: External + Worst-Case Internal Pressures

Height	Velocity Pressure Coeff.	Velocity Pressure		Windward Roof, slopes as indicated																Windward Roof Overhang	Leeward Roof, Slopes as indicated			Pos. I.P.	Neg. I.P.	Individual Roof Design Pressures: Windward Roof, slopes as indicated												Individual Roof Design Pressures: Leeward Roof, Slopes as indicated		
				2.12:12		3.22:12		4.37:12		5.60:12		6.93:12		8.40:12		12:12		20.8:12						GC_{pi} =	GC_{pi} =	2.12:12		3.22:12		4.37:12		5.60:12		6.93:12		8.40:12		12:12				
h	K_h	q_h	$h/_L$	10°		15°		20°		25°		30°		35°		45°		:2 60°			10	15	:2 20°	0.18	-0.18	10°		15°		20°		25°		30°		35°		45°		10	15	:2 20°
15'	0.57	10.1	δ 0.25	-6.0	-1.5	-4.3	0.0	-2.6	1.7	-1.7	2.6	-1.7	2.6	0.0	3.4		3.4	See	6.9	-2.6	-4.3	-5.2	1.8	-1.8	-7.9	0.3	-6.1	1.8	-4.4	3.5	-3.5	4.4	-3.5	4.4	-1.8	5.3		5.3	-4.4	-6.1	-7.0
			0.50	-7.7	-1.5	-6.0	-1.5	-3.4	0.0	-2.6	1.7	-1.7	1.7	-1.7	2.6	0.0	3.4	Note	6.9	-4.3	-4.3	-5.2	1.8	-1.8	-9.6	0.3	-7.9	0.3	-5.3	1.8	-4.4	3.5	-3.5	3.5	-3.5	4.4	-1.8	5.3	-6.1	-6.1	-7.0
			ε 1.0	-11.2	-1.5	-8.6	-1.5	-6.0	-1.5	-4.3	0.0	-2.6	1.7	-1.7	1.7	0.0	2.6	#2	6.9	-6.0	-5.2	-5.2	1.8	-1.8	-13.0	0.3	-10.4	0.3	-7.9	0.3	-6.1	1.8	-4.4	3.5	-3.5	3.5	-1.8	4.4	-7.9	-7.0	-7.0
20'	0.62	11.0	δ 0.25	-6.5	-1.7	-4.7	0.0	-2.8	1.9	-1.9	2.8	-1.9	2.8	0.0	3.7		3.7	See	7.5	-2.8	-4.7	-5.6	2.0	-2.0	-8.5	0.3	-6.7	2.0	-4.8	3.8	-3.8	4.8	-3.8	4.8	-2.0	5.7		5.7	-4.8	-6.7	-7.6
			0.50	-8.4	-1.7	-6.5	-1.7	-3.7	0.0	-2.8	1.9	-1.9	1.9	-1.9	2.8	0.0	3.7	Note	7.5	-4.7	-4.7	-5.6	2.0	-2.0	-10.4	0.3	-8.5	0.3	-5.7	2.0	-4.8	3.8	-3.8	3.8	-3.8	4.8	-2.0	5.7	-6.7	-6.7	-7.6
			ε 1.0	-12.2	-1.7	-9.3	-1.7	-6.5	-1.7	-4.7	0.0	-2.8	1.9	-1.9	1.9	0.0	2.8	#2	7.5	-6.5	-5.6	-5.6	2.0	-2.0	-14.1	0.3	-11.3	0.3	-8.5	0.3	-6.7	2.0	-4.8	3.8	-3.8	3.8	-2.0	4.8	-8.5	-7.6	-7.6
25'	0.67	11.7	δ 0.25	-7.0	-1.8	-5.0	0.0	-3.0	2.0	-2.0	3.0	-2.0	3.0	0.0	4.0		4.0	See	8.0	-3.0	-5.0	-6.0	2.1	-2.1	-9.1	0.3	-7.1	2.1	-5.1	4.1	-4.1	5.1	-4.1	5.1	-2.1	6.1		6.1	-5.1	-7.1	-8.1
			0.50	-9.0	-1.8	-7.0	-1.8	-4.0	0.0	-3.0	2.0	-2.0	2.0	-2.0	3.0	0.0	4.0	Note	8.0	-5.0	-5.0	-6.0	2.1	-2.1	-11.1	0.3	-9.1	0.3	-6.1	2.1	-5.1	4.1	-4.1	4.1	-4.1	5.1	-2.1	6.1	-7.1	-7.1	-8.1
			ε 1.0	-13.0	-1.8	-10.0	-1.8	-7.0	-1.8	-5.0	0.0	-3.0	2.0	-2.0	2.0	0.0	3.0	#2	8.0	-7.0	-6.0	-6.0	2.1	-2.1	-15.1	0.3	-12.1	0.3	-9.1	0.3	-7.1	2.1	-5.1	4.1	-4.1	4.1	-2.1	5.1	-9.1	-8.1	-8.1
30'	0.70	12.3	δ 0.25	-7.3	-1.9	-5.2	0.0	-3.1	2.1	-2.1	3.1	-2.1	3.1	0.0	4.2		4.2	See	8.4	-3.1	-5.2	-6.3	2.2	-2.2	-9.6	0.3	-7.5	2.2	-5.4	4.3	-4.3	5.4	-4.3	5.4	-2.2	6.4		6.4	-5.4	-7.5	-8.5
			0.50	-9.4	-1.9	-7.3	-1.9	-4.2	0.0	-3.1	2.1	-2.1	2.1	-2.1	3.1	0.0	4.2	Note	8.4	-5.2	-5.2	-6.3	2.2	-2.2	-11.7	0.3	-9.6	0.3	-6.4	2.2	-5.4	4.3	-4.3	4.3	-4.3	5.4	-2.2	6.4	-7.5	-7.5	-8.5
			ε 1.0	-13.6	-1.9	-10.5	-1.9	-7.3	-1.9	-5.2	0.0	-3.1	2.1	-2.1	2.1	0.0	3.1	#2	8.4	-7.3	-6.3	-6.3	2.2	-2.2	-15.9	0.3	-12.7	0.3	-9.6	0.3	-7.5	2.2	-5.4	4.3	-4.3	4.3	-2.2	5.4	-9.6	-8.5	-8.5
40'	0.76	13.4	δ 0.25	-8.0	-2.1	-5.7	0.0	-3.4	2.3	-2.3	3.4	-2.3	3.4	0.0	4.6		4.6	See	9.1	-3.4	-5.7	-6.8	2.4	-2.4	-10.4	0.4	-8.1	2.4	-5.8	4.7	-4.7	5.8	-4.7	5.8	-2.4	7.0		7.0	-5.8	-8.1	-9.3
			0.50	-10.3	-2.1	-8.0	-2.1	-4.6	0.0	-3.4	2.3	-2.3	2.3	-2.3	3.4	0.0	4.6	Note	9.1	-5.7	-5.7	-6.8	2.4	-2.4	-12.7	0.4	-10.4	0.4	-7.0	2.4	-5.8	4.7	-4.7	4.7	-4.7	5.8	-2.4	7.0	-8.1	-8.1	-9.3
			ε 1.0	-14.8	-2.1	-11.4	-2.1	-8.0	-2.1	-5.7	0.0	-3.4	2.3	-2.3	2.3	0.0	3.4	#2	9.1	-8.0	-6.8	-6.8	2.4	-2.4	-17.2	0.4	-13.8	0.4	-10.4	0.4	-8.1	2.4	-5.8	4.7	-4.7	4.7	-2.4	5.8	-10.4	-9.3	-9.3
50'	0.81	14.3	δ 0.25	-8.5	-2.2	-6.1	0.0	-3.6	2.4	-2.4	3.6	-2.4	3.6	0.0	4.9		4.9	See	9.7	-3.6	-6.1	-7.3	2.6	-2.6	-11.1	0.4	-8.6	2.6	-6.2	5.0	-5.0	6.2	-5.0	6.2	-2.6	7.4		7.4	-6.2	-8.6	-9.9
			0.50	-10.9	-2.2	-8.5	-2.2	-4.9	0.0	-3.6	2.4	-2.4	2.4	-2.4	3.6	0.0	4.9	Note	9.7	-6.1	-6.1	-7.3	2.6	-2.6	-13.5	0.4	-11.1	0.4	-7.4	2.6	-6.2	5.0	-5.0	5.0	-5.0	6.2	-2.6	7.4	-8.6	-8.6	-9.9
			ε 1.0	-15.8	-2.2	-12.1	-2.2	-8.5	-2.2	-6.1	0.0	-3.6	2.4	-2.4	2.4	0.0	3.6	#2	9.7	-8.5	-7.3	-7.3	2.6	-2.6	-18.4	0.4	-14.7	0.4	-11.1	0.4	-8.6	2.6	-6.2	5.0	-5.0	5.0	-2.6	6.2	-11.1	-9.9	-9.9
60'	0.85	15.1	δ 0.25	-9.0	-2.3	-6.4	0.0	-3.8	2.6	-2.6	3.8	-2.6	3.8	0.0	5.1		5.1	See	10.2	-3.8	-6.4	-7.7	2.7	-2.7	-11.7	0.4	-9.1	2.7	-6.5	5.3	-5.3	6.5	-5.3	6.5	-2.7	7.8		7.8	-6.5	-9.1	-10.4
			0.50	-11.5	-2.3	-9.0	-2.3	-5.1	0.0	-3.8	2.6	-2.6	2.6	-2.6	3.8	0.0	5.1	Note	10.2	-6.4	-6.4	-7.7	2.7	-2.7	-14.2	0.4	-11.7	0.4	-7.8	2.7	-6.5	5.3	-5.3	5.3	-5.3	6.5	-2.7	7.8	-9.1	-9.1	-10.4
			ε 1.0	-16.6	-2.3	-12.8	-2.3	-9.0	-2.3	-6.4	0.0	-3.8	2.6	-2.6	2.6	0.0	3.8	#2	10.2	-9.0	-7.7	-7.7	2.7	-2.7	-19.3	0.4	-15.5	0.4	-11.7	0.4	-9.1	2.7	-6.5	5.3	-5.3	5.3	-2.7	6.5	-11.7	-10.4	-10.4

Exposure C — Enclosed Building

External Effects Only, qGC_p — Internal Effects Only, $q_i(GC_{pi})$ — Individual Roof Design Pressures: External + Worst-Case Internal Pressures

Height	Velocity Pressure Coeff.	Velocity Pressure		Windward Roof, slopes as indicated																Windward Roof Overhang	Leeward Roof, Slopes as indicated			Pos. I.P.	Neg. I.P.	Individual Roof Design Pressures: Windward Roof, slopes as indicated												Individual Roof Design Pressures: Leeward Roof, Slopes as indicated		
				2.12:12		3.22:12		4.37:12		5.60:12		6.93:12		8.40:12		12:12		20.8:12						GC_{pi} =	GC_{pi} =	2.12:12		3.22:12		4.37:12		5.60:12		6.93:12		8.40:12		12:12				
h	K_h	q_h	$h/_L$	10°		15°		20°		25°		30°		35°		45°		:2 60°			10	15	:2 20°	0.18	-0.18	10°		15°		20°		25°		30°		35°		45°		10	15	:2 20°
15'	0.85	14.96	δ 0.25	-8.9	-2.3	-6.4	0.0	-3.8	2.5	-2.5	3.8	-2.5	3.8	0.0	5.1		5.1	See	10.2	-3.8	-6.4	-7.6	2.7	-2.7	-11.6	0.4	-9.1	2.7	-6.5	5.2	-5.2	6.5	-5.2	6.5	-2.7	7.8		7.8	-6.5	-9.1	-10.3
			0.50	-11.4	-2.3	-8.9	-2.3	-5.1	0.0	-3.8	2.5	-2.5	2.5	-2.5	3.8	0.0	5.1	Note	10.2	-6.4	-6.4	-7.6	2.7	-2.7	-14.1	0.4	-11.6	0.4	-7.8	2.7	-6.5	5.2	-5.2	5.2	-5.2	6.5	-2.7	7.8	-9.1	-9.1	-10.3
			ε 1.0	-16.5	-2.3	-12.7	-2.3	-8.9	-2.3	-6.4	0.0	-3.8	2.5	-2.5	2.5	0.0	3.8	#2	10.2	-8.9	-7.6	-7.6	2.7	-2.7	-19.2	0.4	-15.4	0.4	-11.6	0.4	-9.1	2.7	-6.5	5.2	-5.2	5.2	-2.7	6.5	-11.6	-10.3	-10.3
20'	0.90	15.9	δ 0.25	-9.5	-2.4	-6.8	0.0	-4.1	2.7	-2.7	4.1	-2.7	4.1	0.0	5.4		5.4	See	10.8	-4.1	-6.8	-8.1	2.9	-2.9	-12.3	0.4	-9.6	2.9	-6.9	5.6	-5.6	6.9	-5.6	6.9	-2.9	8.3		8.3	-6.9	-9.6	-11.0
			0.50	-12.2	-2.4	-9.5	-2.4	-5.4	0.0	-4.1	2.7	-2.7	2.7	-2.7	4.1	0.0	5.4	Note	10.8	-6.8	-6.8	-8.1	2.9	-2.9	-15.0	0.4	-12.3	0.4	-8.3	2.9	-6.9	5.6	-5.6	5.6	-5.6	6.9	-2.9	8.3	-9.6	-9.6	-11.0
			ε 1.0	-17.6	-2.4	-13.5	-2.4	-9.5	-2.4	-6.8	0.0	-4.1	2.7	-2.7	2.7	0.0	4.1	#2	10.8	-9.5	-8.1	-8.1	2.9	-2.9	-20.4	0.4	-16.4	0.4	-12.3	0.4	-9.6	2.9	-6.9	5.6	-5.6	5.6	-2.9	6.9	-12.3	-11.0	-11.0
25'	0.95	16.7	δ 0.25	-9.9	-2.5	-7.1	0.0	-4.2	2.8	-2.8	4.2	-2.8	4.2	0.0	5.7		5.7	See	11.3	-4.2	-7.1	-8.5	3.0	-3.0	-12.9	0.4	-10.1	3.0	-7.2	5.8	-5.8	7.2	-5.8	7.2	-3.0	8.7		8.7	-7.2	-10.1	-11.5
			0.50	-12.7	-2.5	-9.9	-2.5	-5.7	0.0	-4.2	2.8	-2.8	2.8	-2.8	4.2	0.0	5.7	Note	11.3	-7.1	-7.1	-8.5	3.0	-3.0	-15.7	0.4	-12.9	0.4	-8.7	3.0	-7.2	5.8	-5.8	5.8	-5.8	7.2	-3.0	8.7	-10.1	-10.1	-11.5
			ε 1.0	-18.4	-2.5	-14.2	-2.5	-9.9	-2.5	-7.1	0.0	-4.2	2.8	-2.8	2.8	0.0	4.2	#2	11.3	-9.9	-8.5	-8.5	3.0	-3.0	-21.4	0.4	-17.2	0.4	-12.9	0.4	-10.1	3.0	-7.2	5.8	-5.8	5.8	-3.0	7.2	-12.9	-11.5	-11.5
30'	0.98	17.3	δ 0.25	-10.3	-2.6	-7.4	0.0	-4.4	2.9	-2.9	4.4	-2.9	4.4	0.0	5.9		5.9	See	11.8	-4.4	-7.4	-8.8	3.1	-3.1	-13.4	0.5	-10.5	3.1	-7.5	6.1	-6.1	7.5	-6.1	7.5	-3.1	9.0		9.0	-7.5	-10.5	-11.9
			0.50	-13.2	-2.6	-10.3	-2.6	-5.9	0.0	-4.4	2.9	-2.9	2.9	-2.9	4.4	0.0	5.9	Note	11.8	-7.4	-7.4	-8.8	3.1	-3.1	-16.4	0.5	-13.4	0.5	-9.0	3.1	-7.5	6.1	-6.1	6.1	-6.1	7.5	-3.1	9.0	-10.5	-10.5	-11.9
			ε 1.0	-19.1	-2.6	-14.7	-2.6	-10.3	-2.6	-7.4	0.0	-4.4	2.9	-2.9	2.9	0.0	4.4	#2	11.8	-10.3	-8.8	-8.8	3.1	-3.1	-22.2	0.5	-17.8	0.5	-13.4	0.5	-10.5	3.1	-7.5	6.1	-6.1	6.1	-3.1	7.5	-13.4	-11.9	-11.9
40'	1.04	18.4	δ 0.25	-10.9	-2.8	-7.8	0.0	-4.7	3.1	-3.1	4.7	-3.1	4.7	0.0	6.3		6.3	See	12.5	-4.7	-7.8	-9.4	3.3	-3.3	-14.3	0.5	-11.1	3.3	-8.0	6.4	-6.4	8.0	-6.4	8.0	-3.3	9.6		9.6	-8.0	-11.1	-12.7
			0.50	-14.1	-2.8	-10.9	-2.8	-6.3	0.0	-4.7	3.1	-3.1	3.1	-3.1	4.7	0.0	6.3	Note	12.5	-7.8	-7.8	-9.4	3.3	-3.3	-17.4	0.5	-14.3	0.5	-9.6	3.3	-8.0	6.4	-6.4	6.4	-6.4	8.0	-3.3	9.6	-11.1	-11.1	-12.7
			ε 1.0	-20.3	-2.8	-15.6	-2.8	-10.9	-2.8	-7.8	0.0	-4.7	3.1	-3.1	3.1	0.0	4.7	#2	12.5	-10.9	-9.4	-9.4	3.3	-3.3	-23.6	0.5	-18.9	0.5	-14.3	0.5	-11.1	3.3	-8.0	6.4	-6.4	6.4	-3.3	8.0	-14.3	-12.7	-12.7
50'	1.09	19.3	δ 0.25	-11.5	-2.9	-8.2	0.0	-4.9	3.3	-3.3	4.9	-3.3	4.9	0.0	6.6		6.6	See	13.1	-4.9	-8.2	-9.8	3.5	-3.5	-14.9	0.5	-11.7	3.5	-8.4	6.7	-6.7	8.4	-6.7	8.4	-3.5	10.0		10.0	-8.4	-11.7	-13.3
			0.50	-14.7	-2.9	-11.5	-2.9	-6.6	0.0	-4.9	3.3	-3.3	3.3	-3.3	4.9	0.0	6.6	Note	13.1	-8.2	-8.2	-9.8	3.5	-3.5	-18.2	0.5	-14.9	0.5	-10.0	3.5	-8.4	6.7	-6.7	6.7	-6.7	8.4	-3.5	10.0	-11.7	-11.7	-13.3
			ε 1.0	-21.3	-2.9	-16.4	-2.9	-11.5	-2.9	-8.2	0.0	-4.9	3.3	-3.3	3.3	0.0	4.9	#2	13.1	-11.5	-9.8	-9.8	3.5	-3.5	-24.8	0.5	-19.9	0.5	-14.9	0.5	-11.7	3.5	-8.4	6.7	-6.7	6.7	-3.5	8.4	-14.9	-13.3	-13.3
60'	1.14	20.0	δ 0.25	-11.9	-3.1	-8.5	0.0	-5.1	3.4	-3.4	5.1	-3.4	5.1	0.0	6.8		6.8	See	13.6	-5.1	-8.5	-10.2	3.6	-3.6	-15.5	0.5	-12.1	3.6	-8.7	7.0	-7.0	8.7	-7.0	8.7	-3.6	10.4		10.4	-8.7	-12.1	-13.8
			0.50	-15.3	-3.1	-11.9	-3.1	-6.8	0.0	-5.1	3.4	-3.4	3.4	-3.4	5.1	0.0	6.8	Note	13.6	-8.5	-8.5	-10.2	3.6	-3.6	-18.9	0.5	-15.5	0.5	-10.4	3.6	-8.7	7.0	-7.0	7.0	-7.0	8.7	-3.6	10.4	-12.1	-12.1	-13.8
			ε 1.0	-22.1	-3.1	-17.0	-3.1	-11.9	-3.1	-8.5	0.0	-5.1	3.4	-3.4	3.4	0.0	5.1	#2	13.6	-11.9	-10.2	-10.2	3.6	-3.6	-25.7	0.5	-20.6	0.5	-15.5	0.5	-12.1	3.6	-8.7	7.0	-7.0	7.0	-3.6	8.7	-15.5	-13.8	-13.8

Notes:

1. External effects shown as 0 are provided for interpolation purposes.
2. For windward roof slopes :2 60° but < 80°, use C_p = 0.018. For windward roof slopes > 80°, use C_p = 0.8.
3. For h/L >= 1.0 and a roof slope of 10, the magnitude of the external effects can be reduced as a function of area. See Figure 6-6
4. Positive external pressure is defined as acting towards the exterior wall surface. Negative external pressure is defined as acting away from the exterior wall surface (suction).
5. Positive internal pressure is defined as acting towards the interior wall surface. Negative internal pressure is defined as acting away from the interior wall surface.
6. K_d = 0.85 only when using ASCE 7-05 load combinations or the IBC 2006 basic load combinations. If you are using the IBC 2006 alternative basic load combinations or other load combinations, enter K_d = 1.0 in the project data input table.
7. h is defined as the mean roof height. L is defined as the horizontal building dimension measured parallel to the wind direction.
8. Do not use this table for arched roofs. See Figure 6-8.
9. The minimum wind load used for the MWFRS for an enclosed or partially enclosed building shall not be less than 10 psf mutiplied by the area of the building projected onto a vertical plane.
10. Values for Windward Roof Overhang are applicable to the bottom of the overhang only, and they must be combined with the pressure on the roof surface.

SIP Fasteners

For Structural Insulated Panel and Nail Base Construction

APPLICATION

TRUFAST SIP Fasteners are specifically engineered for attaching structural insulated panels (sips) and nail base panels to wood and metal framing. Featuring a large, pancake head style with a 6-lobe drive, TRUFAST SIP Fasteners drive quickly and smoothly, and draw panels securely without the need of a washer. And only TRUFAST offers three fastener styles for use in wood, corrugated steel, and steel members without pre-drilling! Contact your panel manufacturer or distributor and ask to test drive a TRUFAST SIP Fastener, and see why they're the #1 fastener in the SIP industry.

PRODUCT FEATURES

- Case hardened and tempered for easy installation and long term durability.
- Large diameter, low profile pancake head provides excellent pull-through resistance without the need for a washer while eliminating "telegraphing" on shingles, metal panels and other roof surface materials.
- 6-Lobe internal drive offers excellent bit engagement during installation, especially in high torque applications.
- Widest selection of fastener lengths in the industry for proper sizing to panel thickness.
- Choice of 3 thread/point styles for job-matched performance in either wood or steel substrates.

SIPTP
Thread Point for Wood & Timber Applications

SIPLD
Light Duty - Drill Point for Corrugated Steel Deck & Wood Applications

SIPHD
Heavy Duty - Drill Point for Thick Steel Member Applications

PRODUCT SPECIFICATIONS

Material:	Case hardened and tempered carbon steel
Head Style/Drive:	Pancake Head with T-30 Internal Drive
Head Diameter:	0.625"
Nominal Shank Diameter:	SIPTP and SIPLD: 0.190"
	SIPHD: 0.212"
Thread Length:	SIPTP* and SIPLD: 2.750"
	SIPHD: 3.875"
	** 3" and longer fasteners; 2" and 2-1/2" fasteners are full thread*
Overall Lengths:	SIPTP: 2" thru 18"
	SIPLD: 3" thru 18"
	SIPHD: 6" thru 13-3/4"
Point:	SIPTP: Gimlet Thread
	SIPLD: #2 (0.135" dia.) Drill Point
	SIPHD: #4 (0.225" dia.) Drill Point
Coating:	Epoxy e-coat (black)
	Passes more than 15 cycles (Kesternich) in accordance with DIN 50012

SIP Fasteners

For Structural Insulated Panel and Nail Base Construction

PRODUCT SELECTION

Length in.	(mm)	SIPTP Part #	SIPLD Part #	Pkg. Qty.
2	(51)	SIPTP-2000	NA	500/Pail
2-1/2	(64)	SIPTP-2500	NA	500/Pail
3	(76)	SIPTP-3000	SIPLD-3000	500/Pail
3-1/2	(89)	SIPTP-3500	SIPLD-3500	500/Pail
4	(102)	SIPTP-4000	SIPLD-4000	500/Pail
4-1/2	(114)	SIPTP-4500	SIPLD-4500	500/Pail
5	(127)	SIPTP-5000	SIPLD-5000	500/Pail
5-1/2	(140)	SIPTP-5500	SIPLD-5500	500/Pail
6	(152)	SIPTP-6000	SIPLD-6000	500/Pail
6-1/2	(165)	SIPTP-6500	SIPLD-6500	500/Pail
7	(178)	SIPTP-7000	SIPLD-7000	500/Pail
7-1/2	(191)	SIPTP-7500	SIPLD-7500	500/Pail
8	(203)	SIPTP-8000	SIPLD-8000	500/Pail
8-1/2	(216)	NA	SIPLD-8500	250/Pail
9	(229)	SIPTP-9000	SIPLD-9000	250/Pail
10	(254)	SIPTP-10000	SIPLD-10000	250/Pail
11	(279)	SIPTP-11000	SIPLD-11000	250/Pail
12	(305)	SIPTP-12000	SIPLD-12000	250/Pail
13	(330)	SIPTP-13000	SIPLD-13000	250/Box
14	(356)	SIPTP-14000	SIPLD-14000	250/Box
15	(381)	SIPTP-15000	SIPLD-15000	250/Box
16	(406)	SIPTP-16000	SIPLD-16000	250/Box
18	(483)	SIPTP-18000	SIPLD-18000	250/Box

NOTE: Two T-30 Driver Bits included in each package

Length in.	(mm)	SIPHD Part #	Pkg. Qty.
6	(152)	SIPHD-6000	500/Pail
8	(203)	SIPHD-8000	250/Pail
9-3/4	(248)	SIPHD-9750	250/Pail
11-3/4	(298)	SIPHD-11750	250/Pail
13-3/4	(349)	SIPHD-13750	250/Box

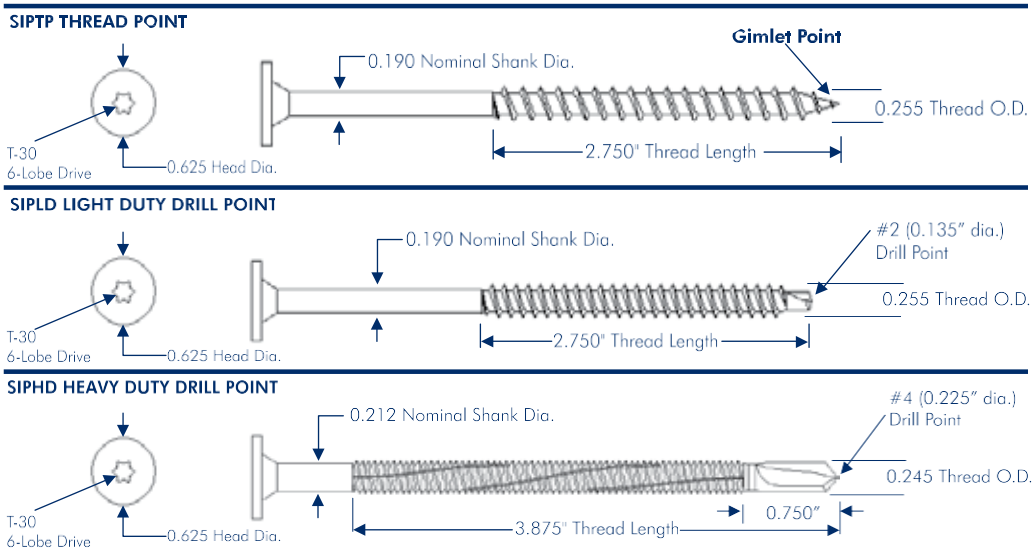
NOTE: Two T-30 Driver Bits included in each package

T-30 Driver Bit

FM APPROVED

NOTE: All tests were conducted by an independent testing laboratory. Test results are offered only as a guide and are not guaranteed in any way by TRUFAST, LLC.
"Head Pull-Thru", "Withdrawal", and "Lateral Load" data reflect average ultimate values.

FASTENER DIMENSIONS



PERFORMANCE DATA

Fastener	Tensile Strength	Shear Strength	Head Pull-Thru Values 7/16" OSB	SIP Panel
SIPTP	3380 lbf.	2900 lbf.	545 lbf.	630 lbf.
SIPLD	3380 lbf.	2900 lbf.	545 lbf.	630 lbf.
SIPHD	6000 lbf.	3400 lbf.	545 lbf.	630 lbf.

Withdrawal Values in Wood*

Specific Gravity	0.67	0.55	0.50	0.46	0.43	0.36	0.31
SIPTP & SIPLD:	1429	1173	1067	981	917	768	661

*Values are in lb/in. of thread penetration

Withdrawal Values in Steel

Type B Corrugated	22 ga	20 ga	18 ga		
SIPLD:	510 lbf	645 lbf	920 lbf		
Structural Steel	16 ga	13 ga	12 ga	3/16"	1/4"
SIPHD:	770 lbf	1130 lbf	1690 lbf	3100 lbf	4500 lbf

Lateral Load Resistance

Fastener	Main Member	Side Member	Load (lbf.)
SIPTP	SPF 2x4	SIP Panel	943
SIPLD	22 ga. Corrugated Steel	Nail Base	411
SIPLD	7/16" OSB	Nail Base	112
SIPHD	1/8" Structural Steel	SIP Panel	929

TRUFAST, LLC
02105 Williams County Road 12-C
Bryan, OH 43506
Phone: 419-636-6715 or 800-443-9602
Fax: 419-636-1784
Email: sales@trufast.com
www.trufast.com

ALTENLOH, BRINCK & CO Group

SINCE 1823

Listing Report: **SIPA120908-10**

PRODUCT: Structural Insulated Panels (SIPs)
DIVISION: Wood and Plastics (06)
SECTION: Structural Panels (06 12 16)

Report Holder
Structural Insulated Panel Association (SIPA)
PO Box 1699
Gig Harbor, WA 98335

Manufacturing Locations

Energy Panel Structures, Inc. (NTA Plant #549)
102 East Industrial Park
Graettinger, IA 51342

FischerSIPS, LLC (NTA Plant #545)
1800 Northwestern Parkway
Louisville, KY 40203

Foard Panel, Inc. (NTA Plant #634)
53 Stow Road
West Chesterfield, NH 03466

IB Panels (NTA Plant #621)
50 West 100 South
Jerome, ID 83338

The Murus Company (NTA Plant #660)
3234 Route 549
Mansfield, PA 16933

PorterCorp (NTA Plant #538)
4240 North 136th Avenue
Holland, MI 49424

Timberline Panel Company, LLC (NTA Plant #624)
141 Morse Road
Bennington, VT 05201

Vantem Panels (NTA Plant #654)
710 FM 306
New Braunfels, TX 78130

1. SUBJECT

SIPA Structural Insulated Panels. Wall and Roof Panels 8 ft. to 20 ft. long, 4-5/8 in. to 12-1/4 in. thick.

2. SCOPE

2.1. NTA, Inc. has evaluated the above product(s) for compliance with the applicable sections of the following codes:
2.1.1. 2006, 2009 International Building Code (IBC)
2.1.2. 2006, 2009 International Residential Code (IRC)

2.2. NTA, Inc. has evaluated the above product(s) in accordance with:
2.2.1. NTA IM 014 Structural Insulated Panel Evaluation
2.2.2. NTA IM 036 Quality System Requirements

2.3. NTA, Inc. has evaluated the following properties of the above product(s):
2.3.1. Structural performance under axial, transverse and racking loads.

To obtain the most current NTA Listing Report visit www.ntainc.com/product-certification/.

3. USES

3.1. General. *SIPA Structural Insulated Panels* are used as structural insulated roof and wall panels capable of resisting transverse, axial and in-plane shear loads.

3.2. Construction Types. *SIPA Structural Insulated Panels* shall be considered combustible building elements when determining the Type of Construction in accordance with 2009 IBC Chapter 6. (IM 014 NACU1)

3.3. Fire Resistive Assemblies. *SIPA Structural Insulated Panels* shall not be used as part of a fire-rated assembly unless suitable evidence and details are submitted and approved by the authority having jurisdiction. (IM 014 ACU14)

4. DESCRIPTION

4.1. General. *Structural Insulated Panels* are factory-assembled, engineered-wood-faced, structural insulated panels (SIPs) with an expanded polystyrene (EPS) foam core. The panels are intended for use as load-bearing or non-load bearing wall and roof panels. Panels are available in 4-5/8 in. through 12-1/4 in. overall thicknesses. The panels are custom made to the specifications for each use and are assembled under factory-controlled conditions. The maximum panel size is 8 ft. wide and up to 20 ft. in length.

4.2. Materials

4.2.1. Facing. The facing consists of two single-ply oriented strand board (OSB) facings a minimum of 7/16 in. thick conforming to 2009 IRC Table 613.3.2 and DOC PS 2-04, Exposure 1, Rated Sheathing with a span index of 24/16. Panels may be manufactured with the facing strength axis oriented in either direction with respect to the direction of SIP bending provided the appropriate strength values are used.

4.2.2. Core. The core material is EPS Foam conforming to the Type I specification defined in ASTM C578. The foam core, up to 11-3/8 in. thickness, has a flame spread rating not exceeding 75 and a smoke-developed rating not exceeding 450 in compliance with 2009 IBC Section 2603.3 Exception 4.

4.2.3. Adhesive. Facing materials are adhered to the core material using a structural adhesive. The adhesive is applied during the lamination process in accordance with the in-plant quality system documentation.

4.2.4. Material Sources. The facing, core and adhesive used in the construction of *Structural Insulated Panels* shall be composed only of materials from approved sources as identified in the in-plant quality system documentation. A list of material suppliers is provided in Table 9.

4.2.5. Splines. *Structural Insulated Panels* are interconnected with surface splines or block splines (Figure 1). Connections using dimensional lumber splines or engineered structural splines are not specifically addressed in this report and must be designed in accordance with accepted engineering practice to meet applicable code requirements. (IM 014 ACU 20)

4.2.5.1. Surface Splines. Surface splines (Figure 1) consist of 3 in. wide by 7/16 in. thick or thicker OSB. At each panel joint, one surface spline is inserted into each of two tight-fitting slots in the core. The slots in the core are located just inside the facing.

4.2.5.2. Block Splines. Block splines (Figure 1) are manufactured in the same manner as the SIP except with an overall thickness that is 1 in. less than the overall thickness of the panel to be joined.

5. DESIGN

5.1. Overall Structural System. The scope of this report is limited to the evaluation of the SIP component. Panel connections and other details related to incorporation of the panel into the overall structural system of a building are beyond the scope of this report. (IM 014 NACU3)

5.2. Design Approval. Where required by the authority having jurisdiction, structures using *Structural Insulated Panels* shall be designed by a registered design professional. Construction documents, including engineering calculations and drawings providing floor plans, window details, door details and connector details, shall be submitted to the code official when application is made for a permit. The individual preparing such documents shall possess the necessary qualifications as required by the applicable code and the professional registration laws of the state where the construction is undertaken. Approved construction documents shall be available at all times on the jobsite during installation.(IM 014 NACU4)

5.3. Design Loads. Design loads to be resisted by the SIPs shall be as required under the applicable building code. Loads on the panels shall not exceed the loads noted in this report.

5.4. Allowable Loads. Allowable axial, transverse, and racking loads may be calculated using the panel properties provided in Tables 1 and 2 or may be selected from Tables 3 through 7. Maximum and minimum panel heights, spans and thicknesses are limited as provided in Table 2 through 7. Unless otherwise noted, all properties and allowable loads apply to panels joined with surface or block splines. Allowable loads for reinforced panel capacities shall be designed by a registered professional. Calculations demonstrating that the loads applied are less than the allowable loads described in this report shall be submitted to the code official for approval.(IM 014 NACU5) For loading conditions not specifically addressed herein, structural members designed in accordance with accepted engineering practice shall be provided to meet applicable code requirements.

5.5. Concentrated Loads. Axial loads shall be applied to the SIP through continuous members such as structural insulated roof or floor panels or repetitive members such as joists, trusses or rafters spaced at regular intervals of 24 in. on center or less. Such members shall be fastened to a rim board or similar member to distribute the load to the SIP. For other loading conditions, reinforcement shall be provided. This reinforcement shall be designed in accordance with accepted engineering practice. (IM 014 ACU12)

5.6. Eccentric and Side Loads. Axial loads shall be applied concentrically to the top of the SIP. Loads shall not be applied eccentrically or through framing attached to one side of the panel (such as balloon framing) except where additional engineering documentation is provided. (IM 014 ACU13)

5.7. Openings. Openings in panels shall be reinforced with wood or steel designed in accordance with accepted engineering practice to resist all loads applied to the opening as required by the adopted code. Details for door and window openings shall be provided to clarify the manner of supporting axial, transverse and/or racking shear loads at openings. Such details shall be shown on approved design documents and subject to approval by the local authority having jurisdiction. (IM 014 ACU8)

5.8. In-Plane Shear Design. Shear walls utilizing block or surface splines shall be sized to resist all code required wind and seismic loads without exceeding the allowable loads provided in Tables 6 and 7. Shear wall chords, hold-downs and connections to transfer shear forces between the wall and surrounding structure shall be designed in accordance with accepted engineering practice. Allowable strengths for shear walls with structural splines along each panel edge shall be designed in accordance with accepted engineering practice and subject to the limitations for wood sheathed shear walls.

5.8.1. Seismic Design Categories A, B and C. The use of the shear wall configurations in Table 6 is limited to structures in Seismic Design Categories A, B and C. Where SIPs are used to resist seismic forces the following factors shall be used for design: Response Modification Coefficient, R = 2.0; System Overstrength Factor, Ω_0 = 2.5; Deflection Amplification Factor, C_d = 2.0. (IM 014 ACU16) The maximum panel height-to-width ratio shall be 2:1. (IM 014 ACU17)

5.8.2. Seismic Design Categories D, E, and F. The shear wall configurations in Table 7 are permitted in Seismic Design Categories D, E and F. Such walls shall be designed using the seismic design coefficients and limitations provided in ASCE 7-05 for light-framed walls sheathed with wood structural panels rated for shear resistance (SFRS A13). These SIPs shall use the following factors for design: Response Modification Coefficient, R = 6.5; System Overstrength Factor, Ω_0 = 3.0; Deflection Amplification Factor, C_d = 4.0.(IM 014 ACU16) The maximum panel height-to-width ratio shall be 1:1. (IM 014 ACU17)

5.8.3. Adhesives and Sealants. Adhesives and sealants shall not be applied at wood-to-wood or spline-to-facing interfaces in shear walls in Seismic Design Categories D, E and F(IM 014 NACU10). Adhesives and sealants may be applied to wood-to-foam or facing-to-foam interfaces. Flexible SIP tape may be applied over panel joints.

5.9. Horizontal Diaphragms. Horizontal diaphragms shall be sized to resist all code required wind and seismic loads without exceeding the allowable loads provided in Table 8. Diaphragm chords and connections to transfer shear forces between the diaphragm and surrounding structure shall be designed in accordance with accepted engineering practice. The maximum diaphragm length-to-width ratio shall not exceed 3:1. (IM 014 ACU18)

5.10. Combined Loads. Panels subjected to any combination of transverse, axial or in-plane shear loads shall be analyzed utilizing a straight line interaction in accordance with *NTA IM014 TIP 01 SIP Design Guide*.

6. INSTALLATION

6.1. General. *Structural Insulated Panels* shall be fabricated, identified and erected in accordance with this report, the approved construction documents and the applicable code. In the event of a conflict between the manufacturer's published installation instructions and this report, this report shall govern. Approved construction documents shall be available at all times on the jobsite during installation. (IM 014 NACU7)

6.2. Splines. *Structural Insulated Panels* are interconnected at the panel edges through the use of a spline. The spline type may be of any configuration listed in Section 4.2.5 as required by the specific design. The spline shall be secured in place with not less than 0.131 in. x 2-1/2 in. nails, spaced 6 in. on center on both sides of the panel, or an approved equivalent fastener. All joints shall be sealed in accordance with the SIP manufacturer's installation instructions. Alternate spline connections may be required for panels subjected to in-plane racking forces. Such panels shall be interconnected exactly as required in Table 6 or 7 or as directed by the designer.

6.3. Plates. The top and bottom plates of the panels shall be dimensional or engineered lumber sized to match the core thickness of the panel. The plates shall be secured using not less than 0.131 in. x 2-1/2 in. nails, spaced 6 in. on center on both sides of the panel, or an approved equivalent fastener.

A second plate composed of 1-1/8 in. minimum thickness dimensional or engineered lumber with a specific gravity of 0.42 that is cut to the full thickness of the panel shall be secured to the first top plate using 0.131 in. x 3 in. nails or an approved equivalent fastener.

6.4. Cutting and Notching. No field cutting or routing of the panels shall be permitted except as shown on approved drawings. (IM 014 NACU6)

6.5. Protection from Decay. SIPs that rest on exterior foundation walls shall not be located within 8 in. of exposed earth. SIPs supported by concrete or masonry that is in direct contact with earth shall be protected from the concrete or masonry by a moisture barrier. (IM 014 ACU6)

6.6. Protection from Termites. In areas subject to damage from termites, SIPs shall be protected from termites using an approved method. Panels shall not be installed below grade or in contact with earth. (IM 014 ACU7)

6.7. Heat-Producing Fixtures. Heat-producing fixtures shall not be installed in the panels unless protected by a method approved by the code official or documented in test reports. This limitation shall not be interpreted to prohibit heat-producing elements with suitable protection. (IM 014 NACU9)

6.8. Voids and Holes

6.8.1 Voids in Core. In lieu of openings designed in accordance with section 5.7, the following voids are permitted. Voids may be provided in the panel core during fabrication at predetermined locations only. Voids parallel to the panel span shall be limited to a single 1 in. maximum diameter hole. Such voids shall be spaced a minimum of 4 ft. on center measured perpendicular to the panel span. Two 1/2 in. diameter holes may be substituted for the single 1 in. hole provided they are maintained parallel and within 2 in. of each other. (IM 014 ACU11)

Voids perpendicular to the panel span shall be limited to a single 1 in. maximum diameter hole placed not closer than 16 in. from the support. Additional voids in the same direction shall be spaced not less than 28 in. on center.

6.8.2 Holes in Panels. Holes may be placed in panels during fabrication at predetermined locations only. Holes shall be limited to 4 in. x 4 in. square. The minimum distance between holes shall not be less than 4 ft. on center measured perpendicular to the panel span and 24 in. on center measured parallel to the panel span. Not more than three holes shall be permitted in a single line parallel to the panel span. The holes may intersect voids permitted elsewhere in this report. (IM 014 ACU15)

6.9. Panel Cladding

6.9.1 Roof Covering. The roof covering, underlayment and flashing shall comply with the applicable code(s). All roofing materials must be installed in accordance with the manufacturer's installation instructions. The use of roof coverings requiring the application of heat during installation shall be reviewed and approved by a registered design professional.

6.9.2 Exterior Wall Covering. Panels shall be covered on the exterior by a water-resistive barrier as required by the applicable code. The water-resistive barrier shall be attached with flashing in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer. (IM 014 ACU9) The exterior facing of the SIP wall shall be covered with weather protection as required by the adopted building code or other approved materials. (IM 014 ACU10)

6.9.3 Interior Finish. The SIP foam plastic core shall be separated from the interior of the building by an approved thermal barrier of 1/2 in. gypsum wallboard or equivalent thermal barrier where required by 2009 IBC Section 2603.4.

7. CONDITIONS OF USE

Structural Insulated Panels as described in this report comply with the codes listed in Section 2.0, subject to the following conditions:

7.1. Installation complies with this report and the approved construction documents.

7.2. This report applies only to the panel thicknesses specifically listed herein. (IM 014 ACU3)

7.3. In-use panel heights/spans shall not exceed the values listed herein. Extrapolation beyond the values listed herein is not permitted. (IM 014 ACU2)

7.4. The panels are manufactured in the production facilities noted in this report. (IM 014 NACU8)

8. EVIDENCE SUBMITTED

NTA, Inc. has examined the following evidence to evaluate this product:

8.1. Review of each manufacturing facility's quality system documentation for conformance to NTA IM 036.

8.2. Qualification test data in accordance with NTA IM 14 *Standard Evaluation Plan 01* (IM 014 SEP 01).

8.3. Periodic quality system audits of the production facilities.

8.4. Periodic testing in accordance with NTA IM 014.

Evaluation evidence and data are on file with NTA, Inc. NTA, Inc. is accredited by the International Accreditation Service (IAS) as follows:
ISO17020 Inspection Agency (AA-682)
ISO17025 Testing Laboratory (TL-259)
ISO Guide 65 Product Certification Agency (PCA-102)

The scope of accreditation related to testing, inspection or product certification pertain only to the test methods and/or standard referenced therein. Design parameters and the application of building code requirements, such as special inspection, have not been reviewed by IAS and are not covered in the accreditation. Product evaluations are performed under the direct supervision of Professional Engineers licensed in all jurisdictions within the United States as required by the building code and state engineering board rules.

9. FINDINGS

All products referenced herein are manufactured under an in-plant quality assurance program to insure that the production quality meets or exceeds the requirements of the codes noted herein and the criteria as established by NTA, Inc. Furthermore, panels must comply with the conditions of this report.

This report is subject to annual renewal.

10. IDENTIFICATION

Each eligible panel shall be permanently marked to provide the following information:

a) The NTA, Inc. listing mark, shown below
b) NTA's Listing No. SIPA120908-10
c) In-plant quality assurance stamp
d) Identifier for production facility
e) Project or batch number.

LISTED
SIPA120908-10

This listing report is intended to indicate that NTA Inc. has evaluated product described and has found it to be eligible for labeling. Product not labeled as specified herein is not covered by this report. NTA Inc. makes no warranty, either expressed or implied, regarding the product covered by this report.

Table 1: Basic Properties[1, 2]

Property	Weak-Axis Bending	Strong-Axis Bending
Allowable Tensile Stress, F_t (psi)	245	495
Allowable Compressive Stress, F_c (psi)	340	580
Elastic Modulus (Bending), E_b (psi)	738900	658800
Shear Modulus, G (psi)	270	405
Allowable Core Shear Stress, F_v (psi)	4.5	5.0
Core Compressive Modulus, E_c (psi)	360	360
Reference Depth, h_o (in.)	4.625	4.625
Shear Depth Factor Exponent, m	0.84	0.86

[1] All properties are based on a minimum panel width of 24 in.
[2] Refer to *NTA IM14 TIP 01 SIP Design Guide* for details on engineered design using basic panel properties.

Table 2: Section Properties

Panel Thickness, h (in.)	Core Thickness, c (in.)	Dead Weight, w_d (psf)	Facing Area, A_f (in.^{2}/ft)	Shear Area, A_v (in.^{2}/ft)	Moment of Inertia, I (in.^{4}/ft)	Section Modulus, S (in.^{3}/ft)	Radius of Gyration, r (in.)	Centroid-to-Facing Dist., y_c (in.)
4.625	3.75	3.2	10.5	50.3	46.0	19.9	2.09	2.31
6.50	5.625	3.3	10.5	72.8	96.5	29.7	3.03	3.25
8.25	7.375	3.5	10.5	93.8	160.2	38.8	3.91	4.13
10.25	9.375	3.6	10.5	117.8	252.7	49.3	--	--
12.25	11.375	3.8	10.5	141.8	366.3	59.8	--	--

Figure 1: SIP Spline Types

Table 3: Allowable Uniform Transverse Loads[1, 4]

Panel Length (ft)	4-5/8 inch Thick SIP			6-1/2 inch Thick SIP		
	Deflection Limit[2]			Deflection Limit[2]		
	L/180	L/240	L/360	L/180	L/240	L/360
8 WAB[3]	50.8	40.9	27.3	73.8	64.7	43.1
8	68.8	51.6	34.4	80.6	80.6	56.6
10	45.1	33.8	22.5	62.0	57.9	38.6
12	30.8	23.1	15.4	50.4	40.9	27.3
14	21.7	16.3	--	39.6	29.7	19.8
16	--	--	--	29.4	22.1	14.7
18	--	--	--	22.4	16.8	--

See Table 4 for notes.

Table 4: Allowable Uniform Transverse Loads (continued)[1, 4]

Panel Length (ft)	8-1/4 inch Thick SIP			10-1/4 inch Thick SIP			12-1/4 inch Thick SIP		
	Deflection Limit[2]			Deflection Limit[2]			Deflection Limit[2]		
	L/180	L/240	L/360	L/180	L/240	L/360	L/180	L/240	L/360
8 WAB[3]	81.4	81.4	58.3	89.9	89.9	75.9	98.6	98.6	93.6
8	88.5	88.5	78.4	97.3	97.3	97.3	106.4	106.4	106.4
10	67.4	67.4	54.8	73.1	73.1	73.1	78.8	78.8	78.8
12	54.4	54.4	39.6	58.6	58.6	54.6	62.5	62.5	62.5
14	45.6	43.9	29.3	48.8	48.8	41.1	51.9	51.9	51.9
16	39.3	33.2	22.1	41.9	41.9	31.5	44.3	44.3	41.7
18	34.1	25.6	17.1	36.7	36.7	24.6	38.7	38.7	32.9
20	26.7	20.0	13.4	32.6	29.2	19.5	34.3	34.3	26.3

[1] Table values assume a simply supported panel with 1.5 in. of continuous bearing on facing at supports (C_v = 1.0) with solid wood plates at bearing locations. Values do not include the dead weight of the panel. For wall panel capacities utilizing a zero bearing configuration, shown in Figure 2, multiply the allowable uniform load shown by C_v = 0.4.

[2] Deflection limit shall be selected by building designer based on the serviceability requirements of the structure and the requirements of adopted building code. Values are based on loads of short duration only and do not consider the effects of creep.

[3] Tabulated values are based on the strong-axis of the facing material oriented parallel to the direction of panel bending. WAB indicates weak-axis bending of the facing material; the strong-axis of the facing material is oriented perpendicular to the direction of panel bending.

[4] Permanent loads, such as dead load, shall not exceed 0.50 times the tabulated load.

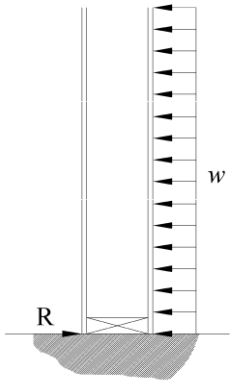


Figure 2: Zero Bearing Support

Table 5: Allowable Axial Loads (plf)[1,2,3,4]

Lateral Brace Spacing (ft)	Panel Thickness		
	4-5/8 inch	6-1/2 inch	8-1/4 inch
8 WAB[5]	2320	2470	2530
8	3630	4070	4240
10	3260	3890	4130
12	2810	3660	4000
14	--	3390	3830
16	--	3090	3640
18	--	2790	3430
20	--	--	3190

1. Permanent loads, such as dead load, shall not exceed 0.50 times the tabulated load.
2. All values are for normal duration and may not be increased for other durations.
3. Axial loads shall be applied concentrically to the top of the panel through repetitive members spaced not more than 24 in. on center. Such members shall be fastened to a rim board or similar member to distribute along the top of the SIP.
4. The ends of both facings must bear on the supporting foundation or structure to achieve the tabulated axial loads.
5. Tabulated values are based on the strong-axis of the facing material oriented parallel to the direction of panel bending. WAB indicates weak-axis bending of the facing material; the strong-axis of the facing material is oriented perpendicular to the direction of panel bending.

Table 6: Allowable In-Plane Shear Strength (Pounds per Foot) for SIP Shear Walls (Wind and Seismic Loads in Seismic Design Categories A, B and C)[1,3]

Spline Type[4]	Nominal SIP Thickness (in.)	Minimum Facing Connections[3,5]			Shear Strength (plf)
		Chord[3]	Plate[3]	Spline[4]	
Block or Surface Spline	4.625	0.131"x 2-1/2" nails, 6" oc	0.131"x 2-1/2" nails, 6" oc	0.131"x 2-1/2" nails, 6" oc	380
	6.625	0.131"x 2-1/2" nails, 6" oc	0.131"x 2-1/2" nails, 6" oc	0.131"x 2-1/2" nails, 6" oc	380
	8.375	0.131"x 2-1/2" nails, 6" oc	0.131"x 2-1/2" nails, 6" oc	0.131"x 2-1/2" nails, 6" oc	400

See Table 7 for notes.

Table 7: Allowable In-Plane Shear Strength (Pounds per Foot) for SIP Shear Walls (Wind and Seismic Loads in Seismic Design Categories D, E and F)[2,3]

Spline Type[4]	Nominal SIP Thickness (in.)	Minimum Facing Connections[3,5]			Shear Strength (plf)
		Chord[3]	Plate[3]	Spline[4]	
Block or Surface Spline	6.5	0.131"x 2-1/2" nails, 3" oc (3/8" edge distance)	0.131"x 2-1/2" nails, 3" oc (3/8" edge distance)	0.131"x 2-1/2" nails, 3" oc (23/32" thick, 3" wide spline)	900

[1] Maximum shear wall dimensions ratio shall not exceed 2:1 (height: width) for resisting wind or seismic loads.
[2] Maximum shear wall dimension ratio shall not exceed 1:1 (height: width) for resisting wind or seismic loads.
[3] Chords, hold downs and connections to other structural elements must be designed by a registered design professional in accordance with accepted engineering practice.
[4] Spline type at interior panel-to-panel joints only. Solid chord members are required at each end of each shear wall segment.
[5] Required connections must be made on each side of the panel. Dimensional or engineered lumber shall have an equivalent specific gravity of 0.42 or greater.

Table 8: Allowable In-Plane Shear Strength (Pounds per Foot) for Horizontal Diaphragms Subjected to Wind or Seismic Loading

Nominal SIP Thickness (in.)	Minimum Connections			Shear Strength (plf)	Max. Aspect Ratio
	Block Spline[1] (Figure 3a)	Boundary[2] (Figure 3b)			
		Support	Spline		
8.25	0.131" x 2-1/2" nails, 6" oc 7/16" x 3" x 7-3/8" OSB Surface Spline	10" Length, 0.190" shank diameter, 0.255" thread o.d., 2.750" thread length 0.625" head diameter SIP Screw 6" oc	0.131" x 2-1/2" nails, 6" oc	265	3:1
	0.131" x 2-1/2" nails, 4" oc 7/16" x 3" x 7-3/8" OSB Surface Spline	10" Length, 0.190" shank diameter, 0.255" thread o.d., 2.750" thread length 0.625" head diameter SIP Screw 4" oc	0.131" x 2-1/2" nails, 4" oc	330	3:1
	0.131" x 2-1/2" nails, 2" oc staggered 3/8" (Figure 3c) 7/16" x 3" x 7-3/8" OSB Surface Spline	10" Length, 0.190" shank diameter, 0.255" thread o.d., 2.750" thread length 0.625" head diameter SIP Screw 3" oc	0.131" x 2-1/2" nails, 2" oc staggered 3/8" (Figure 3c)	575	3:1

[1]Top spline or block spline only at interior panel-to-panel joints. Specified fasteners are required on both sides of panel joint through the top surface only, as shown in Figure 3a.

[2] Boundary spline shall be solid lumber 1.5 in. wide minimum and have a specific gravity of 0.42 or greater. Specified fasteners are required through both facings as shown in Figure 3b.

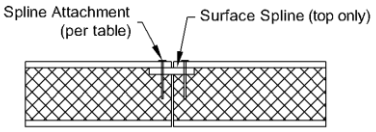


Figure 3a: Surface Spline

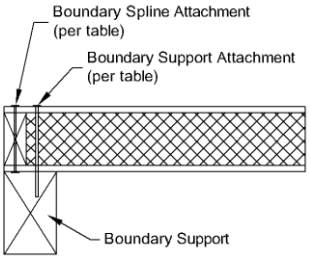


Figure 3b: Boundary

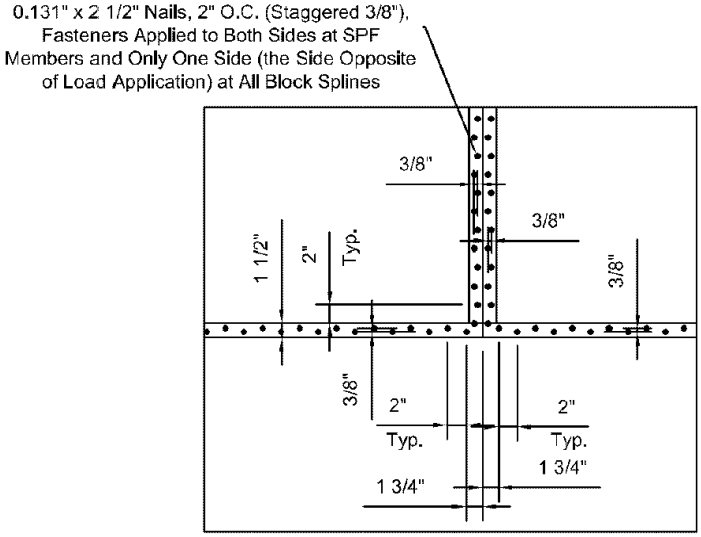


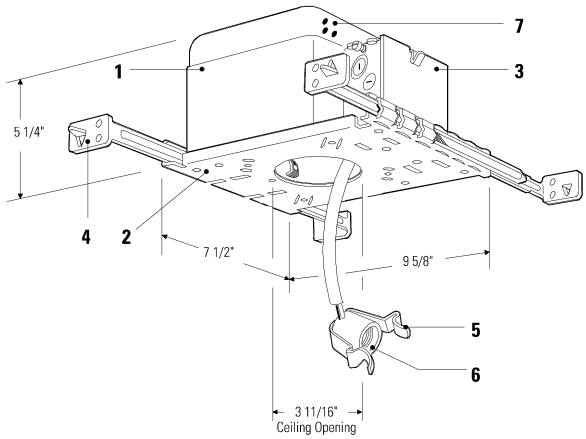
Figure 3c: Boundary Spline

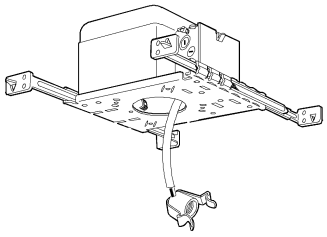
Figure 3: Diaphragm Connection Types

This listing report is intended to indicate that NTA Inc. has evaluated product described and has found it to be eligible for labeling. Product not labeled as specified herein is not covered by this report. NTA Inc. makes no warranty, either expressed or implied, regarding the product covered by this report.

Table 9: Component Material Sources

Facing	Core	Adhesive
Ainsworth Group of Companies Suite 3194 Bentall 4 1055 Dunsmuir Street Vancouver BC, Canada V7X 1L3	ACH Corporation Plant U-37 - Fond du Lac, WI	Ashland Specialty Chemical Company 5200 Blazer Parkway Dublin, OH 43017
Georgia-Pacific 9918 Buford Bridge Road Fairfax, SC 29827	Atlas EPS, A Division of Atlas Roofing Corporation 8240 Byron Center Road SW Byron Center, MI 49315	Foam Supplies, Inc. 4387 N. Rider Trail Earth City, MO 63045
Huber Engineered Woods 1000 Chaney Lane Crystal Hill, VA 24539	Iowa EPS Products, Inc. 5554 N.E. 16th Street Des Moines, IA 50313	Rohm and Haas Company 5005 Barnard Mill Road Ringwood, IL 60072
Louisiana-Pacific Corporation Sagola, MI Sales and Marketing by: Affiliated Resources, Inc. River Forum 1 4380 SW Macadam Avenue, Suite 200 Portland, OR 97239	Northwest Foam Products, Inc. 2390 Rostron Circle Twin Falls, ID 83301	
Tolko Industries, Ltd. 3203 30th Avenue Vernon BC, Canada V1T 6M1	OPCO, Inc. P.O. Box 101 Latrobe, PA 15650	
	Plymouth Foam 1 Southern Gateway Drive Gnadenhutten, OH 44629	
	Polar Industries, Inc. 32 Gramar Avenue Prospect, CT 06712	
	Powerfoam Insulation 550 Murray Street/Highway 287 Midlothian, TX 76065	





FRAME-IN KIT

REFLECTOR TRIM

Complete Fixture consists of Reflector Trim & Frame-In Kit. Select each separately.

Frame-In Kit	Reflector Trims — See Individual Reflector Trim Specification Sheets						
	Open Downlight				Recessed		Enclosed
	Aperture Cone	Satin Cone	Baffles	Pinhole	Adjustable	Eyeball	Diffuser
2000P1	**2012** **2012NM** **2013** **2013BKNM** **2013CD** **2013CDNM** **2013NM** **2013BK** **2013WH** **2013WD** **2013WDP**	**2008** **2008NM** **2010** **2010NM**	**2005** **2005BNM** **2005NM** **2005WH**	**2011**	**2027** **2022WH** **2027NM** **2027WH** **2029BK** **2029BKNM** **2029CD** **2029CDNM** **2029CL** **2029CLNM** **2029GD** **2029GDNM** **2029WH** **2027BNM**	**2022** **2022WH**	**2090**

Features

1. **Housing:** .032" aluminum. Access door for inspection of junction box.
2. **Mounting Frame:** .036" (#20 ga.) galvanized steel. Accommodates all ceilings up to 1" thick. Push-in/twist-out rotoclips hold reflector flush to ceiling.
3. **Junction Box:** 4" x 3 1/2" x 2"; .063 (#14 ga.) galvanized steel. U.L. listed for maximum of 8 No. 12 ga. 75º C through branch circuit conductors. Access door inside of housing allows easy inspection of wiring without removal of housing. Integral cable clamps permit attachment of nonmetallic Romex® or armored cable without need of additional connectors.
4. **Mounting Bars:** .059 (#16 ga.) galvanized steel. 13" long bars extend to 27" with integral nailing tabs. Attaches to wood joist without need of accessories.
5. **Socket Spring:** .030" steel.
6. **Socket:** Porcelain medium base; nickel plated screw shell. Pre-wired with #18 ga. SF1 leads to junction box.
7. **Thermal Protector:** Meets NEC and UL requirements. Insulation must be kept 3" away from fixture sides and wiring compartments and must not be placed above fixture in a manner which will entrap heat.

Options & Accessories

Mounting Bars: **1964** - 20" set of (4)
T-Bar Ceiling Clips: **1956** - set of (4)
Plaster Ceiling Ring: **1959** - 7/8" depth for wet plaster ceilings
277V Remote Step Down Transformer: **7997** - 277V down to 120V 300W max. load.

Labels

UL (Suitable for Damp Locations), I.B.E.W.

Job Information **Type:**

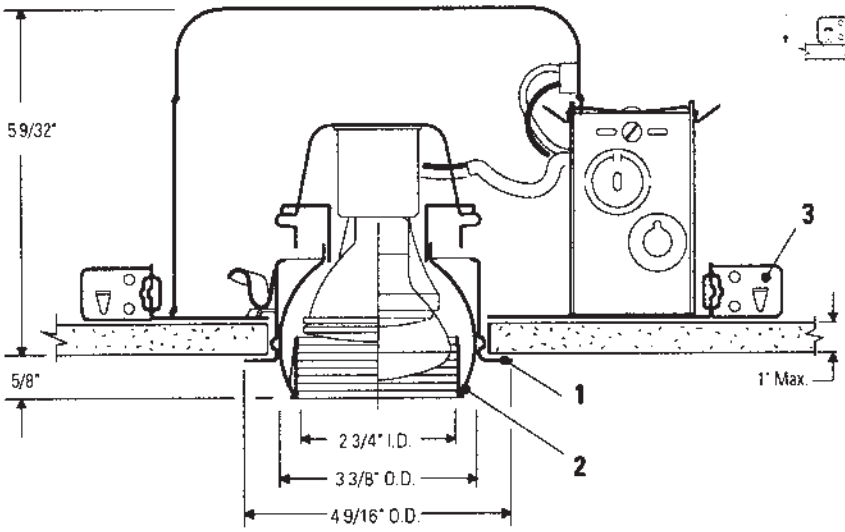
Job Name:

Cat. No.:

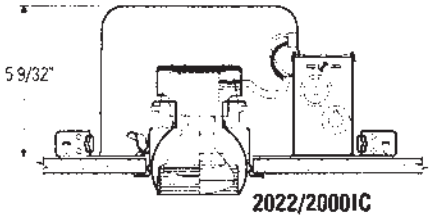
Lamp(s):

Notes:

631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710



2022/2000P1
Standard Incandescent



2022/2000IC
Insulated Ceiling
2022/2000AIC
Insulated CeilingAirSeal™

Complete Fixture consists of Reflector Trim & Frame-In Kit. Select each separately.

Reflector Trim	Frame-In Kit — See Individual Frame-In Kit Specification Sheets			
	Incandescent			
	Frame-In Kit	Installation Type	Lamping	Height
2022 Matte White w/Black Baffle **2022WH** Matte White w/White Baffle	**2000P1**	Standard Non-IC	50W PAR20 75W PAR16, R20	5 9/32"
	2000IC **2000AIC**	IC IC Air Seal	50W PAR20, R20 45W PAR16	5 9/32" 5 9/32"

Features

1. **Trim Ring:** Die-formed aluminum, 0.040" thick (18 ga.). Matte white finish.
2. **Eyeball Housing:** Die-formed, one piece, aluminum, 0.040" thick (18 ga.). Provides 358° horizontal rotation and 0° to 35° vertical adjustment; (0° to 30° with 2000IC and 2000AIC). Matte white finish.
3. **Frame-In Kit:** See Frame-In Kit specification sheets for more details.

Labels

UL (Suitable for Damp Locations), I.B.E.W

Job Information	Type:
Job Name:	
Cat. No.:	
Lamp(s):	
Notes:	

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Lighting Performance Data

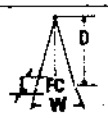
PAR Lamps:

L Beam length **W** Beam width
D Distance **A** Aiming angle
FC Footcandles

Data based on bare lamp photometrics. Dashed lines in beam spreads indicate narrow axes of oval shapped beams. **L** and **W** are the outer points where the candlepower drops to 50% of the maximum **FC** is the initial footcandles at the center of beam.

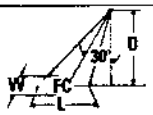
	Narrow				Medium		
	50W PAR20 NSP (T-H)	56W PAR16 NSP (T-H)	75W PAR16 SP (T-H)	50W PAR20 NFL (T-H)	55W PAR16 NFL (T-H)	75W PAR16 NFL (T-H)	
Footcandles (On Beam Center at 6')	128	139	208	35	36	56	
Beam Spread (To 50% Max. CP)	12°	12°	12°	32°	30°	30°	
Max. Candlepower (Candelas)	4600	5000	7500	1250	1300	2000	
Rated Life (Hours)	2000	2000	2000	2000	2000	2000	

0° AIMING ANGLE — Illumination on Horizontal Plane



D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
6'	128	1.3'	1.3'	6'	139	1.3'	1.3'	7'	153	1.5'	1.5'	3'	139	1.7'	1.7'	3'	144	1.6'	1.6'	4'	125	2.1'	2.1'
8'	72	1.7'	1.7'	8'	78	1.7'	1.7'	10'	75	2.1'	2.1'	5'	50	2.9'	2.9'	5'	52	2.7'	2.7'	6'	56	3.2'	3.2'
10'	46	2.1'	2.1'	10'	50	2.1'	2.1'	13'	44	2.7'	2.7'	7'	26	4.0'	4.0'	7'	27	3.8'	3.8'	8'	31	4.3'	4.3'
12'	32	2.5'	2.5'	12'	35	2.5'	2.5'	16'	26	3.4'	3.4'	9'	15	5.2'	5.2'	9'	16	4.8'	4.8'	10'	20	5.4'	5.4'

30° AIMING ANGLE — Illumination on Horizontal Plane



D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
5'	120	1.4'	1.2'	5'	130	1.4'	1.2'	6'	135	1.7'	1.5'	3'	90	2.4'	2.0'	3'	94	2.2'	1.9'	3'	144	2.2'	1.9'
7'	61	2.0'	1.7'	7'	66	2.0'	1.7'	9'	60	2.5'	2.2'	5'	32	3.9'	3.3'	5'	34	3.7'	3.1'	5'	52	3.7'	3.1'
9'	37	2.5'	2.2'	9'	40	2.5'	2.2'	12'	34	3.4'	2.9'	7'	17	5.5'	4.6'	7'	17	5.1'	4.3'	7'	27	5.1'	4.3'
11'	25	3.1'	2.7'	11'	27	3.1'	2.7'	15'	22	4.2'	3.6'	9'	10	7.1'	6.0'	9'	10	6.6'	5.6'	9'	16	6.6'	5.6'

30° AIMING ANGLE — Illumination on Vertical Plane

D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
2'	144	1.7'	0.8'	2'	156	1.7'	0.8'	2'	234	1.7'	0.8	1'	156	3.0'	1.1'	1'	163	2.7'	1.1'	1'	250	2.7'	1.1'
3'	64	2.6'	1.3'	3'	69	2.6'	1.3'	3'	104	2.6'	1.3'	2'	39	6.1'	2.3'	2'	41	5.5'	2.1'	2'	63	5.5'	2.1'
4'	36	3.5'	1.7'	4'	39	3.5'	1.7'	4'	59	3.5'	1.7'	3'	17	9.1'	3.4'	3'	18	8.2'	3.2'	3'	28	8.2'	3.2'
5'	23	4.3'	2.1'	5'	25	4.3'	2.1'	5'	38	4.3'	2.1'	4'	10	12.2'	4.6'	4'	10	10.9'	4.3'	4'	16	10.9'	4.3'

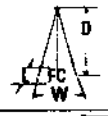
R Lamps:

L Beam length **W** Beam width
D Distance **A** Aiming angle
FC Footcandles

Data based on bare lamp photometrics. Dashed lines in beam spreads indicate narrow axes of oval shapped beams. **L** and **W** are the outer points where the candlepower drops to 50% of the maximum **FC** is the initial footcandles at the center of beam.

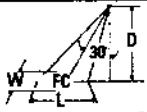
	Wide		
	30W R20 FL	50W R20 FL	75W R20 FL
Footcandles (On Beam Center at 6')	8	13	23
Beam Spread (To 50% Max. CP)	35°	38°	46°
Max. Candlepower (Candelas)	300	530	825
Rated Life (Hours)	2000	2000	2000

0° AIMING ANGLE — Illumination on Horizontal Plane



D	FC	L	W	D	FC	L	W	D	FC	L	W
2'	75	1.3'	1.3'	2'	133	1.4'	1.4'	2'	206	1.7'	1.7'
3'	33	1.9'	1.9'	4'	33	2.8'	2.8'	4'	52	3.4'	3.4'
4'	19	2.5'	2.5'	6'	15	4.1'	4.1'	6'	23	5.1'	5.1'
5'	12	3.2'	3.2'	8'	8	5.5'	5.5'	8'	13	6.8'	6.8'

30° AIMING ANGLE — Illumination on Horizontal Plane



D	FC	L	W	D	FC	L	W	D	FC	L	W
2'	49	1.7'	1.5'	2'	86	1.9'	1.6'	2'	134	2.4'	2.0'
3'	22	2.6'	2.2'	4'	22	3.8'	3.2'	4'	33	4.8'	3.9'
4'	12	3.5'	2.9'	6'	10	5.7'	4.8'	6'	15	7.2'	5.9'
5'	8	4.3'	3.6'	8'	5	7.6'	6.4'	8'	8	9.6'	7.9'

30° AIMING ANGLE — Illumination on Vertical Plane

D	FC	L	W	D	FC	L	W	D	FC	L	W
1'	38	3.6'	1.3'	1'	66	4.3'	1.4'	1'	103	7.4'	1.7'
2'	9	7.2'	2.5'	2'	17	8.6'	2.8'	2'	26	14.8'	3.4'
3'	4	10.8'	3.8'	3'	7	12.8'	4.1'	3'	11	22.2'	5.1'
4'	2	14.4'	5.0'	4'	4	17.1'	5.5'	4'	6	29.6'	6.8'

Beam Center Location

This chart locates the distance **C** to the center of the light beam for various distance **D** when the lamp is aimed 30° from vertical, the preferred aiming angle for lighting pictures on the wall.

Distance **D** (ft.)	1	2	3	4	5	6	7	8	9	10
Distance **C** (ft.)	1.7	3.5	5.2	6.9	8.7	10.4	12.1	13.8	15.6	17.3

Job Information **Type:**

Lightolier a Genlyte company www.lightolier.com
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Plastic•

Size of Tray — 12” x 24”•

3.3” Standard Depth • — 2”, 4”, 6” and Deeper Options Available

Wall Thickness • — 150 mil, Color — Black

40 Drainage Holes • (3/8”) in Bottom of Tray (6” deep trays are different)

Drainage Channels in Both Directions Molded in Bottom of Tray•

Minimal Water Reservoirs to Avoid Root Rot•

Carry Handles on Each End•

Estimated 18 to 23 Pounds per Square Foot for 3.3” Soil Depth. • (Fully saturated weight including mature plant foliage.)

Engineered Growing Media• Meets German FLL Guidelines (Analysis by the Pennsylvania State University Laboratory.)

Plant Types: Sedum, or other approved plants. Can be grown to • Full Establishment (95%+ Coverage) with Enough Lead Time

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Revised 1/3/11

APOLLO

OWNER'S MANUAL

AIR-COOLED DIESEL GENERATOR SET

Model AED6500SR

PREFACE

Thank you for purchasing products from our company . The following manual is only a guide to assist you and is not a complete or comprehensive manual of all aspects of maintaining and repairing your generator. The equipment you have purchased is a complex piece of machinery. We recommend that you consult with a dealer if you have doubts or concerns as to your experience or ability to properly maintain or repair your equipment. You will save time and avoid the inconvenience of having to go back to the store if you choose to write or call us concerning missing parts, service questions, operating advice, and/or assembly questions. Our air-cooled diesel generators have some of the following features:

- Lightweight construction
- Air cooled
- Four-stroke diesel internal combustion engine
- Direct fuel injection system
- Electric, remote start
- Glow plug(also called preheater or cold starter)
- Large fuel tank
- Automatic voltage stabilizer
- AC circuit breaker protection
- AC and DC outputs
- Low oil pressure automatic shut down

APOLLO brand air-cooled diesel generators are widely used when electrical power is scarce. Our generators provide a portable mobile solution in supplying power for field operations during project construction. Some other known applications include pipeline construction and metal welding when electrical power is not available.

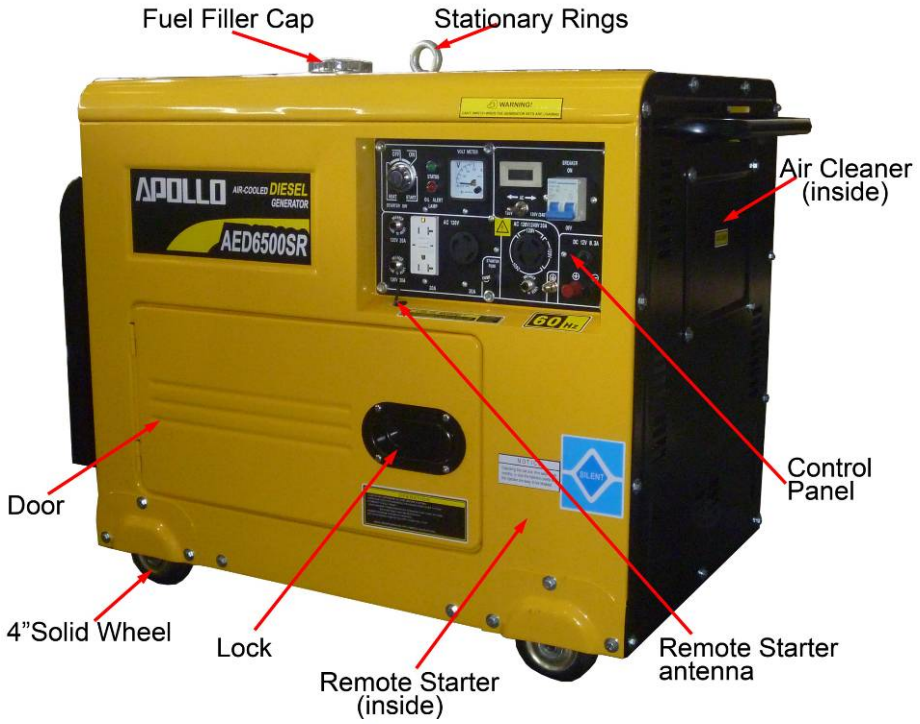
This manual will explain how to operate and service your generator set.

If you have any questions or suggestions about this manual, please contact your local dealer or us directly. **Consumers should notice that this manual might differ slightly from the actual product as more improvements are made to our products. Some of the pictures in this manual may differ slightly from the actual product as well. APOLLO POWER INDUSTRIAL CORP. reserves the right to make changes at any time without notice and without incurring any obligation.**

TABLE OF CONTENTS

CHAPTER 1 TECHNICAL SPECIFICATIONS AND DATA

1-1 Overview of the generator set



1-2 Technical specifications and data

Table1 The Single-cylinder diesel generator

Item \ Model			AED6500SR
Generator data	Generator technical data (AC)	Frequency (HZ)	60
		Rated power (kW) Peak power (kW)	5.0 6.3
		Voltage (VAC)	120/240
		Phase type	Single phase
		Power factor (cosφ)	1.0
	Speed (rpm)		3600
	Excitation		self-excitation , Brushless
	Voltage regulator		Capacitor
	Continuous operation time (Hr. by half load)		Continuous run for 12 hours
	Noise level [dBA/7m] (zero load～full load)		69-74
	Connection		Rigid connection driven shaft
	Dry weight (kg)/(lb) Gross weight(kg) /(lb)		160 / 353 180 / 395
	Dimensions (L×W×H)(mm)/(inch)		929×538×724 / 36.6×21.2 ×28.5
Engine	Engine model		CF186FE
	Engine type		Single cylinder, 4-stroke,air-cooled,vertical, diesel engine
	Fuel type		0# (summer),－10# (winter), －35#(chill cold) diesel
	Lube oil brand		CD or better than CD
	Output	Continuous (kW)	5.8
		Max Output(kW)	6.3
	Bore× stroke (mm) /(inch)		86×72 / 3.39×2.83
	Displacement (cc) /(cub inch)		418 / 25.5
	Compression ratio		19 ： 1
	Lube-oil capacity (L) /(Gal)		1.65 / 0.43
	Fuel tank capacity (L) /(Gal)		14.5 / 3.8
	Starting system		Electric start/Remote start

Note: Allow 30 hrs initial run time for max efficiency.

1-3 Standard features

- Electric start, recoil start and remote control with preheater (cold start)
- Large fuel tank with 12 hours continuous operating capability
- Automatic shutdown for low oil pressure
- Vibration isolation mounting between engine/alternator base align
- AC circuit breaker protection
- Overload protection and convenience
- AC voltmeter
- 120V/240V switch
- 12VDC charging system
- Operation status indicator lamp and low oil alert lamp
- Dependable, brushless alternator
- Advanced direct fuel injection system
- Provides low fuel consumption
- All American standard receptacles
- Battery and hour meter included

1-4 Basic operating parameters

1-4.1 Under the given conditions, the generator will output the specified power in the table listed below.

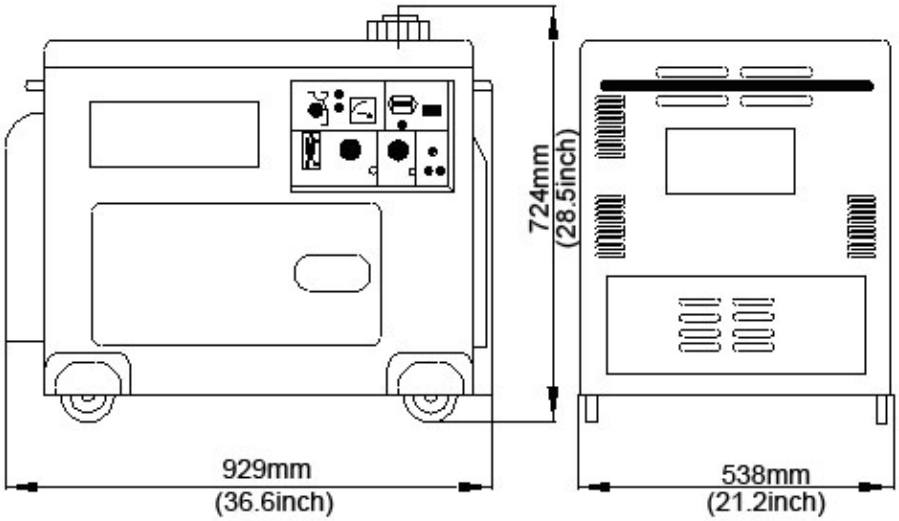
Table 2

Height above sea level (ft)	Ambient temperature (^{o}F)	RH
<3280.8 (1000 m)	41~104 (5-40 ^{o}C)	90%

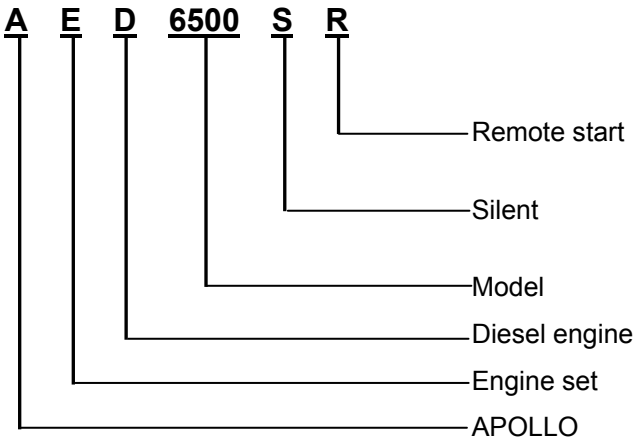
1-5 General dimensions and overview of the generators

1-5.1 AED6500SR dimensions of the series generator.

Fig 1



1-5.2 Generator model number code



CHAPTER 2 OPERATING THE DIESEL GENERATOR

2-1 General main points of safety during operation of the generator set.

In order to operate the generator set safely, please follow all the instructions provided in this manual carefully. Doing so otherwise may lead to accidents or equipment damage.

2-1.1 Fire prevention

The proper fuel for the diesel generator set is light diesel fuel. Do not use gasoline, kerosene or other fuels other than light diesel fuel. Keep all flammable fuels away from the generator as the generator may spark and ignite these gases. In order to prevent fires from occurring and to provide enough ventilation for people and the machine, keep the diesel generator at least 1.5 meters away from buildings and or other equipment. Always operate your diesel generator on a level site. If the generator is operated on an incline, the lubricating system within the engine will not perform well and may lead to failure of the engine.

2-1.2 Prevention from inhaling exhaust gases.

Never inhale exhaust gases emitted by the engine. Diesel engine exhaust emissions have the potential to cause a range of health problems. Diesel engine exhaust emissions (commonly known as diesel fumes) are a mixture of gases, vapors, liquid aerosols and substances made up of particles. They contain the products of combustion including:

- Carbon (soot)
- Nitrogen
- Water
- Carbon monoxide
- Aldehydes
- Nitrogen dioxide
- Sulphur dioxide
- Polycyclic aromatic hydrocarbons

The carbon particle or soot content varies from 60% to 80% depending on the fuel used and the type of engine. Most of the contaminants are adsorbed onto the soot. Petrol engines produce more carbon monoxide but much less soot than diesel engines.

Never operate your generator in places with poor ventilation. In order to operate this machinery indoors, a suitable ventilation system for the building is required to draw the poisonous exhaust gases out.

2-1.3 Prevention from accidental burns

Never touch the muffler and its cover when the diesel engine is running. Never touch the muffler and cover after the diesel engine has been used, as the muffler remains hot for a good period of time.

2-1.4 Electric shock and short circuits

Never touch the generator if the generator is wet. Also never touch the generator if your hand is wet. Never operate your generator if the weather conditions call for any type of precipitation such as rain, snow, or fog. To prevent electrical shocks, the generator should be grounded. Use a lead to connect the grounding end of the generator to the grounding surface of choice. Please refer to Fig. 2 before beginning to use the electric generator.

NOTE

When connecting devices to the generator, make sure all other devices are rated lower than the generators output. Do not over load outlets.

Fig 2 Control panel with grounding terminal

2-1.5 Other safety points

Prior to operation the operator should read and understand all safety precautions.

2-1.6 Battery

The electrolytic liquid of the battery also known as battery acid contains sulfuric acid. In order to protect your eyes, skin, and clothing, wears protective gear when working with the battery. If you come in contact with the electrolytic liquid, wash it immediately with clean water. Also, if the electrolytic liquid comes in contact with your eyes, see a doctor immediately.

2-2 Preparation before operation

2-2.1 Fuel choices and fuel treatment

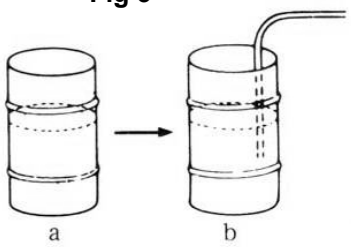
- Use only light diesel fuel.
- The fuel should be filtered clean. Never let dust and water mix with fuel in the fuel tank. Otherwise it will clog the fuel lines and oil nozzles. It may also damage your pressure pump.

WARNING: It is dangerous to overfill the fuel tank. Do not overfill.

a. After purchasing fuel, put it into a drum and let it sit for 3-4 days.

b. 3-4 days later, insert half of the fuel sucker into the drum, (water and impurities stay in the lower portion of the drum)

Fig 3



⚠NOTE

Never smoke near the opening of the fuel tank. Do not let sparks get near the fuel or fuel tank and do not overfill tank. After filling, tighten the fuel cap.

CAUTION

Do not overfill tank. After filling, tighten the fuel cap. Never let fuel or fuel tank expose to sparks. Be careful not to spill fuel when filling, if any fuel is spilled, make sure to clean up all the spilled fuel before starting engine.

2-2.2 Charging battery

We recommend the use of accumulators rated 20 hours shown in table 3.

Table 3 Specifications of recommended accumulators for electric start

Model	Amps-hours
CF186FE	36

Your generator cones with either a maintenance free or dry cell battery (see fig 4). Ensure the battery is fully charged before installation to prevent damage to electrical circuits. Use trickle charge for 8 hrs.

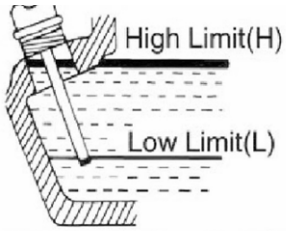
Fig 4 Maintenance free battery (left) and dry battery(right)

If it is dry battery, the battery must be filled with battery acid to required level. Acid can be purchased at a local automotive supply store. To properly maintain your dry battery, check the height of the battery acid once a month. If the level of the liquid drops too low, fill it with distilled water until it reaches up to maximum level mark. If there is not enough battery acid, diesel engine cannot be started. It is important to keep the liquid level between the high and low limits. If the level in the battery is too high, the liquid may flow out and corrode surrounding parts.

2-2.3 Filling engine oil

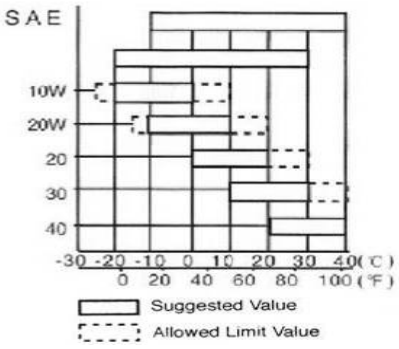
- Make sure the generator is on level ground and remove the dipstick from the engines.
- Check if the oil level is between the high limit and low limit. If the engine is new or oil is not enough, fill the engine with the right engine oil.(see fig 6)
- Put the dipstick back into the hole to check the engine oil level.(see fig 5)

Fig 5 Schematic for filling engine oil



Capacity \ Model	CF186F
Litre (US. gal)	1.65 (0.44)

Fig 6 Choose the right engine oil



Be sure to use oil GRADE CC or CD A.P.I Diesel Engine Service

Engine oil is the most important factor in determining the life of your generator engine. If you use poor engine oil or if you don't change the oil regularly, the piston and cylinder will wear easily or seize up. Also, the life of the other parts in your engine such as bearings, and other rotating parts will shorten considerably.

⚠ NOTE

Although there is an alarm system to check for low oil pressure, it is always a good idea to check the amount of oil inside the engine. If the oil level is low, fill it before starting the engine.

A good time to drain the oil from the engine is when the diesel engine is still hot. If the engine is fully cooled, it is more difficult to drain all the oil out or some impurities will remain in the engine.

⚠ WARNING

DO NOT fill engine oil when the machines are running.

The following procedures help you start our generator with ease:

1. If dry battery comes with your generator, please add enough acid to required level;

2. Fully charge battery prior to cranking diesel engine;

3. Add engine oil to the required level(use the dipstick to check);

4. Add enough diesel in FUEL TANK, turn knob fuel shutoff valve (down) ON position. This is under FUEL TANK.

5. Pull off the fuel hose connected to the fuel pump and LET FUEL DRAIN OUT FREELY, then replace the fuel hose;

6. Connect fully charged battery to generator;

7. DO NOT apply any load at this point and put the CIRCUIT BREAKER to the OFF position;

8. Push RED lever next to oil level check stick to the RUN position;

9. Turn on to the START position and release the electronic key to the ON position(for electric start);

10.Turn electronic key to the ON position, and then press the "ON" button of the remote starter key to start the genset(for remote start).

11. In cold winter area please turn key counterclockwise to HEAT and hold about 10 seconds to preheat cold air, then turn clockwise to START engine, release the key to ON position after engine starts; it helps start the engine in

cold weather; if your remote control unit has remote preheater function, please see refer to operating procedures for remote start for your reference(for electric start);

12. Turn electronic key to the ON position, and then press the " " button of the remote starter key to preheat the genset. After 10 seconds, press the " " button of the remote starter key to stop preheating the genset. Finally, press the "ON" button of the remote starter key to start the genset (for remote start);

13. If the engine does not start, wait 1 to 3 minutes and repeat the 9 or 10;

14. Only try to use remote control after you successfully start the engine using a electronic key.

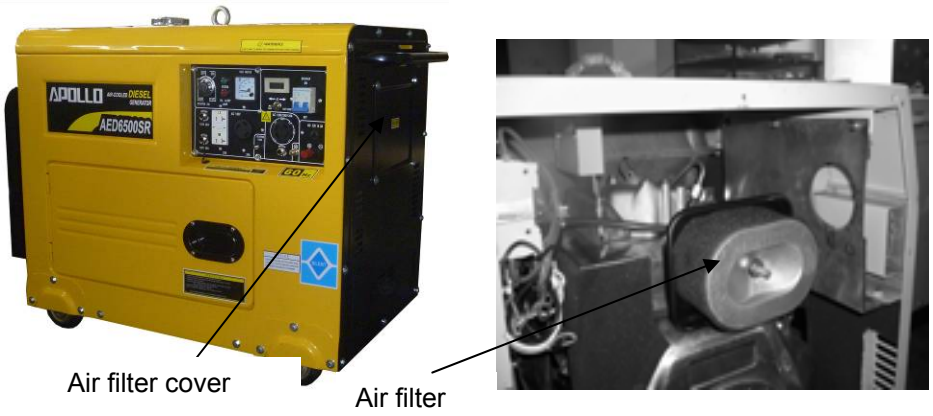
NOTE

This generator comes with recoil starter. If you want to pull start your generator, please refer to Section 2-6 procedures for recoil starting.

2-2.4 Checking the air filter

(1) Loosen the butterfly nut, take the cover of the air filter off and take the air filter element out.

Fig 7



NOTE

- Do not use detergent to wash the air filter element.
- When the performance of the engine decreases or when the color of the exhaust gases is bad, exchange the filter element.
- Never start the engine without the air filter as foreign objects may enter the intake and damage the engine.

(2) After replacing the air filter element, tighten the butterfly nut firmly.

2-2.5 Checking the generators

Before starting the generator, make sure the breaker is in the “OFF” position. Starting the generator with the breaker in the “ON” position is very dangerous.

Use dry compressed air (with pressure about 1.96 x 105 Pa) to blow the dust out in the control panel and at the surface of the alternator.

According to the electric wiring diagram, check to see whether the connecting wire is correct and the connected place is firm.

⚠ WARNING

The generator should be grounded in order to prevent electric shock.

2-3 Checking the operation of the diesel engine

2-3.1 Low-pressure alarm system.

APOLLO diesel engines have a low-pressure sensor system where if the oil pressure drops too low, the sensor will shut the engine off. The purpose of having this system is to ensure that the engine does not seize up. If there is not enough oil in the engine, the temperature of the oil will be raised too high. On the contrary, if there is too much oil in the engine, the engine oil can slow the engine down considerably.

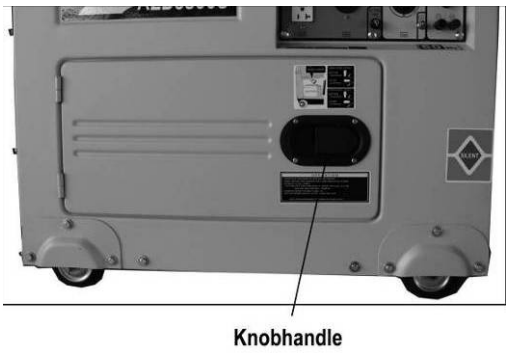
2-3.2 How to open the case door/cover

Fig 8

(1) Open the case door: Pull the handle outward and open the door. Do these checks daily.

(2) Loosen the outer cover bolt of the air filter and outer cover of the oil nozzle, and then check the air filter.

(3) Check the outer cover of the oil nozzle. Loosen the butterfly nut and open the outer cover.



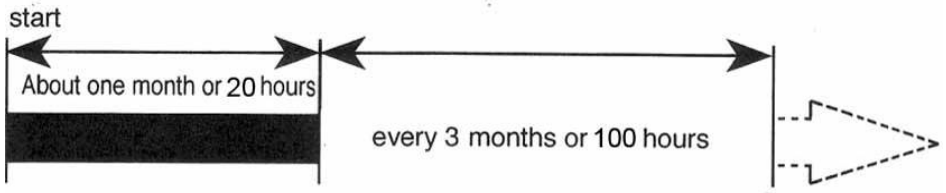
2-3.3 Engine break in

When you purchase a brand new engine, the engine must be properly broken in. The break in period is about 20 hours.

(1) Avoid overloading the engine when brand new. After primely start the genset, please make the engine warm-up about 5 minutes. Do not load a high-power device to the genset during breaking in. A speed of 3600rpm and 50% load are recommended for breaking in.

(2) Change the engine oil according to specifications. An oil change for a brand new engine is about 20 hours or one month, an older engine, the oil change is about 100 hours or three months.(see fig 9)

Fig 9 Interval of changing engine oil



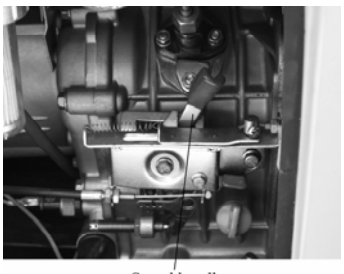
IMPORTANT: Do not apply high load during the first 20 hours of break-in period, change engine oil and check oil filter after first 20 hours of break-in running; if you find any dirty or metal scraps on the oil filter, please use diesel to wash them away, otherwise, it may cause serious damage to your engine.

2-4 Starting the generator set

2-4.1 Electric starting

Start the engine in accordance with procedures below:

Fig 10



(1) Put the switch of fuel filter in the ON position.

(2) Turn the speed handle of the engine to the “RUN” position.

(3) Turn the start switch clockwise to the “START” position and release the electronic key to the ON position.

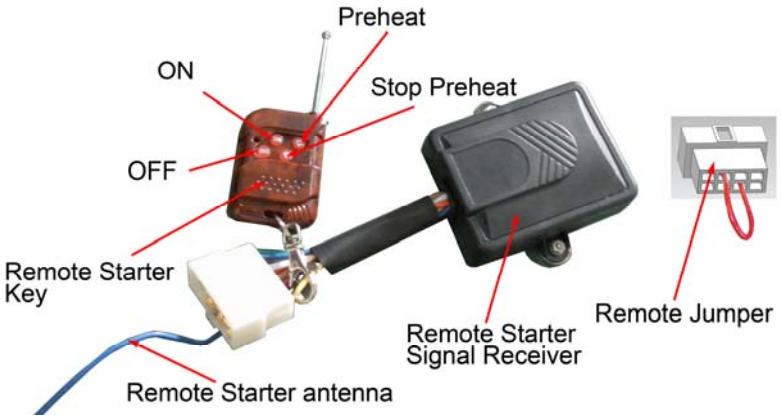
(4) In cold winter area please turn electronic key counterclockwise to HEAT and hold about 10 seconds to preheat cold air, then turn clockwise to START engine, release the electronic key to ON position after engine starts; it helps start the engine in cold weather.

(5) After the diesel engine is started remove your hand from the switch handle; the switch will automatically reset itself to the “ON” position.

(6) If the engine is not starting after 10 seconds of cranking, wait about 15 seconds before trying it again. If you crank too long, the voltage of the battery will drop. This can lead to improper ignition. When the diesel engine is operating, let the ignition remain on the “ON” position.

2-4.2 Remote starting

Fig 11 Remote starter and remote jumper



There are ON、OFF、Preheat( ) and Stop Preheat( ) buttons in Remote Starter Key. Your remote start unit (with 8 wires on) has remote glow plug function, the operating procedures are as follows:

1. Please refer to above generator operation instruction for start using electronic key;

2. If you want to use remote start, please make sure that your electronic key switch is put on “ON” position;

3. Press the ON button to start the genset, and press the OFF button to stop the genset;

4. If you use electronic key to start the generator and then use Remote Starter Key to shut it down, make sure that you need turn electronic key switch to OFF position; otherwise, your generator battery will drain charge gradually;

5. In case your remote control unit fails and a remote jumper comes with your user’s manual package, please unplug your remote control unit first, then plug the remote jumper; this will enable you to use electronic key to start your generator; if there is no remote jumper with your package, please follow the order shown in the picture of remote jumper to electrically shorten the two corresponding wires coming out of your control unit, then you shall use electronic key to start your generator.

2-4.3 Battery

NOTE

If you crank the starter too long, the battery may be drained too much to provide enough energy for proper engine ignition.
Also, when the diesel engine is operating, let the electronic key retain in the “ON” position.

IMPORTANT NOTE

Some of our units come with a dry battery for shipping safety purposes. In order to get your generator started for the first time; the battery must be filled with battery acid which can be purchased at a local automotive supply store and slowly charged (trickle charged) for a day. After charging, the battery may be used.

2-5 How to use glow plug

Fig 12 Control panel with preheater knob

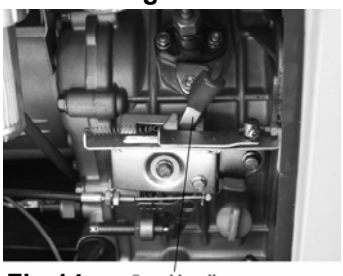
Diesel generator will be very hard to start in cold winter. However, glow plug will help start diesel generator much easier. Please turn electronic key counterclockwise to **HEAT** position and hold about 10 seconds to preheat cold.
If your diesel generator comes with 8-wire remote control unit(it needs special order, extra charge applies), you can remote control glow plug. The operating procedures are as follows:

ON and OFF buttons used for remote starting engine ; Preheat( ) and Stop Preheat( ) buttons used for controlling glow plug respectively(see Fig 11). they are interlocked each other and only one set works at a time, preheat set is programmed for powering on glow plug 10 seconds and you can press the button for power off ,also glow plug will automatically power off after 20 seconds.

2-6 Proper operation of the generator set

2-6.1 Operating the diesel engine

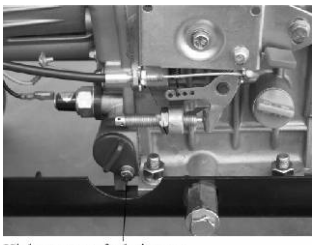
Fig 13



1. Pre-heat the diesel engine for 3 minutes under no load conditions.

2. First check the height of the lubricating oil level, if it is low, refill it. Our diesel engines are equipped with an alarm system that will notify you if the oil pressure is too low. The alarm system will shut down the engine if the oil pressure is too low.

Fig 14



3. Do not adjust the speed limit regulation bolt or the fuel adjustment bolt. These bolts have been set by the factory already, changing them will affect the properties of the engine performance.

2-6.2 Checks during engine operation

1. Check to see if there are abnormal noises.

2. Check to see if the performance is good or bad

3. Check the color of the exhaust gases (whether it is too black or too white). If any of these conditions exist, stop the engine and find the cause of the problem. If no problems are found, please contact your local dealer or our nearest company branch.

2-7 Loading

2-7.1 Load conditions

Exert loads in accordance with the specified parameters.

2-7.2 Applying Load to your Generator

After generator is started, push circuit breaker to ON position and you should read 120V in voltage meter when voltage selector is set for 120V output or 240V in voltage meter when voltage selector is set for 120V/240V output.

When applying loads to generator, make sure to apply loads in order. Apply larger load onto the generator first. If the generator labors great with applied load, smaller load can then be added. Never overload generator. Otherwise, generator will black smoke or circuit breaker will be stripped. In this event, decrease the number of small loads until generator labors normally. Please see the technical specifications of generator for your reference. If the indication of the voltage meter is too high or too low, adjust the engine speed (capacitor used for brushless alternator) accordingly. Special skills are required to perform speed adjustment. An authorized professional is recommended to perform this work. If there are problems, stop the generator immediately and fix the issue.

NOTE: During operation, the generator should be put in a place with good ventilation. Never cover open frame generator using your own cage to solve a noisy problem, as this will cause overheating problem and then damage your generator. You must obtain our prior authorization for any change in our generator. Otherwise, the warranty for your generator will be voided.

Do not apply more than two loads simultaneously. Each load should be started one by one to avoid overloading generator. The generator should be running at 3600 revolutions per minute in order to achieve the frequency of 60Hz. The speed of engine can be adjusted through speed governor.

CAUTION: A alternator consists of windings, namely R2 & R1 and L2 & L1, each set of winding gives 120V output. A voltage selector is used to obtain 120V and/or 240V output. Two sets of windings are in parallel when a selector is set at left while two sets of windings are in serial when a selector is set at right. If you push voltage selector left for only 120V output, you can apply full rated load at 120V outlet; if push selector right for both 120V & 240V outputs, you can apply full rated load at 240V outlet from four-prong socket; however, you can only apply HALF RATED LOAD at either 120V outlet (total two 120V outlets) from four-prong socket.

Fig 15 Wiring diagram for alternator

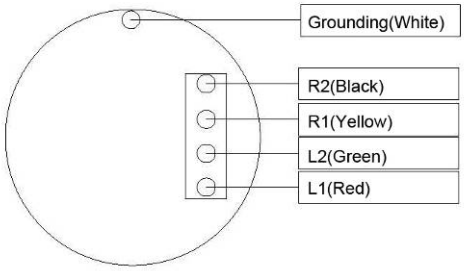


Fig 16 Parallel connection

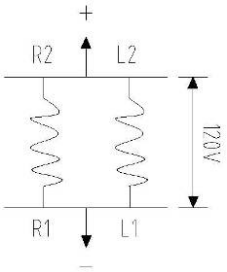
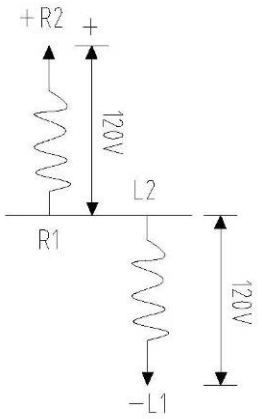


Fig 17 Serial connection



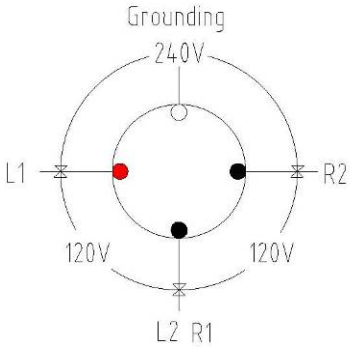
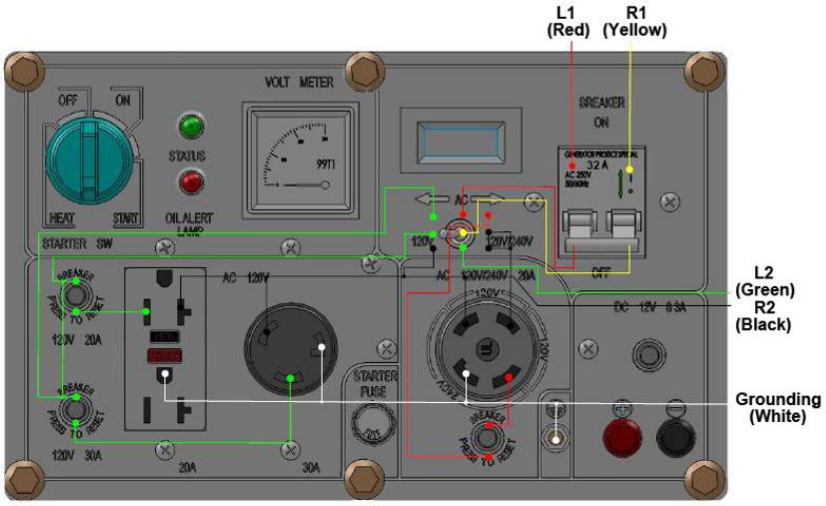


Fig 18 Wiring diagram of electric output for control panel



2-7.3 AC application

1. Ensure engine is running properly and is warmed up for 3 minutes.

2. The voltmeter should point to 240V±5%. Turn circuit breaker on. The AC voltage from the socket of the power supply can be output.

3. When connecting devices to the generator, make sure to connect these devices in order. Connect the large loads onto the generator first. If everything is functional, smaller loads can then be added. If the generator shuts off, it may be because the load being drawn by all the various devices are too high. In this event, decrease the number of small devices until everything is functional. The total drawn power should not exceed the maximum output power of the generator. Please see Table 1 for technical specifications of what the generator can output. In order to reset the generator after overdrawn power, let it sit for several minutes. If the indication of the voltmeter is too high or too low, adjust the speed accordingly. If there are problems, stop the generator immediately and fix the issue.

4. During operation, the generator should be in a place that has very good ventilation. Never cover the engine to solve a ventilation problem, as this will damage your equipment.

⚠ NOTE

Do not start more than two devices simultaneously. Each device should be started one by one to prevent overloading the generator.
The generator should be running at 3600 revolutions per minute in order to achieve the (60 Hz) frequency. The speed of the engine can be adjusted from the speed governor.

2-7.4 DC application

Both DC terminals provide output: 12VDC, 7A. The red terminal is "+"(positive) pole of power supply. It can be used as load for rated voltage 12VDC and also used for charging 12V battery.

1. In case to charge the battery with two lead connect to the start circuit, the negative lead should be disconnected form the generator.

2. Connect the positive and negative poles of the battery with the positive and negative poles of DC terminal.

CAUTION: Take care not to connect positive and negative leads adversely, otherwise the generator and the storage battery will be damaged severely. Do not make positive and negative leads to be touched each other, or the storage battery will be short circuit.

NOTE: The DC output current should not be more than 7A, when charging the large capacity battery, the fuse of DC power supply may be burned off and broken easily for large charging current.

2-7.5 Charging the battery

1. For the electric starter on the generator sets, the 12V battery is automatically charged through the regulator on the side of the engine when it is running.

2. If the generator is not used for long periods of time, the battery should be disconnected to avoid energy loss from the battery.

3. Do not connect the negative and positive terminals of the battery together at any time. Doing so will damage the battery and cause serious injuries.

4. Do not reverse the polarities when attaching the battery cables to the battery. Doing so will damage both the battery and the electric starter.

5. When charging the battery, the battery produces flammable gases. Do not smoke, let flames, and sparks get near the battery while it is charging as this may cause a fire.

To avoid sparking while connecting the cables to the battery, first, connect the cables to the battery then to the motor. To disconnect battery cables, first disconnect the motor end of the cable.

2-8 Stopping the generator

1. Take the electrical load off the generator.

2. Put the speed handle in the "RUN" position and let the engine run for 3 minutes after unloading. Do not stop the diesel engine immediately let it

warm down. Stopping the diesel engine suddenly may raise the temperature of the engine abnormally and lock the nozzle and damage the diesel engine.

3. Turn electronic key to the OFF position to stop the genset. In the same way, you can press the OFF button in remote starter key to stop the genset.

4. If do not use generator for a long time, please shut off fuel valve and then make sure that both intake and exhaust valves are closed for avoiding engine rusting. Pull slowly on the recoil handle until you feel resistance when the piston of engine is in the compression stroke where both intake and exhaust valves are closed.

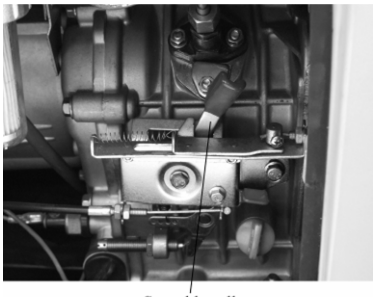
NOTE

1. If you cannot stop the engine with a load on it, then remove the load first than stop the engine.

2. Press down on the brake handle.

3. If equipped with an electric starter, turn the electronic key to the “OFF” position.

4. Put the fuel handle to the “STOP” position.



Speed handle

CHAPTER 3 MAINTENANCE

3-1 Maintenance schedules

Keeping your generator well maintained will prolong the life of your generator. Everything needs to be checked including the diesel engine, generator, control cabinet, and frame. For overhauling procedures, please refer to the instruction manual of the relative subassembly. If you need these manuals, please call our company and we will send you one.

Before starting the maintenance, make sure the diesel engine is off.

Please refer to the Table 4 for the proper maintenance schedule.

Table 4. Maintenance schedule for diesel generator set

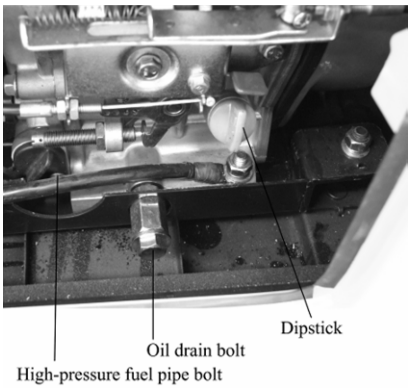
Time / Item	Everyday	After 1 month or 20hours	Every 3 month or 100 hours	Every 6 month or 300 hours	Every year or 1000 hours
Check the fuel level and refill	○Before starting				
Drain the fuel tank		○			
Check and fill enough engine oil	○				
Clean the fuel filter			○		
Check fuel oil leakage	○after every operating				
Check and screw each fastened part	○			●cylinder head bolts	
Check injector				●	
Check injection pump					●
Check fuel pipe				●If necessary exchange it	
Check the lube. oil level in the oil pan and refill	○before starting				
Replace the lube. oil		○the first time	○the second time and afterward		
Clean lube. Oil filter		○the first time	○the second time and afterward		
Check the air cleaner element		○the first time	○the second time and afterward		
Change the core of air filter	If damaged or smeary , change it in time				
Check the battery liquid level and refill	○				
Adjusting the intake and exhaust valve clearance		●the first time		●the second time and afterward	
Grind air intake and air exhausted gate					●
Exchange piston ring					●
Check electric brush and slide ring				●	
Check insulation resistance	The time of stop is over 10 days ○				

NOTE: the quality period of the injector and injection pump is 1500 hours or two years. There into,● means it should operate with special tools, or can be checked by dealer.

3-1.1 Changing the engine oil

Take the oil cover off. Remove the oil drain plug when the diesel engine is still hot. Be careful of hot oil and hot engine as you may get burned. The bolt is located at the bottom of the cylinder. After draining the oil, put the bolt back and tighten it. Then fill with the proper engine oil to the proper level.

Fig 19



3-1.2 Air filter maintenance schedule

1. Clean air-filter every 6 months or 400 hours of operation.

2. If necessary, exchange it.

3. Do not use detergent to clean air filter element.

NOTE

Never start the engine without the air filter. This can cause serious damage to the engine if foreign objects enter the intake system. Always change the air filter on time.

3-1.3 Fuel filter maintenance

1. The fuel filter should be cleaned often to keep the engine running at maximum performance.

2. The recommended time period for cleaning the fuel filter is 6 months or 500 hours of operation.

a. To do this, first drain the fuel from the fuel tank.

b. Loosen the small screws on the fuel switch and remove the fuel filter form the port. Use diesel fuel to clean the fuel filter. Also, remove the fuel injector and clean the carbon deposit around it. The recommended time period for this is 3 months or 100 hours.

3-1.4 Cylinder head bolt tensions

The cylinder head bolts should be tightened to specifications please refer to the diesel engine manual for specifications and the special tools required to do this.

3-1.5 Battery check （maintenance free battery is excepted）

Make sure the battery acid is full. The engine uses a 12V battery. Due to numerous starting cycles, the battery acid may be used up. Also, before filling, verify that the battery is not damaged in any way. Add distilled water to the battery when filling. Perform checks on the battery once a month.

3-2 Storing for long periods of time

If your generator needs to be stored for long periods of time, the following preparations should be made.

1. Start the diesel engine for 3 minutes then stop it.

2. When the engine is still hot, change the engine oil with new engine oil of the proper grade.

3. Pull the rubber plug out of the cylinder head cover and put 2cc of lubricating oil in it, then cover the plughole up again.

4. For manual starting generator, press the decompression handle down and pull the recoil handle 2 or 3 times. This pushes the intake out. (Do not start the engine)

5. For electric started generator, press the decompression handle down and crank the engine for 2-3 seconds. To do this, put the starter switch in the “Start” position. (Do not start the diesel engine)

6. Finally, pull the recoil starter until you feel resistance; this is when the piston is on the compression stroke where the intake and exhaust valves are closed. Having the intake and exhaust valves closed will prevent rust, as moisture cannot get inside the combustion chamber.

7. Clean the engine and store it in a dry place.

CHAPTER 4 TROUBLESHOOTING

4-1 Inspections before operation and maintenance.

4-1.1 Inspections before operation

4-1.1.1 Check the insulated resistance

An insulated resistance usually results in the creepage of the alternator when it is below the regulated value and then brings on the security problems. The user should check the insulated resistance between the master and subordinate reels and the insulated resistance between the reels and the crust with 500V megaohm-meter regularly. The value should not be under 2 M ohms at normal temperature; otherwise these parts should be dried. Use the electric cooker, infrared ray or big bulb or something else to heat them up outside until the insulated resistance reaches the regulate value.

4-1.1.2 Check the insulated resistance

Make sure all the firming components are tight and the rotor is easy to turn by hand without impacting, scrubbing and any abnormal noise. Do not let the rain or other liquid drop into the alternator.

4-1.2 Starting the generator

The end of voltage output should be on before running the machine. Generator should self excite, generate voltage in gear and reach the rated power when engine speed is accelerated to the rated value. Otherwise, stop the machine and check it.

4-1.3 Maintenance

Keep generator away from the oil, vapor, acidic/alkaline gas, saline brume and do not let any other solid matter fall into the generator. Keep drafty when the generator is running. Do not put anything on the surface of generator for baffling ventilation and heat dispersion. Do not operate under over-loading condition continuously and inspect bolts and mechanical firming components routinely.

4-2 Malfunction and troubleshooting for diesel engine

4-2.1 Causes and troubleshooting for the engine not being started

There are many factors causing non-starting issues. General causes for non-starting problem are summarized in Table 5.

For brand new diesel generator, if you can not start it, it is usually caused by entrapped air in the fuel hose. Please full off fuel hose from fuel injection pump and drain fuel freely to release all the entrapped air.

If you have used your generator for some time and find you can not start it or it shuts off automatically, it is usually caused by failure fuel system such as running out of fuel, non-energized solenoid, and burned solenoid or by failed remote control unit. If there is no 12VDC power to solenoid, please troubleshoot as follows:

1. Check whether solenoid fuse blows out or not. If it blows out, replace it.

2. If solenoid fuse is fine, please directly use a copper wire to feed 12V to solenoid(when disconnect blue wire to solenoid, make sure electrically insulate it for avoiding short circuit) and crank engine, see whether you can start it or not. If it works, solenoid control board or remote control unit fails.

CAUTION: there is a blue wire connected to the top of solenoid, NEVER touch the blue wire to engine case while with battery hooked up! Otherwise, a fuse or a control board for solenoid behind control panel will be burned!

Table 5 Causes and troubleshooting for the engine not being started

CAUSES	TROUBLESHOOTING
Air exists in fuel system	Release trapped air in the fuel hose.
It is cold	Preheat cold air using glow plug first, then crank engine.
Engine oil is viscous	Fill machine oil into crankcase after warming-up. Fill machine oil into inlet pipe. Remove the connection belt from the machine(tapered shaft only), start the engine and then stop it. When it is warmed up, assemble the belt and then restart the engine.
Failure of fuel system	Check solenoid and see whether it is energized. Check fuel injection pump.
Water mixed in the fuel	Clean fuel tank, fuel filter and fuel pipe and change the fuel.
The fuel get thickening and can't flow easily	Use prescribed brand fuel
Injection fuel is little or the spray is not excellent	Check the position of governing handle or check and clean the fuel nozzle, change fuel injector if necessary.
Incomplete combustion	Mainly by ill spray Incorrect delivery angle Leakage in gasket of cylinder head Deficiency in pressure of compression
Interrupted of diesel fuel	Run out of fuel and get air in the fuel hose, should refill fuel into the fuel tank and drain fuel hose freely. Fuel pipe leaks or fuel filter is obstructed.

CAUSES	TROUBLESHOOTING
Deficiency in pressure of compression; Loosened nut of cylinder head; Damage or leakage in the gasket of cylinder	Tighten the nuts of cylinder head in the diagonal sequence; check the gasket of cylinder as per the standard requirement. When the engine with the new gasket is heating, tighten the nut of cylinder head again.
Big gap in the piston ring due to wear and tear	Change the piston ring
Leakage caused by each gap of piston ring lined in one direction	Make each gap of piston at angle of 120
Serious stickiness or breakage in piston ring	Clean it by diesel fuel or change the piston ring.
Leakage in valves	Skive the valves, or send it to repair factory if the vestige is too deep.
Incorrect valve clearance	Adjust the gap as specified(0.15～0.20mm).
The valve stem is clipped in the guide pipe	Disassemble the valve, clean the stem and guide pipe with diesel fuel.

3.Use remote jumper to test, if it works, the remote control unit fails and needs replaced.

4.If remote jumper does not work, please turn electronic key to “ON” position, use a multimeter (voltage tester) to measure the voltage on the solenoid, put positive polarity to the conjunction of blue wire and solenoid and negative polarity to engine case, you should read 12V in your meter. If the reading is ZERO, the solenoid control board fails and needs replaced.

If there is 12VDC power to solenoid, please troubleshoot as follows:

1.Take off solenoid from fuel pump using two wrenches. You should use one wrench to hold the solenoid firmly and turn counterclockwise to take it off fuel pump, at the same time, you must use the other wrench to hold metal pipe of fuel pump for avoiding its rotating. Take out a spring and a plunger in the solenoid, replace the solenoid (means bypassing solenoid) to fuel pump, crank the engine and see whether you can start or not; if works, solenoid is burned and needs replaced.

2.If you can not solve starting problem by bypassing solenoid, fuel pump or fuel injector may have failed.

How to test fuel pump or fuel injector?

a. Loosen the end of high pressure metal fuel pipe to fuel pump, crank engine and see whether you can see diesel popped out of fuel pump, if you can see diesel out of pump, the pump is fine. Otherwise, fuel pump needs replaced.

b. Take off fuel injector and test it: open the cover right on the top of enclosure (silent model) or muffler cover (open frame model), loosen two 10MM nuts, take out fuel injector with high pressure metal fuel pipe hooked up together, reconnect the other end of metal fuel pipe to fuel pump so that make sure you can observe the tip of fuel injector when cranking engine. if fuel injector is fine, you shall observe 4 well-sprayed diesel mists out of fuel injector tip; if not, try to use a piece of soft cloth to clean it and then try again; if you still can not see four mists, one or more tiny holes of fuel injector is/are bitted and fuel injector needs replaced.

c. Also, please check your battery voltage level, if it is below 12.5 V, you probably can not start your engine; please fully charge your battery or try using your vehicle battery to crank.

d. If you can hear cranking sound at all when you turn electronic key to start or use remote control unit to start, electronic key or the solenoid of electric starter is burnt and needs replaced. You can use a small copper wire to jump start your electric starter motor; jump start your electric starter and see whether your engine turns over; if it turns over, the starter is good and electronic key needs replaced; otherwise, starter needs replaced.

Make sure you leave electronic key in OFF position or simply remove electronic key from control panel when you use remote start! Also, please depress OFF button after you remote shut down generator, otherwise, the battery will be gradually drained; it will also have a risk of burning solenoid.

CAUTION: please disconnect battery from your generator prior to conducting any maintenance or repair. Otherwise, some electronic parts will be burned with power operation.

If you perform all the above procedures and find fuel system is fine, please further check your diesel engine. Adjustment screw or tappet of your engine is probably snapped:

Remove fuel injector from your engine and take off cylinder cover, pull recoil handle or manually rotate flywheel, perceive whether you can see both intake and exhaust valves moves; if one of them does not move, please take a closer look at the cylinder head and make sure whether adjustment screw or tapper is snapped. If adjustment screw is snapped, try to take out the broken screw and replace it with a new one. Make sure you correctly adjust the gap of valves in the range of 0.15～0.20mm. if tappet is snapped, you must remove alternator from diesel engine and then disassemble engine for replacement.

4-2.1.1 Instructions for disassembling alternator from engine

1. Drain out all the fluids from your generator including oil and fuel.

2. Remove generator frame from base pan.

3. Loosen four long bolts for holding alternator first and then remove stator from alternator.

You should use two flat head screwdriver to warp up the stator out through two symmetrically distributed notches in the alternator cast case. It usually takes less than 10 seconds to remove stator from alternator.

4. Remove rotor from engine shaft.

Completely loosen the long bolt with a 14MM hex head nut that is used to hold rotor to engine shaft so that you can take it out. However, you should not take out the long bolt, but to leave the loosened bolt in place, then use a RUBBER HAMMER hit heavily hit the 14MM hex head nut of long bolt about 10 times at the directions of left, right, back and forth, take out long bolt and then you shall pull out the rotor from engine shaft easily.

WARNING: Never use metal hammer rather than rubber hammer to hit the nut and avoid hitting in the bearing of rotor. Otherwise, the bearing will be broken.

4-2.1.2 Instructions for disassembling diesel engine

1. Loosen the end of high pressure metal fuel pipe to fuel injection pump and then remove the fuel injection pump from engine.

2. Remove fuel injection nozzle(injector) with high pressure fuel pipe from engine.

3. Remove cylinder gasket cover.

4. Remove rocker arm.

5. Remove two push rods.

6. Remove then half crankcase in alternator side (drive shaft side) from engine.

7. Remove cam shaft.

8. Remove the snapped tapper with a new one.

4-2.1.3 Instructions for setting valves and reassembling diesel engine

A. How to reassemble a diesel engine:

1. Suppose a diesel engine is disassembled at this step, e.g. fuel pump, fuel injector removed from, rocker arm and push rods taken off engine; DO NOT REPLACE THEM NOW, OTHERWISE, YOU CAN'T PUT BACK THE HALF CASE OF ENGINE ON ALTERNATOR SIDE!

2. If tappets are snapped, please replace them and put the new ones in holes;

3. In case you pull off balance shaft during disassembling engine and need replace, please align balance gear and crank gear; there are TWO NOTS and ONE DOT in balance and crank gears respectively, you must align them at this step before aligning crank and cam gears;

4. Align crank gear(drive shaft) and cam gear(cam shaft): there are TWO NOTS and ONE NOT in crank and cam gears respectively, you must align them at this step;

5. Put case gasket and match two halves of engine together, tighten all bolts.

6. Put back push rods and rocker arm assembly, tighten two bolts for holding rocker arm, adjustment screws and nuts on rocker arm assembly and make sure adjustment screws touch push rods slightly so that you can lift up and down push rods. DO NOT TIGHTEN ADJUSTMENT SCREWS FIRMLY AT THIS POINT, OTHERWISE, YOU CAN'T ADJUST VALVE GAP.

B. How to set valve gaps:

The 4 strokes for engine are:

Intake → spray fuel, compress → explode → outtake exhaust.

When you spin flywheel, you can see push rods and rocker arms moving back and forth to make intake and exhaust valves open and / or close;

When both push rods move to their lowest positions, both intake and exhaust valves are close, then you can use your hand to move both rocker arms a little (both valves are close at this position);

This position is very important, you need adjust the valve gaps at this point; the gap between rocker arm and valve clip(a small round platform) for both sides(intake and exhaust valves) is 0.15～0.20mm (about 0.005906～0.007874 in). you can use a filler ruler of 0.15～0.20mm thickness to adjust.

C. Install fuel injector first, then install fuel pump.

You must install fuel pump correctly, otherwise you either can't start engine or overspeed engine. Below are brief procedures for reinstallment :

1. When you reinstall fuel pump, pull its needle half way in OBSERVATION WINDOW (bottom opening in fuel pump), push speed handle(fuel throttle lever) halfway. You can see a HOOD of speed handle when you move speed handle from left to right. The HOOD is used to hold fuel pump needle so that you can simultaneously move needle while push speed handle from left to right.

2. Use one hand to replace fuel pump while use the other hand to hold speed handle half way, let fuel pump needle right sit in the HOOD of speed handle, tighten upper two nuts first then move fuel lever and see whether the needle moves with fuel throttle lever, otherwise, you need reinstall the fuel pump again.

IMPORTANT NOTES:

When you need use a hammer during disassembling or reassembling process whenever necessary, please NEVER USE METAL HAMMER to hit any parts, otherwise, you will deform or damage them.

4-2.2 Causes and Troubleshooting for Deficient Power of Diesel Engine

Table 6

CAUSES	TROUBLESHOOTING
Malfunction of fuel system Parts obstruction in fuel filter and fuel pipe Inadequate fuel supplying	Check the fuel switch, they should be opened fully. Check the fuel filter and fuel pipe.
Bad pressing of fuel pump	Check or change the damaged parts of fuel pump.
Malfunction of the fuel nozzle Incorrect injection pressure	Adjust the injection pressure
Carbon deposit in the nozzle hole	Clean
Needle was bit	Clean or change
Loose fit between needle and needle body	Change
Obstruction in air filter	Remove, clean or change the filter core.
Not fast enough of engine speed	Check the speed of engine with the tachometer, and then readjust the speed limit bolts.

4-2.2.1 Instructions for speed adjustment

There are three bolts used in the speed limit system: left (C), middle bottom and right (A) screws. Screws A & C are used for tightening metal plate B, A is also used for fine adjustment of speed and middle bottom screw for setting maximum fuel throttle. Please note that there is an oval-shaped hole in the metal plate B with A through.

Screw A is used for fine adjusting RPM (Frequency $<$ 5 Hz), moving B up decreases RPM while moving B down increases RPM.

There are two rows of three small holes right behind the metal plate B and four large holes in location E. If the adjusted frequency $>$ 10 Hz, the thick spring D is used for coarse tuning. Try to hook two ends of D in one of six small and four large holes E respectively for obtaining desired frequency, e.g., if we need change 60Hz to 50Hz, this method will be involved. Given position of hooked small hole, the obtained frequency decreases in the order from left to right holes of E; given position of hooked large hole, the obtained frequency decreases in the order from left to right small hole in the same row and upper to lower small holes. Frequency adjustment shall be conducted with a frequency meter.

Bolt F is preset for maximum power output position by manufacturer, it NEVER touches fuel lever unless the maximum power output is reached. So, NEVER adjust the position of threaded bolt.

CAUTION: If your generator runs unstable, e.g., runs at upper or lower speed and you excludes fuel system problem, you must try hooking the two end s of coarse spring D in different small and large holes to find out flexibly balanced position.

4-2.2.2 Causes and Troubleshooting for Engine Stopping Automatically

Table 7

CAUSES	TROUBLESHOOTING
Malfunction of the fuel system Run out of fuel	Check solenoid, fuel pipe, fuel pump & fuel injector Fill fuel.
Low oil level or oil is too dirty	Check oil and change if necessary.
Air exists in fuel system	Release the air.
Nozzle needle was bitted	Clean, skive the nozzle or change it if necessary.
Obstruction in air filter	Check, clean or brush off , or change the filter element
Sudden increase of load	Lighten the load.
Remote control unit fails	Use remote jumper or replace with a new remote unit

4-2.2.3 Causes and Troubleshooting for Exhaust with Black Smoke

Table 8

CAUSES	TROUBLESHOOTING
Overload	Lighten the load; change the unmatched loads if it does not comply with the requirements.
Bad spray	Faulty fuel injection system, change the nozzle if it is damaged.
Lack of air or leakage	Damaged or clogged air filter
Incomplete fuel combustion	Wrong grade of fuel Incorrect fuel injection pump timing Engine overheating Low compression ratio

4-2.2.4 Causes and Troubleshooting for Exhaust with Blue Smoke

Table 9

CAUSES	TROUBLESHOOTING
Engine oil mixed cylinder	Check the oil level, drain off the redundant engine oil
Piston ring is clipped, worn or lack of elasticity, hatch of each ring turned to the same direction and make engine oil up	Check and replace the piston ring and cross hatch of each ring
Big gap between piston and cylinder	Remedy or change
Worn and torn valve and guide	Change

4-2.2.5 Causes and Troubleshooting for Exhaust with White Smoke

Table10

CAUSES	TROUBLESHOOTING
Water mixed in diesel fuel	Clean the fuel tank and filter and change the diesel fuel.
Improper air/fuel mixture	Faulty fuel injection system Incorrect fuel injection and valve timing Engine overheating Faulty fuel pump and/or injection pump

4-2.2.6 Checking Methods for malfunctioned Engine

Table11

CAUSES	TROUBLESHOOTING
Speed sometimes fast, sometimes slow	Check if the speed governing system is flexible, and if air mixed in oil pipeline.
Abnormal noise suddenly sent out	Stop the engine and inspect each movable parts carefully
Exhaust with black suddenly	Check fuel system, especially the nozzle.
Rhythmically metal knocking sound in the cylinder	The fuel delivery angle is too big, should adjust the angle.

4-2.3 Overhaul and Troubleshooting for Diesel Generator

4-2.3.1 Causes and troubleshooting for the generator not being started

Table12

CAUSES	TROUBLESHOOTING
Lack of diesel fuel	Add diesel fuel
Fuel switch is not on the position of “ON”(start switch)	Turn fuel switch handle to the position of “ON”
Air entrapped in fuel system	Release air
No or little spray from injection pump and nozzle	Disassemble the nozzle and adjust it on the test table
The governor speed handle is not on the position of “RUN”	Turn the governor handle to the position of “ON”
Air entrapped in fuel system	Release air

CAUSES	TROUBLESHOOTING
No or little spray from injection pump and nozzle	Disassemble the nozzle and adjust it on the test table
The governor speed handle is not on the position of “RUN”	Turn the governor handle to the position of “RUN”
Oil lever is too low or oil is too dirty	The standard of lubricating oil is between upper line “H” and bottom line “L” Change oil if necessary
Recoil starter is not swift and powerful enough	Start the engine according to “Start Operation Procedure”
Dirty in the nozzle	Clean the nozzle
Ambient temperature is very low	Preheat cold air
No electricity of storage battery	Charge up or change the storage battery
Solenoid is not energized or stuck	Check fuse, or replace solenoid
Electronic key or remote control unit fails	Change if necessary
Electric starter fails	Change starter
Remote starter fails	Change the cell of remote starter key

4-2.3.2 Causes and troubleshooting for the generator not generating electricity

Table13

CAUSES	TROUBLESHOOTING
Power switch is on the position of ‘OFF”	Turn the switch handle to the position of “ON”
Bad contact of the socket	Adjust the socket pins
Burned capacitance or capacitor	Change the capacitance or capacitor
Nuts loosened in volt meter	Tighten loosened nuts
Voltage selector is burned	Replace voltage selector
Carbon brush is snapped or worn off	Check carbon brush
Stator is short-circuited	Change stator
Rotor Diode(s) is broken through	Change diode(s)
Rotor is burned	Change rotor

4-2.4 Damage Cause and Remedy of Brushless Alternator

Table14

PHENOMENA	CAUSE	REMEDY
Can not generate	1.Switch is on the position of “OFF”	1.Turn the switch to the position “ON”.
	2.Worse connection of the plug or the control panel.	2.Adjust the contactor of the plug or the wires inside the control panel.
	3.Circuit break of the stator coil or the capacitor overloads.	3.Check the stator at the point of the break; if it is the just reason that causes problem, change the stator; or check the capacitor with the multimeter, if the needle dose not move, change the capacitor.
	4.Short circuit of the rectifier.	4.Check the rectifier by the Multimeter as the following steps: connect the pens to each two of the four contactors of the rectifiers both in the clock-wise way and in the counter-clock-wise way; if you find that both ways are electrically conducting or non-conducting, it needs replaced.
	5.Connection between the coil of the rotor and the rectifier is wrong, which can not make the different magnetic poles(N/S).	5.Check the reel and the rectifier by the Multimeter. Kindly note the current way while connecting.
Low Voltage	1.Low engine speed	1.Increase the engine speed.
	2.Short-circuit of the rotor reels.	2.Change the rotor.
	3.Short-circuit of the capacitor or the stator.	3.Chang the capacitor or stator.
Others	1.The rectifier of the rotor gets short circuit and the output voltage decreases suddenly after loading.	1.Check the rectifier as per the above instruction. Replace a new one.
	2.After loading, the Power take-off(PTO) drive shaft skids. This causes voltage to drop and alternator to overheat.	2.Disassemble the engine. Maintain the PTO shaft and the inside hole of the rotor until the conic degree reaches the reasonable level, then reassemble the engine.
	3.Short-circuit of the rotor or the stator makes the alternator overheat. The voltage drops.	3. Change the stator or the rotor.

4-2.5 Damage Cause and Remedy of Brush Alternator

Table15

PHENOMENA	CAUSE	REMEDY
Can not generate	1.Switch is on the position of “OFF”.	1.Turn the switch to the position “ON”.
	2,Worse connection of the plug or the control panel.	2.Adjust the contactor of the plug or the wires inside the control panel.
	3.The connection of the capacitance contact is bad or capacitance burns.	3.Connect the contactor well or change capacitance.
	4.The carbon brush wears out or its positive pole and its negative poles are connected crossly.	4.Change the carbon brush or make the wrong connection right.
	5.The second reel of the alternator has turnoff.	5.Check the reel by the Multimeter. And change the stator if it needs.
	6,The rotor has turnoff.	6,Check the reel by the Multimeter and change the rotor if it needs.
Low Voltage	1.Low engine speed	1.Increase the engine speed.
	2.Short-circuit of the rotor reels. Capacitance burns.	2.Change capacitance firstly. If the voltage is not high enough, change the rotor.
	3.Short-circuit of stator.	3.Chang the stator.
	4.The sample voltage has short circuit.	4.Adjust the resistance of Capacitance. If the voltage remains, change the stator of the alternator
Others	1. Capacitance burns after load. The voltage decreases, even disappear.	1.Change capacitance.
	2.After loading, the PTO shaft skids, the voltage decreases, and the alternator overheats.	2.Disassemble the engine. Maintain the PTO shaft and the inside pole of the rotor until the conic degree reaches to the reasonable level. Then reassemble the engine.
	3.Short-circuit of the rotor or the stator makes the alternator overheat. The voltage decreases.	3.Change the stator or the rotor.

If you are still having trouble, please contact with your nearest dealer or with our company directly if necessary.

4-3 Questions and doubts

If you do not understand anything or have any questions, please feel free to contact your local dealer or with our company directly. Below is a list of some information you should have ready before contacting your local dealer or us.

1. Model of diesel engine generator and engine model number.

2. State of residency

3. Number of hours of operating equipment along with the problem that occurred.

4. A detailed condition and time when the problem occurred, in other words, climate and atmosphere

CHAPTER 5 GENERATOR PARTS DIAGRAMS AND LISTINGS

Figure 5-1. *Overall view of engine generator assembly*

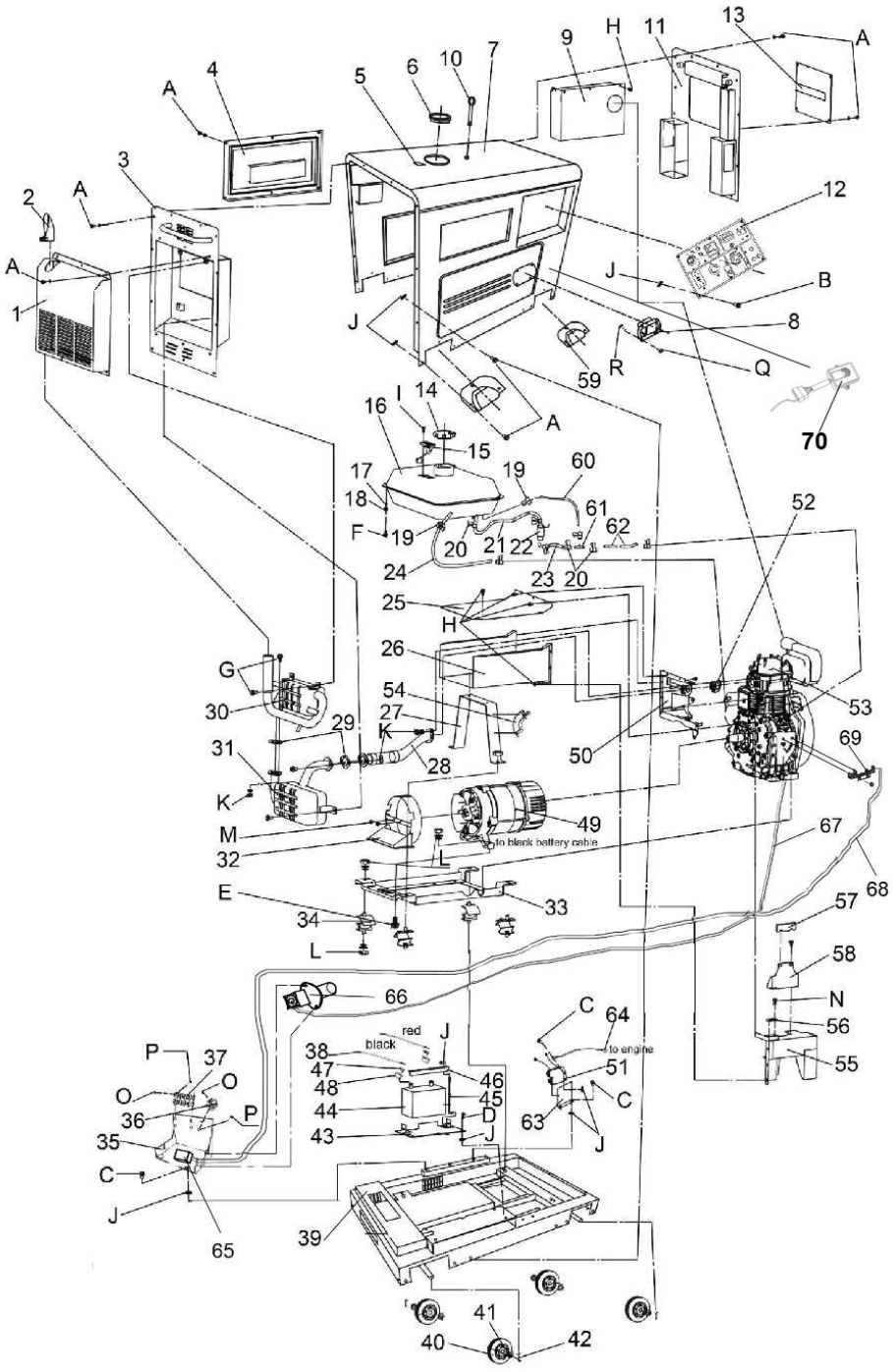


Table 5-1. Please refer to figure 5-1 for illustration

No	Part Description	Quantity	Part Code
1	Silencer cover	1	6500S-E-001
2	Silencer bend	1	6500S-E-002
3	Left board of cover	1	6500S-E-003
4	Back door of cover	1	6500S-E-004
5	Fixing sleeve for observing bore	1	6500S-E-005
6	Fixing sleeve for input of fuel tank	1	6500S-E-006
7	Main cover	1	6500S-E-007
8	Switch of front door	1	6500S-E-008
9	Air filter baffle	1	6500S-E-009
10	stationary rings of generators	1	6500S-E-010
11	Right board of cover	1	6500S-E-011
12	Output panel assembly	1	6500S-E-012
13	Cover of observing bore for air filter	1	6500S-E-013
14	Cover of fuel tank assembly	1	6500S-E-014
15	Buoy for oil level indication	1	6500S-E-015
16	Fuel tank(not assembly)	1	6500S-E-016
17	Lining of absorbing mat	4	6500S-E-017
18	Shock absorbing mat	4	6500S-E-018
19	Clip Φ9	4	6500S-E-019
20	Clip Φ13	4	6500S-E-020
21	Fuel inlet pipe Ⅰ (Φ13)	1	6500S-E-021
22	Fuel filter assembly with cover	1	6500S-E-022
23	Fuel inlet pipe Ⅱ (Φ13)	1	6500S-E-023
24	Fuel leak-off pipe	1	6500S-E-024
25	Cover of U-type chamfer	1	6500S-E-025
26	U- type chamfer	1	6500S-E-026
27	Support of U-type chamfer	1	6500S-E-027
28	Moire output pipe	1	6500S-E-028
29	Gasket of silencer	1	6500S-E-029
30	Upper silencer	1	6500S-E-030
31	Low silencer	1	6500S-E-031
32	Back cover of alternator	1	6500S-E-032
33	Bracket of classis	1	6500S-E-033
34	Shock absorbing mat of generators	4	6500S-E-034
35	Tow structure	1	6500S-E-035
36	Rectify bridge	1	6500S-E-036
37	Wiring seat3×2	1	6500S-E-037
38	Battery cable(set)	1	6500S-E-038
39	Chassis	1	6500S-E-039
40	Rolling wheel on chassis(4 inch)	4	6500S-E-040
41	Flat washer	8	6500S-E-041
42	Pin 3×25	4	6500S-E-042
43	Motherboard of accumulator	1	6500S-E-043
44	Accumulator (maintenance free)	1	6500S-E-044
45	hook type bolt of battery	2	6500S-E-045
46	Pressing plate of accumulator	1	6500S-E-046

No	Part Description	QU.T	Part Code
47	clamp of accumulator with bolt and nut	2	6500S-E-047
48	cover of clamp of accumulator	2	6500S-E-048
49	Alternator assembly	1	6500S-E-049
50	Output wind leading shaft	1	6500S-E-050
51	Manostat	1	6500S-E-051
52	Gasket of output bore	1	6500S-E-052
53	Diesel engine	1	6500S-E-A53
54	Capacitor/AVR	1	6500S-E-054
55	Intake wind leading shaft	1	6500S-E-055
56	Pressing plate of high pressure fuel pipe	1	6500S-E-056
57	shock preventing mat of intake wind leading shaft	1	6500S-E-057
58	shock preventing holder of intake wind leading shaft	1	6500S-E-058
59	Cover of wheel	4	6500S-E-059
60	Fuel leak-off pipe of pipe tee ϕ 9	1	6500S-E-060
61	Pipe tee	1	6500S-E-061
62	Fuel inlet pipe of pipe tee ϕ 13	1	6500S-E-062
63	Support of manostat	1	6500S-E-063
64	lead of manostat	1	6500S-E-064
65	Electromagnet	1	6500S-E-083
66	Accelerator electromagnet	1	6500S-E-084
67	Pulling wire for turn-off	1	6500S-E-085
68	Pulling wire for throttle	1	6500S-E-086
69	Pulling role for accelerator	1	6500S-E-087
70	Remote starter	1	6500XER-F-056
A	Bolt M6×16with flat washer	54	6500S-E-065
B	Heterotypic bolt M6×8	6	6500S-E-066
C	Heterotypic bolt M6×14	6	6500S-E-067
D	Heterotypic bolt M6×22	6	6500S-E-068
E	Bolt M10×45with flat washer and spring washer	4	6500S-E-069
F	Bolt M6×16	4	6500S-E-070
G	Bolt M8×25	5	6500S-E-071
H	Bolt M6×12	17	6500S-E-072
I	Bolt M5×8	2	6500S-E-073
J	Heterotypic nut M6	34	6500S-E-074
K	Nut M8 with flat washer ϕ 8and spring washer ϕ 8	6	6500S-E-075
L	Nut M10with flat washer ϕ 10and spring washer ϕ 10	12	6500S-E-076
M	Bolt M5×12	2	6500S-E-077
N	Bolt M6×22	2	6500S-E-078
O	crossed bolt M4×22 with flat washer and spring washer	5	6500S-E-079
P	Nut M4	5	6500S-E-080
Q	crossed bolt M5×12	4	6500S-E-081
R	Nut M5	4	6500S-E-082

* Please notice that Item 65,66,67,68 and 69 only can be supplied to the generators with mechanical injection pump. If you use electromagnetic pumps, these parts are not necessary. Please consult the dealer before make the orders.

Figure 5-2. *Electric panel parts drawing*

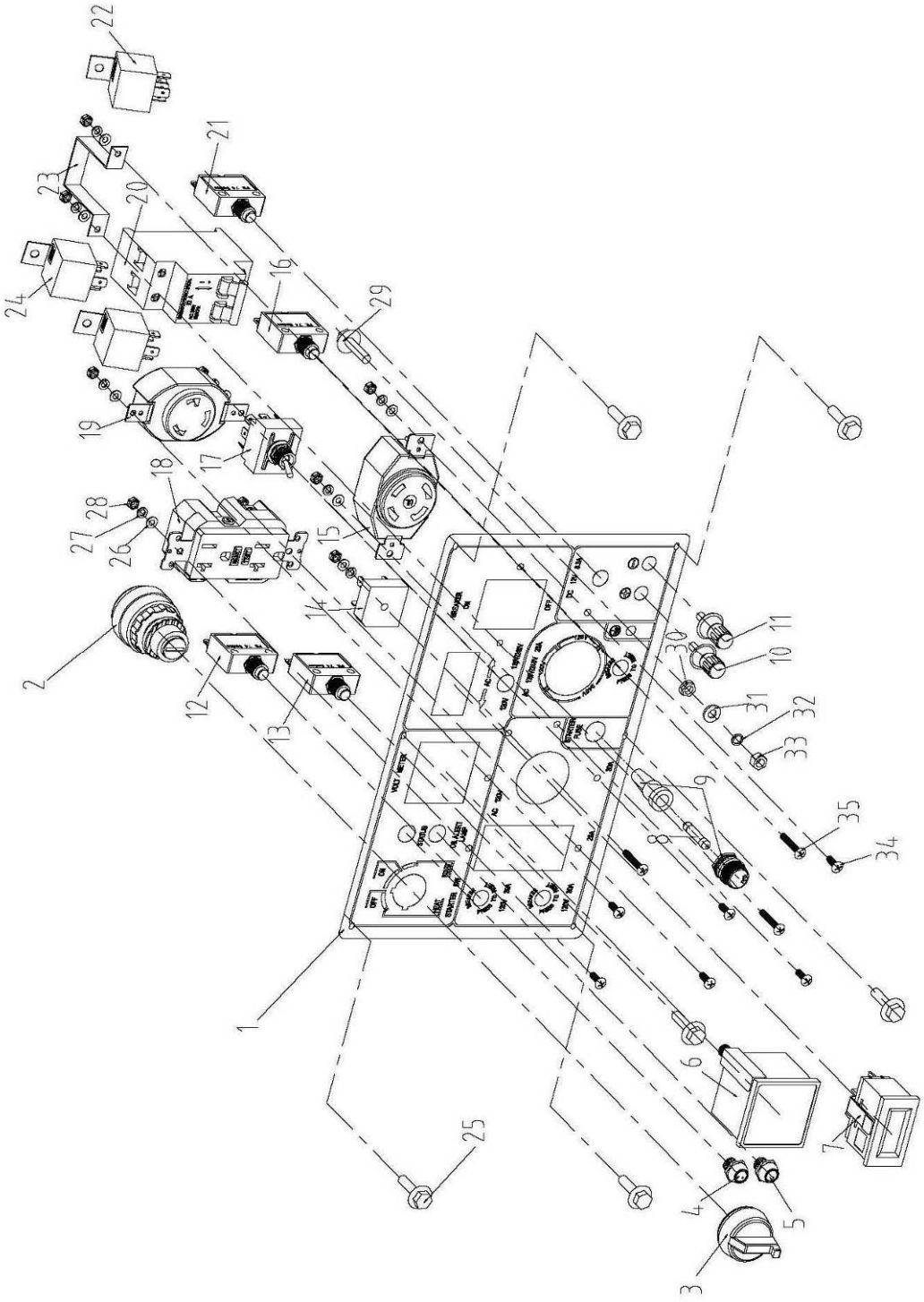


Table 5-2. Please refer to Figure 5-2

No	Part Description	Quantity	Part Code
1	AED6500XER panel for APOLLO	1	6500XER-P-001
2	Electric start switch (JK426)	1	6500WF-P-002
3	Electronic key	1	6500WF-P-003
4	Indicating lamp of power supply(12V)	1	6500WF-P-004
5	Low-oil protection indicating lamp(12V)	1	6500WF-P-005
6	Voltmeter(99T1/300V)	1	6500WF-P-006
7	Digital Timing(AC 30-240V)	1	6500WF-P-007
8	Fuse 30A	1	6500WF-P-022
9	DC fuse seat assembly	1set	6500WF-P-021
10	Red wire holder(107)	1	6500WF-P-023
11	Black wire holder(107)	1	6500WF-P-024
12	Over-load protector(20A)	1	6500XER-P-002
13	Over-load protector(30A)	1	6500XER-P-003
14	Rectifier(12V)	1	6500WF-P-017
15	American type 4-hole unit loose socket(UL)	1	6500WF-P-010
16	Over-load protector(16A)	1	6500XER-P-004
17	Transfer switch302/25A	1	6500WF-P-016
18	Square American type-socket(UL)	1	6500WF-P-008
19	American type 3-hole unit loose socket(UL)	1	6500WF-P-009
20	Breaker (2P/20A)	1	6500WF-P-014
21	Over-load protector(7A 32VDC)	1	6500WF-P-013
22	Relay (DC12V) JD1914	1	6500WF-P-019
23	2P support of breaker	1	6500WF-P-015
24	Relay (DC12V) JD1912	2	6500WF-P-018
25	Flange bolt M6×16	1	203050006161
26	Plate washer ϕ4	9	207020000040
27	Spring washer ϕ4	9	208000000040
28	Nut M4	9	202000000040
29	Flange bolt M6×25	1	203050006250
30	Flange nut M6	1	202060000060
31	Plate washer ϕ6	2	207020000060
32	Spring washer ϕ6	1	208000000060
33	Nut M6	1	202000000060
34	Screw M4×12	6	206080004120
35	Screw M4×25	3	206030004252

Figure 5-3. Generator head assembly

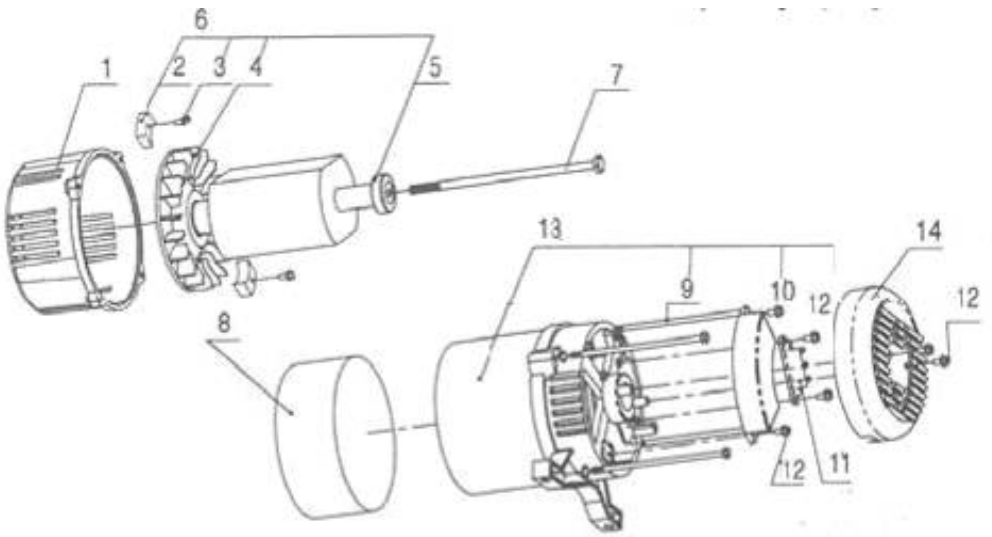
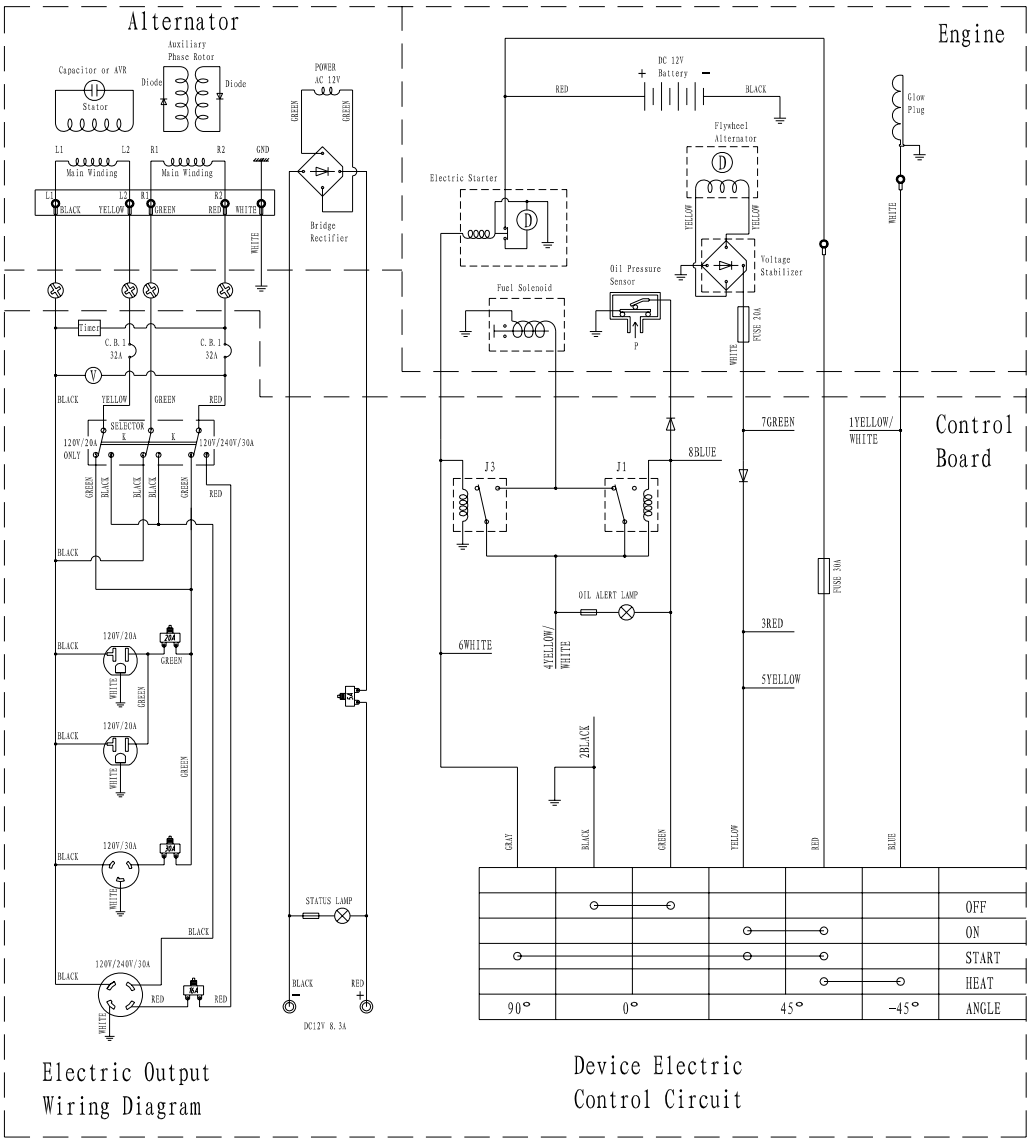
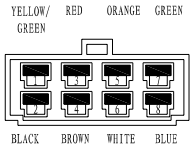


Table 5-3. Please refer to figure 5-3

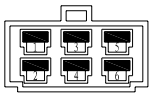
Number	Part Description	Quantity	Part Code
1	Front end cover	1	1000-B-001
2	Diode 3510	1	1000-B-002
3	Bolt M5 x 16	2	1000-B-003
4	Fan Blade	1	1000-B-004
5	Bearing 6204(GB/T 307)	1	1000-B-005
6	Rotor Unit	1	1000-B-006
7	Center bolt M10 x 216 (GB/T5789-1986)	1	1000-B-007
8	Guard board of motor	1	1000-B-008
9	Installing bolt M6×180(GB/T5789-1986)	4	1000-B-009
10	Capacitance	1	1000-B-010
11	Wiring seat	1	1000-B-011
12	Heterotypic bolt M5×14	6	1000-B-012
13	Stator unit	1	1000-B-013
14	Dust cover	1	1000-B-014

CHAPTER 6 CIRCUIT DIAGRAM

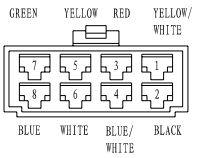




Remote Signal Receiver Plug(Male)



Ignition Key Switch Plug



Remote Signal Receiver Plug(Female)